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ALGORITHM BASED ON CLOUD COMPUTING AND IMAGE PROCESSING DESIGN

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Image processing technology is a popular practical technology in the computer field and has important research value for signal information processing. This article is aimed at studying the design and algorithm of image processing under cloud computing technology. This paper proposes cloud computing technology and image processing algorithms for image data processing. Among them, the material structure and performance of the system can choose a verification algorithm to achieve the final operation. Moreover, let us start with the image editing features. This article isolates software and hardware that function rationally. On this basis, the structure of a real-time image processing system based on SOPC technology is built and the corresponding functional receiving unit is designed for real-time image storage, editing, and viewing. Studies have shown that the design of an image processing system based on cloud computing has increased the speed of image data processing by 14%.Compared with other algorithms, this image processing algorithm has great advantages in image compression and image restoration.

INTRODUCTION

By improving computer hardware technology, larger storage devices and faster processors will enable computers to process digital images more efficiently. However, conventional images based on image matrix representation are not highly efficient because they require a lot of unnecessary information and a lot of storage space. Considering the different types of unnecessary information in the image represented by the image matrix, researchers have proposed many imaging methods that can improve the performance. Although the reconstruction efficiency of these imaging methods insignificantly improved compared to pixel matrix imaging, people are exploring ways to create deeper images. And the quick and easy downloads do not stop here. In recent years, real-time target detection has been widely used, and feature extraction is an indispensable part of target detection algorithms. At present, moment features are widely used in many aspects of image classification and recognition processing. If the image is moving, rotating, or scaling up or down in equal proportions. The computer system should display a fixed feature when recognizing these images, if images should remain unchanged. To improve the inspection efficiency of printed circuit board (PCB) solder joints, Wang et al. aim to detect PCB solder joints through image processing methods. Through a series of image processing algorithms, they completed the threshold segmentation and feature extraction of the solder joint image; then, the sphericity was determined according to the area and circumference, as well as the shape parameters and eccentricity of the calculated area, paving the way for the identification of defect patterns. However, there are some errors in the research process, leading to inaccurate results [1]. Hussainet al. offer a CMOS image sensor with a resolution of 200× 200. The sensor is specially designed for applications where each pixel is used exclusively, measuring approximately15 μm×15μm and image sensor chip size approximately3:5mm× 3:5mm. The proposed sensor is simulated with a single-pixel input current variation of 2pA to100 pA and a corresponding measurement value of 2mVto 855mV per pixel. Moreover, they proposed a new method of pattern detection and recognition in the case of blood coverage, which can accurately segment the patterns in the blood. However, there are errors in image segmentation[2]. Venkatram and Geetha put forward the main purpose of big data which is to quickly view the cutting-edge and latest work being done in the field of big data analysis in different industries [3]. Since many academicians, researchers, and practitioners are very interested, it is rapidly updated and focuses on how to use existing technologies, frameworks, methods, and models to use big data analytics to take advantage of the value of big data analytics. However, the analysis process is very complicated. According to the current technical level and development trend of video image processing systems, this document carries out a great design and implementation of logic devices that will be implemented with large logic devices in the design. In particular the computing cloud in video image processing systems and analyzing infrared, reason for the image unevenness, the theory, and the method of infrared unevenness correction is studied, and feasible image enhancement algorithm based on infrared image characteristics is proposed and realized through experiments. Performance, a proven algorithm can be selected to perform the final action [10]. In the cloud processing system, the working environments more complicated. For the processing of the original image, processing steps such as noise, interference, image clarity, and image improvement are required [11]. According to the current research status domestically and internationally, the commonly used image smoothing methods are the average sector method, intermediate filtering method, filtering method, selective masking, media collection filtering, and

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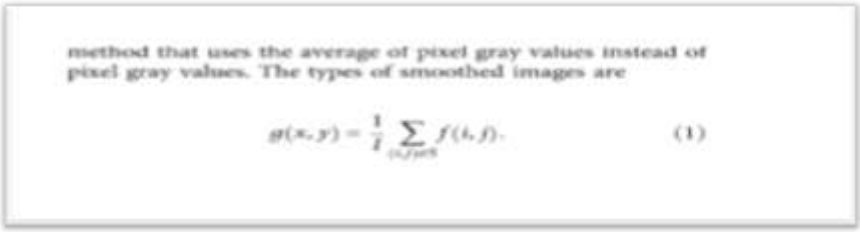
other methods [12].The average vector method is a spatial processing method that uses the average of pixel gray values instead of pixel gray values. The types of smoothed images are


method that uses the average of pixel gray values instead of pixel gray values. The types of smoothed images are

$$g(x,y) = \frac{1}{l} \sum_{(i,j) \in S} f(i,j). \quad (1)$$

2. Graphics Processing Method Based On Cloud Computing

2.1. Cloud Computing Technology

2.1.1. Data Storage and Management Technology. Cloud computing uses distributed storage technology to store unwanted data in multiple distributed storage devices, and to maintain efficient and reliable storage, the space customers need to achieve the level of machine requirements and reduce the number of model applications [4]. In some large-scale projects, such as FIFA and League of Legends, large amounts of data will be stored on the cloud platform. Players only need to download the software and log in to the cloud platform to use it. This significantly reduces the need for computer equipment. [5]. The basic framework diagram of data storage and management technology is shown in Figure 1.

2.1.2. Virtualization Technology.

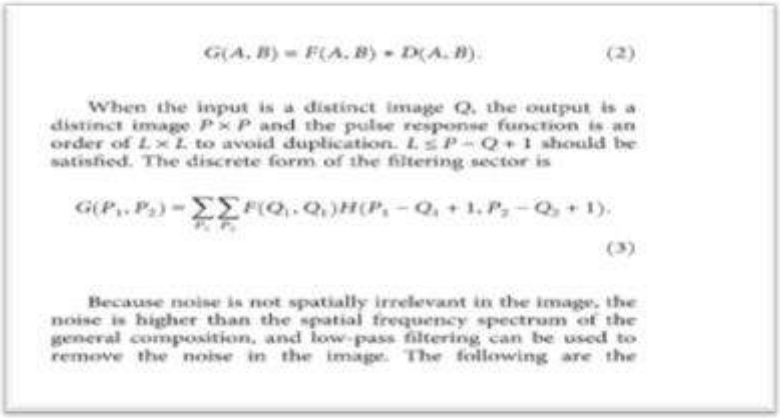
Virtualized focus of the service equipment Virtualized multi-individual visualization. This is the main content of the LAS pre calculation [6, 7].This is the main goal: the main material of the virtual machine, the system of the operation system, the super level of the ear, the cutting high horizontal application program, the general physical equipment division, and the virtual machine [8]. The original operating system and application were virtual, the machine form was run at a virtual level, and many virtual machines could be executed on natural machines. Virtual multi machine can be applied to different operating systems in the enterprise, such as management systems and operating systems [9].

2.2. Graphics Processing Algorithms for Cloud Computing.

The computer system includes computational and detection targets. Depending on the hardware structure and system

2.2.1. Spatial Low-Pass Filtering Algorithm. We know that the slow part of the signal belongs to the low-frequency part of the frequency part, and the fast part of the signal belongs to the high-frequency part of the frequency part [14]. The spatial frequency of the image and the interference frequency of the edge are higher. Therefore, low-pass filtering

can be used to remove noise, while frequency-domain filtering can be easily achieved by spatial rotation. Therefore, as long as the impulse response matrix of the spatial system is designed reasonably, the noise can be filtered [15]. The basic flowchart of the system using low-pass filtering algorithm to remove noise is shown in Figure 2.If there is a two-dimensional function *F(A, B)*, input the filter system and the output signal is recorded as *G(A, B)*.Suppose the impulse response function of the filter system is (*DA, B*); then, there is


$$G(A,B) = F(A,B) * D(A,B). \quad (2)$$

When the input is a distinct image Q, the output is a distinct image $P \times P$ and the pulse response function is an order of $L \times L$ to avoid duplication. $L \le P - Q + 1$ should be satisfied. The discrete form of the filtering sector is

$$G(P_1,P_2) = \sum_{P_1} \sum_{P_2} F(Q_1,Q_1) H(P_1 - Q_1 + 1, P_2 - Q_2 + 1). \quad (3)$$

Because noise is not spatially irrelevant in the image, the noise is higher than the spatial frequency spectrum of the general composition, and low-pass filtering can be used to remove the noise in the image. The following are the

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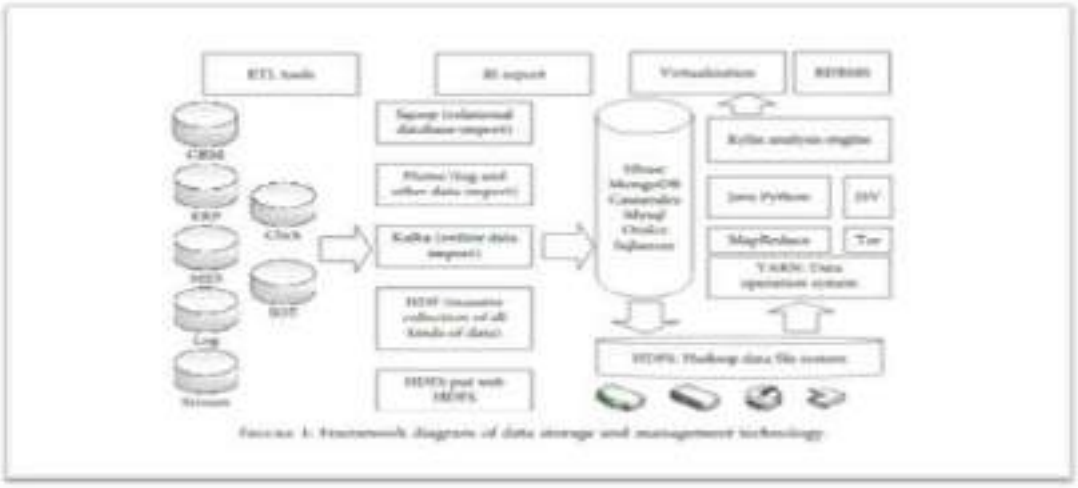

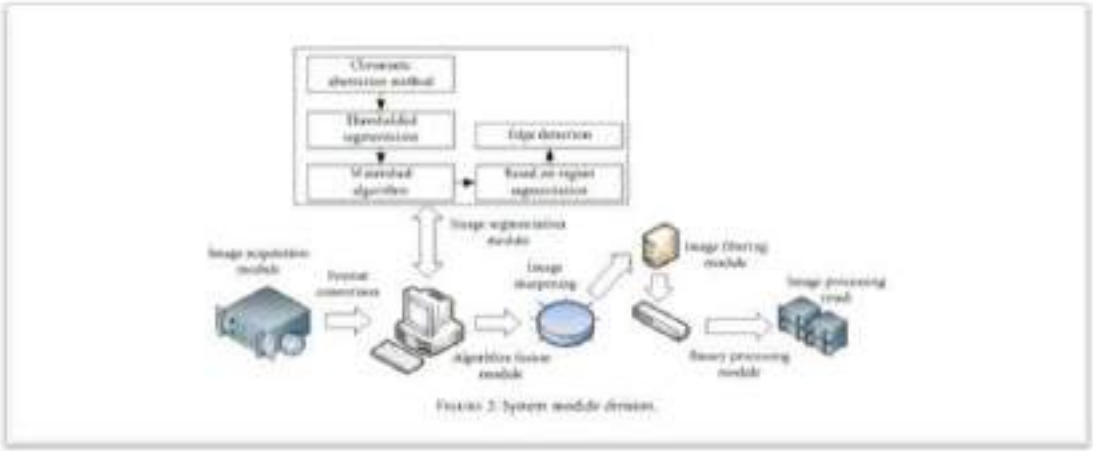

different forms of the low-pass spatial response function in the case of $L = 3$, represented by matrix

different forms of the low-pass spatial response function in the case of $L = 3$, represented by matrix K:

$$1 - \delta_K \le \frac{\|\Phi_x\|_2^2}{\|x\|_2^2} \le 1 + \delta_K. \qquad (4)$$

It can be seen that using the second filter, the result is similar to the result achieved by the simple neighbor hood average method under a 3 × 3 window.

2.2.2. Median Filtering Algorithm.

In an image contaminated by noise, if linear filtering is used in the processing, most of the linear filtering flow is relatively small, and the image edge is blurred while removing the noise. Under certain conditions, the average filtering method can get better results in removing noise and protecting image edges. In other words, this is a nonlinear image emphasis technology, which has an excellent suppression effect on interference pulses and speckle noise and can more appropriately maintain the

edges of the image [16].

The operation process of median filtering is as follows: Here is a combination $X1$, $X2$,……, Xn; arrange the magnitudes of the n numbers as follows

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$$\bar{\theta} = \sum_{i=1}^{K} \alpha_i V_i \text{subject to} \left\| \theta - \bar{\theta} \right\| \le \epsilon, \qquad (5)$$

4

$$Y = \text{MED}\{X_1, X_2, \cdots, X_n\} = \begin{cases} X_{i((n+1)/2)}, \\ \frac{1}{2}\left[X_{i(n/2)} + X_{i((n/2)+1)}\right], \end{cases} \quad \text{th} \qquad (6)$$

The median of the category is represented by *y*. For example, the sequence is (70, 80, 190, 100, 110,) and the median value of this sequence is 100.Suppose the input sequence is { *Xi*, *i* ∈ *I*,} and the subset of natural numbers is represented by *I*, where the length of the window is *n*. Next, the output filter is represented a

$$Y_i = \text{MED}\{X_i\} = \text{MED}\{X_{i-w}, \cdots, X_i, \cdots, X_{i+w}\}. \qquad (7)$$

The filter can be represented in the form of a two-dimensional window. Let $\{X_{ij}\}$ represent the gray value of each point of a digital image. The two-dimensional central filter of filter window A can be represented as

$$Y_{ij} = \text{MED}\{X_{ij}\} = \text{MED}\left\{X_{(i+r),(j+s)}, (r,s) \in A, (i,j) \in I^2\right\}. \qquad (8)$$

2.2.3. Edge Detection Algorithm.
The local intensity of the target in the image represents that the edge detection method, background area, etc. change greatly. It serves as basis for image analysis, such as image fragmentation and texture characteristics. The first step is edge detection, which is by the sharpness strength of continuity. The image intensity sequence can be divided as follows. The grayscale pixel value of the image link is different, and the image intensity returns to the starting point after maintaining a small change. The images obtained using various detection methods have a high edge detection effect and can suppress noise. Image processing methods usually use general edge detection methods.

2.3. Digital Image Processing Algorithm.
The result of sampling and quantization is a table. There are generally two ways to represent digital images:

$$f(x,y) = \begin{bmatrix} f(0,0) & f(0,1) & \cdots & f(0,n-1) \\ f(1,0) & f(1,1) & \cdots & f(1,n-1) \\ \cdots & \cdots & \cdots & \cdots \\ f(n-1,0) & f(n-1,1) & \cdots & f(n-1,n-1) \end{bmatrix}. \qquad (9)$$

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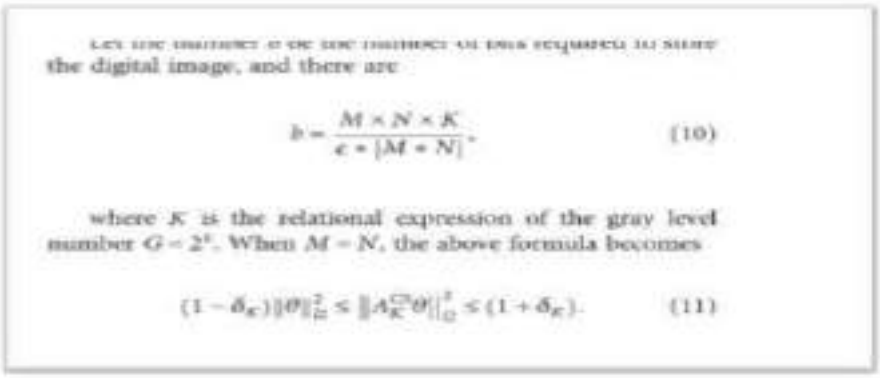
The various elements of the image layout are individual values called pixels. In digital image processing, the general table *N* and gray level *G* have the integral power of 2,namely, $N = 2^n$ and $G = 2^m$. For TV images in general laboratories, *N* is 256 or 512 and grayscale *G* is 64-256,which can meet the needs of image processing. For images with special requirements such as satellite images, take2340 × 3240 and the grayscale *m* is 8-12 bits.

Let the number *b* be the number of bits required to store the digital image, and there are


the digital image, and there are

$$b = \frac{M \times N \times K}{c * [M * N]}, \tag{10}$$

where K is the relational expression of the gray level number $G = 2^K$. When $M = N$, the above formula becomes

$$(1 - \delta_K)\|\theta\|_2^2 \le \left\|A_K^{\square}\theta\right\|_{\square}^2 \le (1 + \delta_K). \tag{11}$$

The chain code represents a binary image composed of straight lines and curves, which is very suitable for describing the boundaries of images. Using chain code ratio matrix expressions can save a lot of bits.

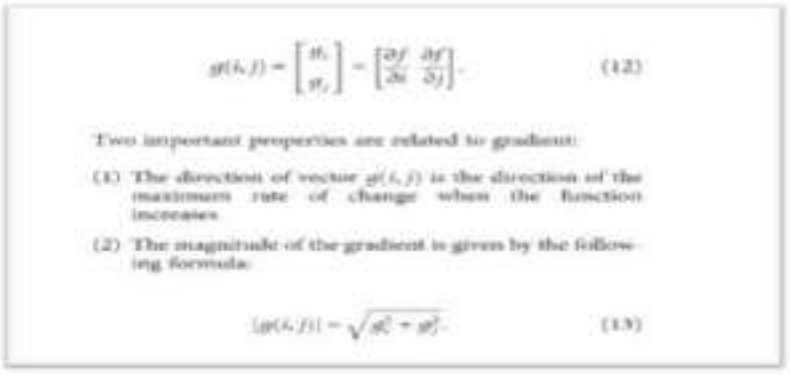
2.4. Edge Detection Algorithm.

The edges of the image are usually related to the continuation of the image intensity or the first derivative of the image intensity. The continuation of the image intensity can be divided into the following:

(1) Step discontinuity, that is, the gray value of the pixel son both sides of the discontinuity has a significant difference

(2) The line is not continuous; that is, the image intensity suddenly changes from one value to another and then returns to the original value after maintaining a small stroke.

Edge detection is the most basic function for detecting important local changes in an image. In one direction, the end of the step is related to the local top of the dominant function of the image. The slope is a measure of the change of the function, and the image can be regarded as a series of sampling points by continuously operating image intensity. Therefore, the situation of the same dimension is similar, and discrete hierarchical approximation functions can be used to detect large changes in image gray values.


$$g(i,j) = \begin{bmatrix} g_i \\ g_j \end{bmatrix} = \begin{bmatrix} \frac{\partial f}{\partial i} & \frac{\partial f}{\partial j} \end{bmatrix}. \tag{12}$$

Two important properties are related to gradient:

(1) The direction of vector $g(i, j)$ is the direction of the maximum rate of change when the function increases

(2) The magnitude of the gradient is given by the following formula:

$$|g(i,j)| = \sqrt{g_i^2 + g_j^2}. \tag{13}$$

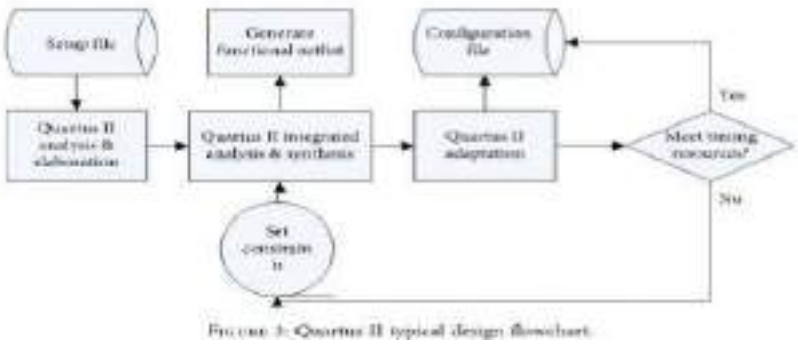


Figure 3: Quartus II typical design flowchart

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In practical applications, the absolute value is usually used to approximate the gradient amplitude:

$$|g(i,j)| = \max\left(|g_i|, \left|g_j\right|\right). \quad (14)$$

According to vector analysis, the slowly changing vector is

$$a(i,j) = \arctan\left(\frac{g_j}{g_i}\right). \quad (15)$$

The angle α is the angle relative to the x-axis.

3. Image Processing System Design Experiment

3.1. Experimental Parameter Design.

In this experiment, MATLAB is used for modeling, and then, the sample data of this article is imported. The compressed sensing sparsity is 1000; that is, after the original image is wavelet transformed, the wavelet coefficients are sorted, and then, 1000large coefficients are retained and reset the remaining coefficients to zero. Observe the sparse wavelet coefficients of the observation matrix. The size of the observation matrix is4116 × 16424, and then, the observation results are transmitted to SOPC for reconstruction. This experiment was conducted to determine whether the SOPC system regenerated by OMP was functioning normally. Therefore, the wavelet coefficients after zeroing are used to observe the original image instead of the original image [17]. In this experiment, the wavelet coefficients after zeroing are equal to the original image and the reconstructed wavelet coefficients are equal to the reconstructed image.

3.2. Image Processing Programmable System Design

(1) Design input: there are many ways to introduce design. At present, the two most commonly used are circuit diagrams and material description languages. For simple drawings, you can use charts or ABEL language design. For complex designs

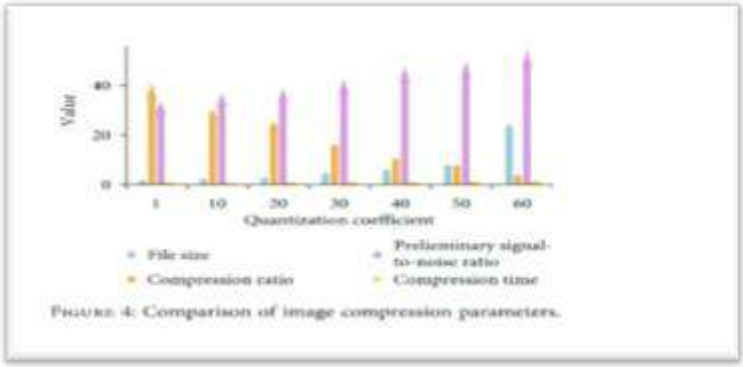

Figure 4: Comparison of image compression parameters.

schematic diagrams or material description languages or a mixture of the two can be used, and hierarchical design methods can be used to describe units and hierarchical structures. When the software design and input check for grammatical errors, the software will create a list of grammatical errors for the design and input

(2) Design realization: design realization refers to the drawing process from design input files to bit stream files. In this process, the training software automatically compiles and optimizes the design files and performs mapping, placement, and routing of selected devices and creates the corresponding bit stream data files

(3) Device configuration:

FPGA device configuration modes fall into two categories: active configuration features and passive configuration features. Active configuration mode is a configuration operation program guided by GAL devices that control the external storage and preparation process. Passive configuration is a controlled synthesis process

(4) Design verification: this is consistent with the design verification process including functional simulation,

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Table 1: Image compression parameter table with different quantization coefficients.

Quantization Coefficient	File Size (KB)	Compression Ration	Preliminary Signal to noise Ratio	Compression time (Seconds)
60	1.9	41	33.9	0.6
50	2.5	31	37.3	0.5
40	2.9	36	39.3	0.7
30	4.8	17	43.1	0.8
20	6.3	11	48.2	0.9
10	8.2	18	50.5	0.95
1	25	4	55.1	1.2

S.No	1	2	3	4	5	6	7	8	9
a	0.4	0.45	0.5	0.55	0.6	0.65	0.7	0.8	0.9
Fuzzy SSIM	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58
PSF restore SSIM	0.79	0.8	0.804	0.807	0.808	0.8	0.79	0.78	0.77
SVPSF Restore SSIM	0.85	0.854	0.857	0.867	0.868	0.858	0.856	0.845	0.845

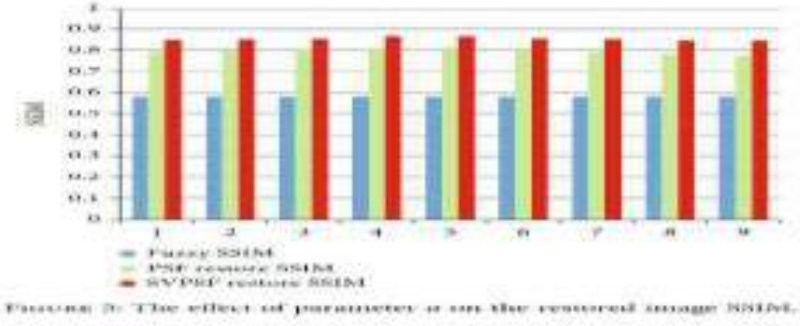
Table 2: The influence of parameter *a* on the restored image SSIM.

timing simulation, and equipment testing. Functional simulation verified the design logic. In the process of introducing the design, part of the operation or the entire design can be simulated. Timing simulation is a delay simulation of device layout and operation after the design is implemented, and the timing relationship is analyzed. Equipment testing is to use test tools to test the final function and performance indicators of the equipment after the experiment or programming, as shown in Figure 3.

4. Image Processing Algorithms Based on Cloud Computing

This section analyzes the performance of the compression algorithm, the complexity of the processing process, and the image reconstruction of compressed sensing.

4.1. Image Coding Compression Performance Test. To test the performance index of the algorithm, this paper selects the real scene geometric regular image collected by the web camera as the original image of compression coding. The image resolution is in pixels. Figure 4 is an image effect frame encoding with different quantization factors in a compression encoder. The difference in image quality after compression coding can be instinctively compared through human vision [18, 19]. The experiment compares the processing effect map from the file size reduction ratio, peak signal-to no is ratio, time complexity, visual effect, and other aspects. The running results of the reduction algorithm with different quantization coefficients are shown in Table 1.From the data in Table 1, it can be seen that different choices of system parameter settings will have a greater impact on the image compression effect. The larger the quantization coefficient, the smaller the amount of compressed image data, the larger the image compression ratio, and the smaller the peak signal-to-noise ratio of the image. At the same time, the compression time of the algorithm is



also less, and the visual effect of the image can be seen in obvious blocking effects. The complexity of the algorithm is $O(n \log 2n)$. The real object taken by the image cannot be distinguished. To observe the comparison of data more intuitively, draw the table into a picture, as shown in Figure 4.

It can be seen from the experimental data that the system quantization coefficient is set to 15, and the visual effect of the compressed image is obvious. At this time, the image has no obvious distortion, and the difference from the original image is small. At the same time, the image compression, peak signal-to-noise ratio,

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compression time, and other parameters are compared. So it can be ensure the compression ratio under the condition of get a better image quality.

Table 3: Influence of parameter *b* on reconstructed image SSIM.

S.No	1	2	3	4	5	6
b	256	200	400	600	1600	4600
Fuzzy SSIM	0.57	0.57	0.57	0.57	0.57	0.57
PSF Restore SSIM	0.8	0.51	0.8	0.51	0.815	0.818
SCPSF Restore SSIM	0.86	0.86	0.85	0.87	0.88	0.86

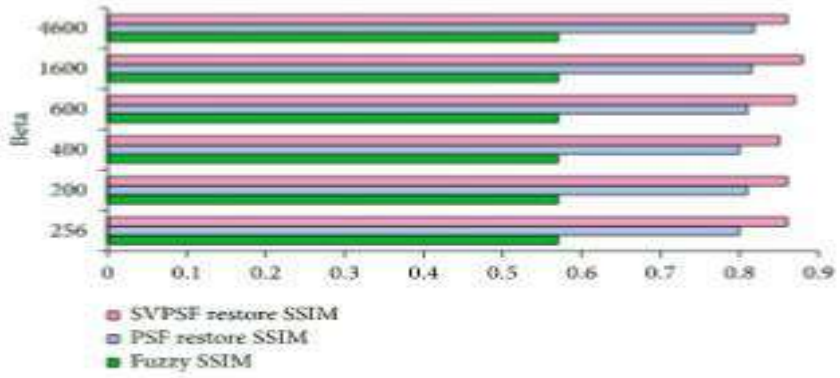

FIGURE 6: The effect of parameter *b* on the restored image SSIM.

4.2. Image Processing Algorithm Analysis.

The fuzzy image is restored based on the super Laplace prior model. From the above analysis, it can be seen that the regularization term index *a* and the regularization parameter *b* of the algorithm have a great impact on the restoration quality of the image and the execution time of the algorithm. In this paper, based on SVPSF, the image formed by the single-lens imaging system can be restored in blocks through the super Laplace prior algorithm. By taking the values of the parameters *a* and *b* selected by Dilip Krishnan's experiment as 0.5 and256, respectively, the block restoration is based on the SVPSF image.

4.2.1. The Influence of Parameter on the Image Restoration Algorithm.

The image is restored by accurately establishing the model through the super Laplacian operator; usually, the range of *a* is 0.5-0.8 and the index has a great influence on the restoration effect. Different intervals correspond to different algorithm models. When *a* = 1, it is the Laplace restoration model, which does not fit the heavy-tailed distribution of the image very well. When

a = 2, it is a Gaussian distribution model, and the fitting effect is very different. When *a* is between 0 and 1, it is a super Laplace model, and when *a* is between 0.5 and 0.8, the restoration effect is better. Therefore, it is necessary to analyze the value of parameter *a* and restore the restored image with different values of a parameter to obtain different SSIM. The experimental data is shown in Table 2.According to the analysis of the experimental data in the table, the restored image and SSIM change with the value of

Table 4: Compressed sensing SOPC image reconstruction results.

Image	Lena	Man	House	Hill	Camera
PSNR	26.9	26.1	30.5	27.6	27.5

parameter *a*. SSIM increase monotonously in the range of0.4-0.55. When *a* = 0:6, the SSIM value is the largest, and the similarity is increased by 1.5% compared to that before optimization; it decreases monotonously in the range of0.6-0.9. It can be seen from Figure 5 that the parameter *a* had influence on the restored image SSIM.

4.2.2. The Influence of Parameter *b* on the Image Restoration Algorithm. It is solved by the semi quadratic penalty method, and the variable *w* is introduced while giving the blurred image *x*. *b* is the weight of a regularization process change, and its value increases monotonously from b *(*0) to *b*(inc) to *b*(max); as *b* changes, the number of iterations of graph restoration also changes. At the same time, the number of iterations is closely related to the running time of the restoration algorithm and the restoration effect, so this article analyzes the parameter *b*.

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From the data analysis in Table 3 and Figure 6, it can be seen that under the condition that parameter *a* does not change, the SSIM of the restored image changes with the change of parameter *b*

From the data in the table, it can be known that as the parameter *b* gradually increases, the SSIM of the restored image shows a trend of first increasing and then decreasing.

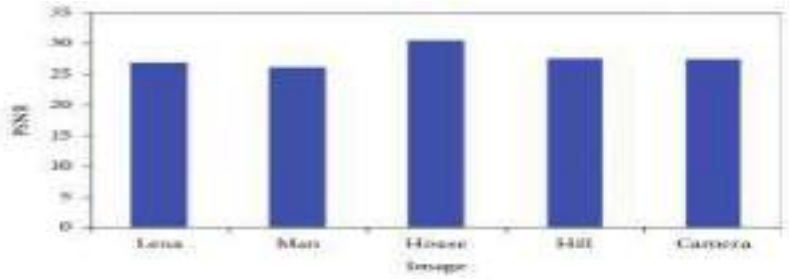

FIGURE 7: PSNR value comparison after SOPC image reconstruction.

Table 5: The relationship between image reconstruction sparsity and PSNR.

Sparsity	500	600	700	800	900	1000	1100	1200	1300	1400
Cameraman	24	25	25.6	26.4	27.1	28	28.3	28.6	23	21
Hill	25.2	26	26.5	27	27.3	27.5	27.9	28.1	25.3	23
House	26.7	27.8	28.3	29	29.5	30	31.2	31.7	27	25
Man	23.7	24	24.6	25.3	26.2	26.5	27	27.2	24.5	21.4
Lena	24	24.3	25	25.8	26.8	27.2	28	28.2	23.4	21.6

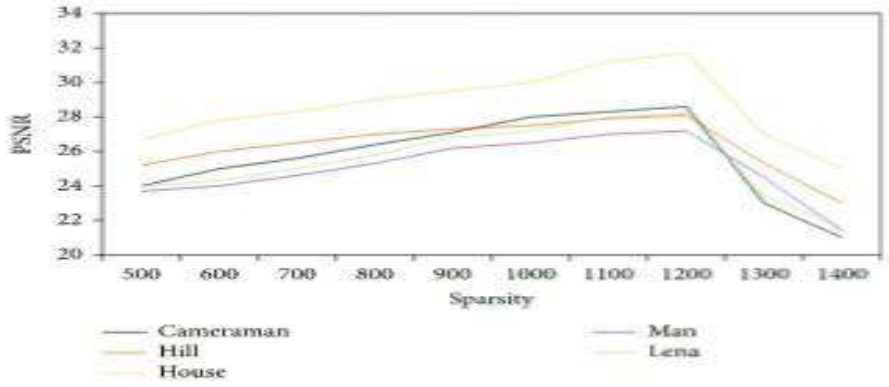

FIGURE 8: The result of image reconstruction changes with sparsity.

When *b* is between 200 and 600, the value of the restored image SSIM gradually increases, and there is a maximum value of 0.87. When *b* is between 1600 and 4600, the SSIM value of the restored image gradually decreases, and the SSIM value after restoration is smaller than that before optimization.

4.3. Image Reconstruction Analysis of Compressed Sensing. This article introduces the SOPC implementation of compressed sensing based on the OMP reconstruction of Cholesky matrix decomposition. The following is an analysis of the experimental results of SOPC. The results of the analysis are shown in Table 4. From the comparison of the data in the table, it can be seen that the PSNR of the SOPC reconstructed image is not high. Analysis shows that three reasons affect the PSNR:

(1) All data in this SOPC system are represented by fixed-point numbers, so the accuracy of the algorithm is affected to a certain extent, so the PNSR of the reconstructed image is not high.

(2) In this system, LFSR is used to generate a random observation matrix. Since the random number generated by LFSR is not completely random, it affects the incoherence of the observation matrix to a certain extent. Reconstructed PSNR is affected.

(3) Before observing the wavelet coefficients, the small coefficients in the wavelet coefficients are reset to zero, and then, some small details are lost, so PNSR will be affected. the data, draw the table into a graph, as shown in Figure 7.

According to the data analysis in the figure, it can b concluded that among the 5 images, the house image has the highest PSNR. The analysis shows that the house image is relatively regular, and the coefficients obtained

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after the wavelet transform are relatively sparse, and the wavelet coefficients are reset to the minimum of the house image, so the PSNR after reconstruction is the maximum. In this experiment, the size of the observation matrix is still 4100 × 16400, but the sparsity is increased from 500 to1400, with an interval of 10 each time. Five images were reconstructed, and the relationship between the sparsity and PSNR obtained is shown in Table 5 and Figure 8.

4.4. Discussion. This paper builds a wavelet transform model under Quartus II. Compared with the model in the reference ,the simulation parameter in this paper has a better effect in the range of 0.5-0.8. In the literature, the value of *a* is between 0.5 and 2 due to the difference in the model. This is because the model in this paper optimizes parameters such as image compression, peak signal-to-noise ratio, and compression time to reduce interference, so the value range is concentrated, which facilitates the control of the model and does not cause model distortion. In addition, the model in this paper can process images with a signal-to-noise ratio between 500 and 1400, while other methods have smaller signal-to-noise ratio intervals. Therefore, the method in this paper can process images with a large signal-to-noise ratio range to a small value and has a high degree of recovery.

5. CONCLUSIONS

The hardware implementation scheme of the image processing algorithm is proposed. By comparing the PC implementation of the image processing system and the dedicated digital signal processor (DSP) implementation, the structure of the cloud computing-based on-chip programmable system is constructed, and the various parts of image acquisition, storage, and real-time display of each part of image processing are carried out, and the overall structure design is improved. The structure design has been improved. The cloud computing application introduced in this article is an important cloud imaging system project. Different choices of system parameter settings will have a greater impact on the image compression effect. The larger the quantization coefficient, the smaller the amount of compressed image data, the larger the image compression rate, and the smaller the peak signal-to-noise ratio of the image. At the same time, the compression time of the algorithm is less, and the visual effect of the image can be seen in the obvious occlusion effect. It is impossible to distinguish the real objects captured in the image.

Because the image data itself contains a large amount of information, the realization of image processing algorithms puts forward higher requirements on hardware devices. With the development of embedded system technology, the functions of embedded microprocessors are becoming increasingly powerful. The combination of style and image processing will also become a complex system project.

DATA AVAILABILITY

The data underlying the results presented in the study are available within the manuscript.

Conflicts of Interest The authors declare that they have no conflicts of interest.

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वैश्विकरणाचा भारतीय समाजावरील प्रभाव

प्रा. राजकुमार एस. बिरादार
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सारांश:

कार्ल मार्क्स यांच्या आर्थिक निर्धारणवादाच्या सिद्धांतानुसार समाजाच्या अधोसंरचनेत बदल झाला की, समाजाच्या अधिसंरचनेत बदल घडून येतो. भारतीय अर्थव्यवस्थेत जागतिकीकरणाचा स्वीकार केला. मार्क्स यांच्या सिद्धांताप्रमाणे त्याचा परिणाम म्हणून भारतीय समाजव्यवस्थेत अमुलाग्र बदल घडून आला. भारतीय अर्थव्यवस्थेची स्थिती खालावल्याने नवीन आर्थिक धोरणाद्वारे जागतिकीकरणाचा स्वीकार करण्यात आला. त्यामुळे परकीय चलन साठयात वाढ, राहणीमानाचा दर्जा उंचावला, औद्योगिकरणाला गती मिळाली, बहुराष्ट्रीय कंपन्याची एकाधिकारशाही, शेतकऱ्यासमोर आंतरराष्ट्रीय बाजारपेठेचे आव्हान आणि पर्यावरणाचा ऱ्हास आणि पर्यावरण प्रदूषणामध्ये वाढ झालेली दिसून येते.

महत्त्याच्या संकल्पना: गॅट करार, नवीन आर्थिक धोरण १९९१, जागतिकीकरण, खाजगीकरण, उदारीकरण, बहुराष्ट्रीय कंपनी

प्रस्तावना:

दुसऱ्या महायुद्धानंतर जागतिक व्यापार वाढविण्यासाठी जागतिक व्यापार संघटनेकडून प्रयत्न चालू होते. गॅट करारात सामील झालेल्या सदस्य राष्ट्रांनी जकाती, आयात-निर्यातीसाठी परवाना पद्धती, भेद भाव, कोटा पद्धती असे आंतरराष्ट्रीय व्यापारातील अडथळे दूर करायचे होते. १९४७ ते १९८६ पर्यंत गॅट कराराच्या आठ फेऱ्या झाल्या होत्या. आठवी फेरी गॅटचे डायरेक्टर आर्थर डंकेल यांच्या नेतृत्त्याखाली चालू होती. त्याच वेळी १९९१ मध्ये भारतीय अर्थव्यवस्था डबघाईला आली होती. अशा वेळी जागतिक संस्था (जागतिक बँक, आंतरराष्ट्रीय नाणेनिधी) यांनी मदत तर केलीच नाही. भारतावर अप्रत्यक्षरित्या जागतिकीकरणाच्या स्वीकारासाठी दबाव आणला. तेंव्हा भारताने आपल्या अर्थव्यवस्थेत संरचनात्मक बदल चालू केले. नवीन आर्थिक धोरण जाहीर केले. त्यानुसार भारताने जागतिकीकरण, खाजगीकरण आणि उदारीकरण याचा स्वीकार केला.

संशोधनाची उद्दिष्ट्ये:

१) जागतिकीकरणाचा स्वीकार करण्यामागील पार्श्वभूमीचे अध्ययन करणे.

२) जागतिकीकरणाचा भारतीय अर्थव्यवस्थेच्या दृष्टिकोनातून मूल्यमापन करणे.

संशोधन पध्दती:

प्रस्तुत विषयावरील अध्ययनासाठी संपूर्ण भारत हे कार्यक्षेत्र निश्चित करण्यात आले. वरील उद्दिष्टानुसार अध्ययन करण्यासाठी दुय्यम तथ्य सामुग्रीचा उपयोग करण्यात आला. दुय्यम तथ्याच्या उपलब्धतेसाठी दैनिक समाचार पत्र, संदर्भ ग्रंथ, मासिके, शोध निबंध, लेख इत्यादीचा आधार घेण्यात आला आहे.

जागतिकीकरण म्हणजे काय?

जागतिक अर्थव्यवस्था निर्माण करण्यासाठी जगातील देशांनी आपापल्या देशाच्या भौगोलिक सीमाचा विचार न करता जागतिक पातळीवर सर्व आर्थिक व्यवहार करून सर्व देशाची एकच बाजारपेठ म्हणजेच जागतिक बाजारपेठ निर्माण करणे याला जागतिकीकरण असे म्हणतात. जागतिकीकरणामध्ये आंतरराष्ट्रीय व्यापार मुक्त करण्यात येतो. आयात निर्यातीवर बंधने असत नाहीत. सर्व व्यवहार बाजारातील मागणी आणि पुरवठ्यानुसार चालतात. तसेच भाडवली वस्तूचे उत्पादन, तंत्रज्ञान, सेवा-सुविधा यामध्ये देशी परदेशी असा भेद केला जात नाही. भांडवलदाराचा प्रवाह मुक्तपणे कोणत्याही देशातून इतर देशात जाऊ शकतो. तसेच कोणत्याही देशात तयार झालेली वस्तू कोणत्याही बाजारपेठेत विकता येते. समाजशास्त्र विश्वकोश के अनुसार "भूमंडलीकरण की अवधारणा विश्व के बारे में एक एकल समष्टि के रूप में एक नवीन चेतना के उदभव को इंगित करती है। अतः भूमंडलीकरण को विश्व की एक मूर्त संरचना की सम्पूर्णता के रूप में परिभाषित किया जाता है।"[1]

तथ्याचे विश्लेषणात्मक निर्वचन:

१) १९९१ मध्ये भारतीय अर्थव्यवस्थेकडे जगातील इतर देश एका वेगळ्या नजरेने पाहू लागले त्यावेळी देशाला परकीय कर्जाचा बोजा असह्यय झाला होता. भारत सरकारला देणी वेळेवर देता येईनात, जुनी कर्ज फेडण्यासाठी नवीन अधिक रकमेची कर्ज घ्यावी लागत होती. केंद्र सरकारचे उत्पन्न कमी व खर्च जास्त अशी परिस्थिती होती. दैनंदिन खर्चासाठी सुध्दा कर्ज घ्यावे लागत होते. अल्प मुदतीच्या कर्जासाठी मुदतवाढ मिळणे अवघड झाले होते. काही कर्जाना दररोज नवीन करून घ्यावे लागत होते. त्यात भर म्हणून परदेशात राहणाऱ्या भारतीयांनी आपल्या ठेवी काढून घेण्यास सुरवात केली. परदेशी चलन साठा संपत आला. पंधरा दिवस आयात करता येईल एवढेच परकीय चलन भारताजवळ राहिले होते. या परिस्थिती बाबत एस. एल. दोषी लिहितात की "बाहरी कर्ज का संकट ई.1991 में. सामने आया। हमने विदेशो से कर्जा लिया था, उसका भुगतान समय पर नही हो सका। बाकी किस्तो का अंबार लाग गया। हुआ यह कि 1980 से हम बराबर घाटे के बजट पर चाल राहे थे।"[2] भारतीय अर्थव्यवस्थेची अशी परिस्थिती असताना मात्र जागतिक अर्थव्यवस्था जलद गतीने बदलत होती. जगातील अनेक राष्ट्रांनी जागतिक अर्थव्यवस्थेशी जोडले जाण्यासाठी देशामध्ये नवीन आर्थिक सुधारणा करण्याचे धोरण स्वीकारले' भारतासमोर सुध्दा पर्याय नसल्याने नवीन आर्थिक धोरणाचा स्वीकार कराचा लागला.

२)विदेशी गुंतवणूक ही विदेशी चलनात येते त्यामुळे परकीय चलनाचा साठा वाढतो यातूनच आंतरराष्ट्रीय चलन विषयक व आंतरराष्ट्रीय रोखतेचा प्रश्न सुटतो जागतिकीकरणामुळे कृषि विकास व आंतरराष्ट्रीय विकास प्रभावित होऊन उत्पादन वाढ होते. वाढीव उत्पादनातून देशातील लोकांच्या गरजा भागून उर्वरित उत्पादनाची निर्यात केली जाते. निर्यातवाढीतून परकीय चलनसाठ्यात वाढ होते. परकीय चलन साठ्यात वाढ झाल्यास देशातील आंतरराष्ट्रीय पातळीवर पत वाढते. जागतिकीकरणापूर्वी परकीय चलनाची परिस्थिती कशी होती या विषयी कै. प्रा. डॉ. स. श्री. मु. देसाई आणि सौ. डॉ. निर्मल भालेराव लिहितात "एका बाजूला स्थिरावलेली अर्थव्ययस्था, किंवहुना कमी होणारी भारताची निर्यात आणि दुसऱ्या बाजूला सतत वाढणारी आयात, अशी परिस्थिती निर्माण झाल्यामुळे भारताला परकीय चलनाची अधिकाधिक टंचाई भासू लागली."[3]

३) जागतिकीकरणामुळे अनेक दर्जेदार वस्तू देशात उपलब्ध झाल्याने उपभोक्त्यांना अनेक पर्याय उपलब्ध होतात. वस्तू निवडीची संधी प्राप्त होते. दर्जेदार वस्तू रास्त किंमतीला मिळू लागतात. त्यामुळे उपभोक्त्याच्या वास्तव उत्पन्नात वाढ होते. वस्तू व सेवांच्या मागणीत वाढ होते. उपभोगात

वाढ होते. लोकांचा राहणीमानाचा दर्जा उंचावला. या बाबतीत एस.एल.दोषी लिहितात "अब भारतीय समाज एक उपभोग समाज का रूप ले राहा है। देश के कई गावो में बिजली पहुंच गई है। मिट्टी के तेल का उपभोग व्यापक हो गया है, सडको का विशाल जाल फैल गया है, संचार साधन विकसित हो गये है और खान-पान तथा रहन-सहन में सजातीयता आ गई है।"[४]

४)परकीय भांडवल गुंतवणुकीस मिळणारे प्रोत्साहन, उयोजकांना देण्यात आलेल्या सवलती यामुळे नवे उयोग व्यवसाय देशात सुरु आहेत. तंत्रज, शास्त्रज, अभियंता, कुशल कामगार यांना रोजगाराच्या नव्या संधी उपलब्ध होत आहेत. परदेशातही आशा संधी मिळू लागल्या आहेत.

५)भारताने जागतिकीकरणाचे धोरण स्वीकारल्या नंतर भारतातून निर्यात होणाऱ्या शेतमालावरील नियंत्रण दूर झाले. परिणामी शेतमालाच्या निर्यातीस प्रोत्साहन मिळाले. या धोरणानुसार आयातीवरील बंधने दूर केल्याने शेती उत्पादनासाठी नवीन तंत्रज्ञानाची आयात सहज करता येईल. परिणामी शेती क्षेत्रात नवीन तंत्रज्ञानाचा वापर वाढला. शेती उत्पादनासाठी बते, बियाणे, किटकनाशके इत्यादी घटकांची आवश्यकता असते या घटकांना शेती आदाने म्हणतात. नवीन धोरणामुळे शेतीसाठी आदाने सहज उपलब्ध होतील. भारतीय शेती क्षेत्रात विविधता आहे. भारतातील नैसर्गिक अनुकूलतेमुळे येथे विविध पिकांचे उत्पादन होते. या सर्व प्रकारच्या उत्पादनाला आंतरराष्ट्रीय पातळीवर बाजारपेठाची संधी उपलब्ध झाली.

६)पूर्वी आयात निर्यात व्यापारावरील निर्बधामुळे देशी उयोजकांना संरक्षण मिळाले होते. हे निर्बध शिथिल झाल्यामुळे देशी उयोजकांना कंपन्याशी स्पर्धा करावी लागत आहे. परकीय कंपन्याकडील भांडवल, अत्याधुनिक तंत्रज्ञान, प्रचार तंत्र यामुळे अनेक देशी उयोग जागतिक स्पर्धेत टिकाव धरू शकले नाहीत. बाजारपेठेत स्वदेशी वस्तूची जागा परदेशी वस्तू घेऊ लागल्या आहेत. तसेच अनेक स्वदेशी कंपन्याना आपली मालमत्ता परकीय कंपन्यांना विकणे भाग पडलेले आहे. हिंदुस्थान लिव्हर या बहुराष्ट्रीय कंपनीने कोठारी फुडस, डॉलाप आईस्क्रीम, किसान फूड, इ. कंपन्या ताब्यात घेऊन आपल्या समूहात विलीन केले.

७) जागतिकीकरण हे बहुराष्ट्रीय कंपन्याच्या विस्तारास अनुकूल ठरले आहे. प्रचंड भांडवल, अत्याधुन तंत्रज्ञान, विक्रीचे कौशल्य याच्या बळावर या कंपन्या बाजारपेठेत आपले वर्चस्व निर्माण करतात. लहान आणि मध्यम उयोग त्यांच्याशी स्पर्धा करु शकत नाहीत. यामुळे देशी बाजारपेठेत बहुराष्ट्रीय कंपन्याची मक्तेदारी निर्माण होण्याचा धोका निर्माण झाला.

८)जागतिकीकरणामुळे सार्वजनिक उयोगाचे खाजगीकरण करण्यात येऊ लागले. या प्रक्रीये खाजगीकरणाला विशेष महत्व असते. सार्वजनिक उयोग ना नफा ना तोटा या तत्वावर निर्माण झालेली होती. खाजगीकरणात नफा या घटकाला प्राधान्य देऊनच त्याचे कार्य चालते त्याचा परिणाम गरीब वर्गावर होत आहे.

९) जागतिकीकरणामुळे कृषी उत्पनात वाढ होईल आणि भारताच्या एकूण निर्यातीत शेती या शेतीशी संबंधित क्षेत्राचा वाट वाढेल अशी अपेक्षा केली गेली पण प्रत्यक्षात असे काहीही घडले नाही. जागतिक स्पर्धेत भारतीय शेतकरी टिकाव धरू शकला नाही. सरकारकडून शेतीसाठी अनुदान फार कमी प्रमाणात दिले जाते. या संदर्भात प्रा.के.एच.ठक्कर, प्रा.जि. व्ही. कुंभोजकर लिहितात "जपान मधील शेतकऱ्यांना सरकारकडून त्यांच्या एकरी उत्पादनाच्या ९०% सबसिडी दिली जाते तर युरोपमधल्या शेतकऱ्यांना ६४% सबसिडी दिली जाते तर अमेरिकेमधील शेतकऱ्यांना ती ३० ते ३५% इतकी दिली जाते. भारतात मात्र शेतकऱ्यांना १२ ते १५% इतकीच सबसिडी दिली जाते."[५]

१०) जागतिकीकरणाच्या प्रक्रियेत उत्पादनात वाढ करण्यासाठी नैसर्गिक साधन सामुग्रीचा अमर्याद वापर होऊ लागला. त्यामुळे ती संपुष्टात येईल आणि भविष्यात विकासाबाबत समस्या निर्माण होतील.

निष्कर्ष:

१) भारतीय अर्थव्यवस्थेची स्थिती खालावल्याने नवीन आर्थिक धोरणाद्वारे जागतिकीकरणाचा स्वीकार करण्यात आला.

२) जागतिकीकरणाचा स्वीकार करण्यापूर्वी परकीय चलन साठ कमी होता तुलनेत यामध्ये मोठ्या प्रमाणात वाढ झालेली दिसून येते.

३) जागतिकीकरणामुळे उपभोक्त्याच्या राहणीमानाचा दर्जा उंचावलेला दिसून येतो.

४) अर्थव्यवस्थेतील औद्योगिकरणाला गती मिळालेली दिसून येते.

५) देशी उद्योगांना आंतरराष्ट्रीय बाजारपेठेत स्पर्धा करावी लागत आहे.

६) बाजारपेठेत बहुराष्ट्रीय कंपन्याची एकाधिकारशाही निर्माण होण्याची शक्यता निर्माण झाली.

७) भारतीय शेतकऱ्यासमोर आंतरराष्ट्रीय बाजारपेठेचे आव्हान निर्माण झाले.

८) पर्यावरणाचा ऱ्हास आणि पर्यावरण प्रदूषणामध्ये वाढ झालेली दिसून येते.

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वैश्विकरणाचा भारतीय समाजावरील प्रभाव

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सारांश:

कार्ल मार्क्स यांच्या आर्थिक निर्धारणवादाच्या सिद्धांतानुसार समाजाच्या अधोसंरचनेत बदल झाला की, समाजाच्या अधिसंरचनेत बदल घडून येतो. भारतीय अर्थव्यवस्थेत जागतिकीकरणाचा स्वीकार केला. मार्क्स यांच्या सिद्धांताप्रमाणे त्याचा परिणाम म्हणून भारतीय समाजव्यवस्थेत अमुलाग्र बदल घडून आला. भारतीय अर्थव्यवस्थेची स्थिती खालावल्याने नवीन आर्थिक धोरणाद्वारे जागतिकीकरणाचा स्वीकार करण्यात आला. त्यामुळे परकीय चलन साठयात वाढ, राहणीमानाचा दर्जा उंचावला, औद्योगिकरणाला गती मिळाली, बहुराष्ट्रीय कंपन्याची एकाधिकारशाही, शेतकऱ्यासमोर आंतरराष्ट्रीय बाजारपेठेचे आव्हान आणि पर्यावरणाचा ऱ्हास आणि पर्यावरण प्रदूषणामध्ये वाढ झालेली दिसून येते.

महत्त्याच्या संकल्पना: गॅट करार, नवीन आर्थिक धोरण १९९१, जागतिकीकरण, खाजगीकरण, उदारीकरण, बहुराष्ट्रीय कंपनी

प्रस्तावना:

दुसऱ्या महायुद्धानंतर जागतिक व्यापार वाढविण्यासाठी जागतिक व्यापार संघटनेकडून प्रयत्न चालू होते. गॅट करारात सामील झालेल्या सदस्य राष्ट्रांनी जकाती, आयात-निर्यातीसाठी परवाना पद्धती, भेद भाव, कोटा पद्धती असे आंतरराष्ट्रीय व्यापारातील अडथळे दूर करायचे होते. १९४७ ते १९८६ पर्यंत गॅट कराराच्या आठ फेऱ्या झाल्या होत्या. आठवी फेरी गॅटचे डायरेक्टर आर्थर डंकेल यांच्या नेतृत्त्याखाली चालू होती. त्याच वेळी १९९१ मध्ये भारतीय अर्थव्यवस्था डबघाईला आली होती. अशा वेळी जागतिक संस्था (जागतिक बँक, आंतरराष्ट्रीय नाणेनिधी) यांनी मदत तर केलीच नाही. भारतावर अप्रत्यक्षरित्या जागतिकीकरणाच्या स्वीकारासाठी दबाव आणला. तेंव्हा भारताने आपल्या अर्थव्यवस्थेत संरचनात्मक बदल चालू केले. नवीन आर्थिक धोरण जाहीर केले. त्यानुसार भारताने जागतिकीकरण, खाजगीकरण आणि उदारीकरण याचा स्वीकार केला.

संशोधनाची उद्दिष्ट्ये:

१) जागतिकीकरणाचा स्वीकार करण्यामागील पार्श्वभूमीचे अध्ययन करणे.

२) जागतिकीकरणाचा भारतीय अर्थव्यवस्थेच्या दृष्टिकोनातून मूल्यमापन करणे.

संशोधन पध्दती:

प्रस्तुत विषयावरील अध्ययनासाठी संपूर्ण भारत हे कार्यक्षेत्र निश्चित करण्यात आले. वरील उद्दिष्टानुसार अध्ययन करण्यासाठी दुय्यम तथ्य सामुग्रीचा उपयोग करण्यात आला. दुय्यम तथ्याच्या उपलब्धतेसाठी दैनिक समाचार पत्र, संदर्भ ग्रंथ, मासिके, शोध निबंध, लेख इत्यादीचा आधार घेण्यात आला आहे.

जागतिकीकरण म्हणजे काय?

जागतिक अर्थव्यवस्था निर्माण करण्यासाठी जगातील देशांनी आपापल्या देशाच्या भौगोलिक सीमाचा विचार न करता जागतिक पातळीवर सर्व आर्थिक व्यवहार करून सर्व देशाची एकच बाजारपेठ म्हणजेच जागतिक बाजारपेठ निर्माण करणे याला जागतिकीकरण असे म्हणतात. जागतिकीकरणामध्ये आंतरराष्ट्रीय व्यापार मुक्त करण्यात येतो. आयात निर्यातीवर बंधने असत नाहीत. सर्व व्यवहार बाजारातील मागणी आणि पुरवठ्यानुसार चालतात. तसेच भाडवली वस्तूचे उत्पादन, तंत्रज्ञान, सेवा-सुविधा यामध्ये देशी परदेशी असा भेद केला जात नाही. भांडवलदाराचा प्रवाह मुक्तपणे कोणत्याही देशातून इतर देशात जाऊ शकतो. तसेच कोणत्याही देशात तयार झालेली वस्तू कोणत्याही बाजारपेठेत विकता येते. समाजशास्त्र विश्वकोश के अनुसार "भूमंडलीकरण की अवधारणा विश्व के बारे में एक एकल समष्टि के रूप में एक नवीन चेतना के उदभव को इंगित करती है। अतः भूमंडलीकरण को विश्व की एक मूर्त संरचना की सम्पूर्णता के रूप में परिभाषित किया जाता है।"[1]

तथ्याचे विश्लेषणात्मक निर्वचन:

१) १९९१ मध्ये भारतीय अर्थव्यवस्थेकडे जगातील इतर देश एका वेगळ्या नजरेने पाहू लागले त्यावेळी देशाला परकीय कर्जाचा बोजा असह्यय झाला होता. भारत सरकारला देणी वेळेवर देता येईनात, जुनी कर्ज फेडण्यासाठी नवीन अधिक रकमेची कर्ज घ्यावी लागत होती. केंद्र सरकारचे उत्पन्न कमी व खर्च जास्त अशी परिस्थिती होती. दैनंदिन खर्चासाठी सुध्दा कर्ज घ्यावे लागत होते. अल्प मुदतीच्या कर्जासाठी मुदतवाढ मिळणे अवघड झाले होते. काही कर्जाना दररोज नवीन करून घ्यावे लागत होते. त्यात भर म्हणून परदेशात राहणाऱ्या भारतीयांनी आपल्या ठेवी काढून घेण्यास सुरवात केली. परदेशी चलन साठा संपत आला. पंधरा दिवस आयात करता येईल एवढेच परकीय चलन भारताजवळ राहिले होते. या परिस्थिती बाबत एस. एल. दोषी लिहितात की "बाहरी कर्ज का संकट ई.1991 में. सामने आया। हमने विदेशो से कर्जा लिया था, उसका भुगतान समय पर नही हो सका। बाकी किस्तो का अंबार लाग गया। हुआ यह कि 1980 से हम बराबर घाटे के बजट पर चाल राहे थे।"[2] भारतीय अर्थव्यवस्थेची अशी परिस्थिती असताना मात्र जागतिक अर्थव्यवस्था जलद गतीने बदलत होती. जगातील अनेक राष्ट्रांनी जागतिक अर्थव्यवस्थेशी जोडले जाण्यासाठी देशामध्ये नवीन आर्थिक सुधारणा करण्याचे धोरण स्वीकारले' भारतासमोर सुध्दा पर्याय नसल्याने नवीन आर्थिक धोरणाचा स्वीकार कराचा लागला.

२)विदेशी गुंतवणूक ही विदेशी चलनात येते त्यामुळे परकीय चलनाचा साठा वाढतो यातूनच आंतरराष्ट्रीय चलन विषयक व आंतरराष्ट्रीय रोखतेचा प्रश्न सुटतो जागतिकीकरणामुळे कृषि विकास व आंतरराष्ट्रीय विकास प्रभावित होऊन उत्पादन वाढ होते. वाढीव उत्पादनातून देशातील लोकांच्या गरजा भागून उर्वरित उत्पादनाची निर्यात केली जाते. निर्यातवाढीतून परकीय चलनसाठ्यात वाढ होते. परकीय चलन साठ्यात वाढ झाल्यास देशातील आंतरराष्ट्रीय पातळीवर पत वाढते. जागतिकीकरणापूर्वी परकीय चलनाची परिस्थिती कशी होती या विषयी कै. प्रा. डॉ. स. श्री. मु. देसाई आणि सौ. डॉ. निर्मल भालेराव लिहितात "एका बाजूला स्थिरावलेली अर्थव्ययस्था, किंवहुना कमी होणारी भारताची निर्यात आणि दुसऱ्या बाजूला सतत वाढणारी आयात, अशी परिस्थिती निर्माण झाल्यामुळे भारताला परकीय चलनाची अधिकाधिक टंचाई भासू लागली."[3]

३) जागतिकीकरणामुळे अनेक दर्जेदार वस्तू देशात उपलब्ध झाल्याने उपभोक्त्यांना अनेक पर्याय उपलब्ध होतात. वस्तू निवडीची संधी प्राप्त होते. दर्जेदार वस्तू रास्त किंमतीला मिळू लागतात. त्यामुळे उपभोक्त्याच्या वास्तव उत्पन्नात वाढ होते. वस्तू व सेवांच्या मागणीत वाढ होते. उपभोगात

वाढ होते. लोकांचा राहणीमानाचा दर्जा उंचावला. या बाबतीत एस.एल.दोषी लिहितात "अब भारतीय समाज एक उपभोग समाज का रूप ले राहा है। देश के कई गावो में बिजली पहुंच गई है। मिट्टी के तेल का उपभोग व्यापक हो गया है, सडको का विशाल जाल फैल गया है, संचार साधन विकसित हो गये है और खान-पान तथा रहन-सहन में सजातीयता आ गई है।"[४]

४)परकीय भांडवल गुंतवणुकीस मिळणारे प्रोत्साहन, उयोजकांना देण्यात आलेल्या सवलती यामुळे नवे उयोग व्यवसाय देशात सुरु आहेत. तंत्रज, शास्त्रज, अभियंता, कुशल कामगार यांना रोजगाराच्या नव्या संधी उपलब्ध होत आहेत. परदेशातही आशा संधी मिळू लागल्या आहेत.

५)भारताने जागतिकीकरणाचे धोरण स्वीकारल्या नंतर भारतातून निर्यात होणाऱ्या शेतमालावरील नियंत्रण दूर झाले. परिणामी शेतमालाच्या निर्यातीस प्रोत्साहन मिळाले. या धोरणानुसार आयातीवरील बंधने दूर केल्याने शेती उत्पादनासाठी नवीन तंत्रज्ञानाची आयात सहज करता येईल. परिणामी शेती क्षेत्रात नवीन तंत्रज्ञानाचा वापर वाढला. शेती उत्पादनासाठी बते, बियाणे, किटकनाशके इत्यादी घटकांची आवश्यकता असते या घटकांना शेती आदाने म्हणतात. नवीन धोरणामुळे शेतीसाठी आदाने सहज उपलब्ध होतील. भारतीय शेती क्षेत्रात विविधता आहे. भारतातील नैसर्गिक अनुकूलतेमुळे येथे विविध पिकांचे उत्पादन होते. या सर्व प्रकारच्या उत्पादनाला आंतरराष्ट्रीय पातळीवर बाजारपेठाची संधी उपलब्ध झाली.

६)पूर्वी आयात निर्यात व्यापारावरील निर्बधामुळे देशी उयोजकांना संरक्षण मिळाले होते. हे निर्बध शिथिल झाल्यामुळे देशी उयोजकांना कंपन्याशी स्पर्धा करावी लागत आहे. परकीय कंपन्याकडील भांडवल, अत्याधुनिक तंत्रज्ञान, प्रचार तंत्र यामुळे अनेक देशी उयोग जागतिक स्पर्धेत टिकाव धरू शकले नाहीत. बाजारपेठेत स्वदेशी वस्तूची जागा परदेशी वस्तू घेऊ लागल्या आहेत. तसेच अनेक स्वदेशी कंपन्याना आपली मालमत्ता परकीय कंपन्यांना विकणे भाग पडलेले आहे. हिंदुस्थान लिव्हर या बहुराष्ट्रीय कंपनीने कोठारी फुडस, डॉलाप आईस्क्रीम, किसान फूड, इ. कंपन्या ताब्यात घेऊन आपल्या समूहात विलीन केले.

७) जागतिकीकरण हे बहुराष्ट्रीय कंपन्याच्या विस्तारास अनुकूल ठरले आहे. प्रचंड भांडवल, अत्याधुन तंत्रज्ञान, विक्रीचे कौशल्य याच्या बळावर या कंपन्या बाजारपेठेत आपले वर्चस्व निर्माण करतात. लहान आणि मध्यम उयोग त्यांच्याशी स्पर्धा करु शकत नाहीत. यामुळे देशी बाजारपेठेत बहुराष्ट्रीय कंपन्याची मक्तेदारी निर्माण होण्याचा धोका निर्माण झाला.

८)जागतिकीकरणामुळे सार्वजनिक उयोगाचे खाजगीकरण करण्यात येऊ लागले. या प्रक्रीये खाजगीकरणाला विशेष महत्व असते. सार्वजनिक उयोग ना नफा ना तोटा या तत्वावर निर्माण झालेली होती. खाजगीकरणात नफा या घटकाला प्राधान्य देऊनच त्याचे कार्य चालते त्याचा परिणाम गरीब वर्गावर होत आहे.

९) जागतिकीकरणामुळे कृषी उत्पनात वाढ होईल आणि भारताच्या एकूण निर्यातीत शेती या शेतीशी संबंधित क्षेत्राचा वाट वाढेल अशी अपेक्षा केली गेली पण प्रत्यक्षात असे काहीही घडले नाही. जागतिक स्पर्धेत भारतीय शेतकरी टिकाव धरू शकला नाही. सरकारकडून शेतीसाठी अनुदान फार कमी प्रमाणात दिले जाते. या संदर्भात प्रा.के.एच.ठक्कर, प्रा.जि. व्ही. कुंभोजकर लिहितात "जपान मधील शेतकऱ्यांना सरकारकडून त्यांच्या एकरी उत्पादनाच्या ९०% सबसिडी दिली जाते तर युरोपमधल्या शेतकऱ्यांना ६४% सबसिडी दिली जाते तर अमेरिकेमधील शेतकऱ्यांना ती ३० ते ३५% इतकी दिली जाते. भारतात मात्र शेतकऱ्यांना १२ ते १५% इतकीच सबसिडी दिली जाते."[५]

१०) जागतिकीकरणाच्या प्रक्रियेत उत्पादनात वाढ करण्यासाठी नैसर्गिक साधन सामुग्रीचा अमर्याद वापर होऊ लागला. त्यामुळे ती संपुष्टात येईल आणि भविष्यात विकासाबाबत समस्या निर्माण होतील.

निष्कर्ष:

१) भारतीय अर्थव्यवस्थेची स्थिती खालावल्याने नवीन आर्थिक धोरणाद्वारे जागतिकीकरणाचा स्वीकार करण्यात आला.

२) जागतिकीकरणाचा स्वीकार करण्यापूर्वी परकीय चलन साठ कमी होता तुलनेत यामध्ये मोठ्या प्रमाणात वाढ झालेली दिसून येते.

३) जागतिकीकरणामुळे उपभोक्त्याच्या राहणीमानाचा दर्जा उंचावलेला दिसून येतो.

४) अर्थव्यवस्थेतील औद्योगिकरणाला गती मिळालेली दिसून येते.

५) देशी उद्योगांना आंतरराष्ट्रीय बाजारपेठेत स्पर्धा करावी लागत आहे.

६) बाजारपेठेत बहुराष्ट्रीय कंपन्याची एकाधिकारशाही निर्माण होण्याची शक्यता निर्माण झाली.

७) भारतीय शेतकऱ्यासमोर आंतरराष्ट्रीय बाजारपेठेचे आव्हान निर्माण झाले.

८) पर्यावरणाचा ऱ्हास आणि पर्यावरण प्रदूषणामध्ये वाढ झालेली दिसून येते.

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२)दोषी एस.एल.,२००२,आधुनिकता उत्तर-आधुनिकता एवं नाव-समाजशास्त्रीय सिद्धांत,जयपूर, रावत पब्लिकेशन्स पृ.क्र.३५३

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SOCIAL REALITY OF MIGRATION IN ABDULRAZAK GURNAH'S NOVELS

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ABSTRACT:
Social Reality of Migration in Abdulrazak Gurnah's Novels Migration is a multifaceted social issue in Abdulrazak Gurnah's Novels. The purpose of this research is to take an analytical approach to Abdulrazak Gurnah's fundamental concerns about human migration. The portrayal of human migration has always been an important part of literature. The goal of this research is to better understand how Gurnah's literary depictions from the early days of colonialism through the end of the twentieth century delve into the cultural, social, and political landscape of East Africa's coast. The study will be conducted to find out the social reality of migration in Abdulrazak Gurnah's novels.

Key words: - *Migration, colonialism, multifaceted social issue*

INTRODUCTION:

Human migration is a multifaceted societal problem. I try to take an analytical approach to Abdulrazak Gurnah's fundamental concerns about social reality of human migration. Human migration has long been an important theme in literature. The researchers seek to comprehend how Gurnah speculates and interrogates the cultural, social, and political picture on the East African coast via his literary description from colonialism's beginnings until the end of the twentieth century.

SIGNIFICANCE OF THE STUDY:

The present paper studies the entire novelistic corpus of Abdulrazak Gurnah, whose work focuses on the issue of migration. Gurnah, on the other hand, uses fresh aesthetic qualities as an analytic frame to connect with his signature issue in each novel. Gurnah's novels offer new insights into relocation and raise new concerns about what it means to be a migrant or stranger in hostile surroundings, and how such circumstances necessitate a negotiation of hospitable space. The artistic resourcefulness and diversity with which he structures his storylines in order to locate them within their historical circumstances is what gives each of his works a specific aesthetic appeal. Gurnah employs a range of narrative perspectives that not only challenge the reader in the effort of comprehending his complicated works, but also allow the reader to enjoy the process of doing so. Gurnah is one of the most prolific and refreshing personalities in East African writing. His writing style is different adhered to reality. Memory of Departure (1987), Pilgrims Way (1988), Dottie (1990), Paradise (1994, short-listed for the Man Booker Prize), Admiring Silence (1996), By the Sea (2001), Desertion (2005) and The Last Gift (2011), all of Gurnah's these novels are engage with migration and its attendant themes. Apart from the eight novels, Gurnah is also known for his critical works. He has edited several volumes of literary criticism, Essays on African Writing: A Re-evaluation (1993) and Essays on African Writing: Contemporary Literature (1995) and The Cambridge Companion to Salman Rushdie (2007).

Social Reality of Migration - A Brief :

In Gurnah's novels, there is a specific focus on Zanzibar setting. The fundamental context of Gurnah's story is the environment of hatred in the UK, as well as the circumstances of his expulsion from Zanzibar. Gurnah's principal themes of migration, trade, and hospitality are crystallised by his compassion for those dislocated from their place of origin. These topics are explored throughout his fiction, which is situated in a variety of diverse yet interconnected temporal and physical locales. The cultural, historical and economic significance of Zanzibar may be better understood. Human exchanges are recurring themes in Gurnah's work. The extensive commercial history between Zanzibar and the rest of the world resulted in the Zanzibar community's mosaic-like composition. Because of this trading history, as well as Zanzibar's contact with the horrific past of slavery and colonialism, human connections on the East African Indian Ocean Island have been defined by power disparities attributable to these historical occasions.

They brought with them their goods and their God and their way of looking at the world, their stories and their songs and prayers, and ... and a glimpse of their learning ... they brought their hungers and greed, their fantasies and lies and hatreds, leaving some among their numbers behind .... (By the Sea 15)

Social reality of migration in Gurnah's novels focuses our attention to his novels. They experience with travel and narration which expose and contradict monologic conceptions of reality. This paper has demonstrated how Gurnah's novels direct the reader's attention to the extensive and various intercultural exchanges between the East African Indian Ocean coast and the outside world, even before European colonialism. The relocation of people caused by post-independence nationalism and the violence associated with East African nationalism accounts for the social and existential problems that his characters experience in the UK. Thus, his writings inspire readers to join him in questioning the world they live in, with its numerous exclusionary mechanisms, whether discursive or material, and to envisage alternative social realities.

Gurnah's novels draw our attention to how monologic versions of reality are exposed and challenged by encounters brought about by travel and narration. Through an analysis of these devices, it has been shown how the reader's attention to the long and varied intercultural exchanges between the East African Indian Ocean coast and the outside world, even before the advent of European colonialism. The displacement of people, occasioned by post-independence nationalism and the violence attending the politics of the nation in East Africa, accounts for the social and existential anxieties that his characters live with in the UK.

In Gurnah's fictions, Migration has two stratums-internal and external. He deployed internal migration as the movement of people to a particular place within the country, and external migration as the movement of people to other country. Cultural changes are more prevalent in the case of external migration in compare to the internal migration. According to Malinowski,

"Culture is an adaptive mechanism, created by the society to please different needs of the people of any community. The cultural attribute is established in a specific situation and circumstances..."

According to him, all the different cultures on this paradise should be considered on the basis of its historical context. In the process of Migration from particular regions of individuals and groups may have to redefine a new cultural trait to adapt them in a new cultural milieu. It enables humans to make adjustment in

behaviour without going through a biological modification of one's organism. Migrants bring with them different cultures, traditions, languages and religions. When culturally different persons come into the contacts of another culture they significantly influence on each other's culture, language, and even politics.

The cross-cultural interaction creates conflicts and confusions. Cultural philosophy has been inheritedfrom the ancestors. On the basis of this inherited philosophy, it is usually creates the assumptions that how and in which way it is culturally related or different from others. The way to look at realism of society is influenced by the self-centred principle to judge others. This philosophy of culture believes can be understood in the context cultural history of a particular society.

Gurnah's novels delineate homelessness and how the feeling of homeless creates identity crisis. ***Memory of Departure*** is set in the years immediately after Tanzania's independence in 1961. The novel insists that how the human body tries to follow the soul as body is far from where the soul wants to wander. Post-colonial literary theory of Cap low very relevant in which he emphasizes that a condition of detachment from society is characterized by the absence or attenuation of the affiliated bonds. The setting of this novel is not prolonged outside East African and Indian Ocean coastal towns but the novel narrates Gurnah's complete historical, geopolitical, and economic legacy through imagination. This novel engages with cynicism, disillusionment, and the violent socio-political situation just after independence in Tanzania. This violent situation left many natives just like an immigrant in their own country because they had to relocate by leaving their own place. The novel explores the different aspect in post-independence Tanzania's political system.

Gurnah's ***Paradise*** is set before the First World War in Zanzibar. The novel has six segments which progressing around the life of the Yusuf and an Arab descent slave trader Aziz. It focuses on the depiction of nineteenth century colonial East Africa. The relevance of this depiction can be found significant as it gives historical description of the end of the nineteenth century, finding the strong link between the Slavery and migrated Arabs in East Africa.

Abdulrazak Gurnah's ***Admiring Silence*** published in 1996 is written in a first-person account of an unnamed migrant of Omani-Swahili origin from Zanzibar who is smuggled out England from his native place Zanzibar. The first section of the novel describes how he came in contact with a British white woman Emma and we come to know the background of the narrator.

Gurnah's novel Pilgrims Way published in 1988 depicts the tussle between different ethnic and racial groups during 1970s in Britain. These all different groups of British society had tried to come together in the previous decades to fight with racism. Gurnah through this novel tries to give a realistic picture of society through the political consciousness of its main character Daud. The protagonist Daud is a young misanthropic Tanzanian migrant who works in a hospital in Canterbury. He suffers with racial abuse so many times in his life. This minute description is constructed to place Daud in British society with a synchronic and diachronic perception. It portrays the process of difficulty in identity formation by the protagonist through a visualization process of '*othering*'.

AIMS AND OBJECTIVES:

The present research aims to study following objectives:

1. To make an indepth study of different social human relationship in Abdulrazak Gurnah's novels.
2. To understand migration problem and its consequences related to refugees.
3. To critically examine the socio-cultural issues in Abdulrazak Gurnah's novels.

HYPOTHESIS:

The present research will be based on following Hypothesis:

1. Abdulrazak Gurnah is the thinker of social reality of migration.
2. Abdulrazak Gurnah's profound and systematic exposition of migration has got much to offer the contemporary society.
3. Migration and homelessness is the core issue of Abdulrazak Gurnah's novels.

SCOPE AND LIMITATION:

The present study aims to investigate how Abdulrazak Gurnah is deep-rooted in humanism which allowed him to give voice to the silenced majority of the refugees. Almost all the novels of Gurnah are related to cultural aspect of human relationship and the predicament of migration. The scope for the study is limited to his ten novels.

RESEARCH METHODOLOGY:

With the corpus of his fictional writings, Gurnah attracted the attention of critics and scholars from the different parts of the country and the world as well. I propose to make a humble endeavour in the dissertation to study all the novels of Gurnah in a systematic manner in the light of critical responses of various critics. The Descriptive and analytical methods will be used for the study. The material used for the study will be original novels, texts books as primary sources.

CONCLUSION :

To be conclude this research paper demonstrates how Gurnah's fiction employs numerous artistic tactics as possible means of thinking about individual identity and social relations with others through its examination of migratory subjectivities and their multiple and varied negotiations to construct enabling spaces.

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Synthesis, Characterization and Antibacterial Study of Some Transition Metal Complexes with Novel Schiff Base having 1,3,4-Thiadiazole Moiety

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Some transition metal ions [Zr(IV), Co(II), Cu(II), Cr(III), Ag(I), Pd(II)] complexes were synthesized by reacting anisaldehyde, thiosemicarbazide and 2-(4-hydroxybenzylideneamino)benzoic acid to form (4-[2{5-[(4-methoxy-benzylidene)amino][1,3,4]thiadiazole-2-yl}phenylimino)methyl]phenol ligand. Schiff base ligand and its metal complexes were characterized by elemental analysis, IR, UV-visible, NMR (^{1}H NMR, ^{13}C NMR), thermal analysis, molar conductance, magnetic susceptibility and antimicrobial study. Zone of inhibition as well as MIC has been evaluated against *E. coli* (MTCC443), *S. aureus* (MTCC1688), *P. aeruginosa* (MTCC96), *C. albicans* (MTCC227), *A. niger* (MTCC82) organisms comparing with standard antimicrobial and antifungal drugs. TGA/DTA of the synthesized metal complexes shows the thermal stability and non-spontaneous nature of decomposition. It also shows multi-step degradation behaviour and final weight loss with respect to the formation of metal oxide and residue.

Keywords: Biological activity, Coordination, Schiff base, Thermal analysis, Transition complex.

INTRODUCTION

1,3,4-Thiadiazole structure showed much feeble because of inductive effect of S-atom which acquire strong aromaticity [1]. Azomethine bearing sp^2 hybridized N-atom considerably signify because of its structural flexibility. Heterocyclic nitrogen atom in ring structure can acts as e^- deficient, as a result electrophilic substitution reaction can takes place at 2nd and 5th position of ring [2]. To obtain 4-{[(2-5-amino[1,3,4]thiadiazole-2-yl)-phenylimino]methyl}phenol intermediate, the pH of reaction mixture should be maintain at 7. As 1,3,4-thiadiazole derivative showed *meso*-ionic nature which are capable to transverse cell layer as a result they showed *in vitro* biological property [3].

Ligands which donate electron to *d*-orbital of metal ion and form a bond has to be a great attention due to its potential activity towards transition metal complexes [4]. Synthesized complexes having N,O donor atoms in coordination complexes show valuable use in stereospecific reaction as well as biological activity [5]. Metal complex exhibited thiadiazole ring synthesized from Schiff base ligand comprising significant function in various influence for lower down toxicity and increase strength in living organism [6]. Palladium(II) complexes show biological activity such as anti HIV, antifungal, antitumor activities and show less side effect compared to cisplatin [7]. As a result transition metal complexes prepared from Schiff base ligands have wide applications in medicinal purposes [8].

1,3,4-Thiadiazoles derivatives show the remarkable use in CNS depressant, molluscicidal, antitubercular also anti H-pylori [9], antibacterial, antifungal and anticancer properties, pharmaceutical [10]. Now a days, there has been much interest in the metal complex study containing, N, S and N, O donor ligand because of structural properties and carcinostatic activity of ligands and its meal complexes derived from them [11]. In view of above facts, the present article embodies the spectral, thermal and biological studies on the newly synthesized (4-[2{5-[(4-methoxybenzylidene)amino][1,3,4]-thiadiazole-2-yl}phenylimino)methyl]phenol and its metal complexes [Zr(IV), Co(II), Cu(II), Cr(III), Ag(I), Pd(II)].

EXPERIMENTAL

All the chemicals and solvents were of A.R. grade and used without purification. Phosphorus oxychloride was purchased from Loba Chemie, 4-nitrobenzaldehyde, anisaldehyde

were procured from Thomas-Baker, potassium hydroxide pallets and silver nitrate from Loba chemie, $PdCl_2$ was purchased from Burgoyne. The UV-visible spectra was recorded on Agilent Cary 5000, infrared spectra were recorded on Perkin Elmer FTIR 400, ^{1}H NMR in Bruker Avance III, NMR by Jeol, Japan ECZR Series 600 MHz Spectrometer, ^{13}C NMR from Avance Neo Brucker 125 MHz, magnetic susceptibility was done by Gouys balance electromagnet model no. SSA-1305B, (Acculab) melting point were determined in electrical melting point apparatus and are uncorrected. Digital conductivity meter (model no. EQ 660A) was used to evaluate conductivity of ligand and its metal complexes using DMSO-d_6 solvent. Elemental analysis (C,H,N,S) were determined on Elementary Vario EL III. Thermal analysis (TGA, DTA) was done on Perkin-Elmer STA 600.

Synthesis of Schiff base ligand

(4-[2{5-[(4-Methoxy-benzylidene)amino][1,3,4]thiadiazole-2yl}phenylimino)methyl]phenol (L): A mixture of 2-(4-hydroxybenzylideneamino)benzoic acid (0.01 mol), thiosemicarbazide (0.01 mol) and $POCl_3$ (5 mL) was heated under reflux for about 3 h. Upon cooling 50 mL distilled water was added to the reaction mixture and refluxed was carried for 4 h. The obtained filtrate was neutralized with KOH solution to obtain 4-{[(2,5-amino[1,3,4]thiadiazole-2-yl)phenylimino]-methyl}phenol. In the next reaction, 4-{[(2,5-amino[1,3,4]-thiadiazole-2-yl)phenylimino]methyl}phenol (0.02 mol) was added dropwise in 20 mL ethanolic solution of anisaldehyde in (0.02 mol) solution. The mixture afterwards refluxed for about 3 h. Yellow coloured precipitate was obtained, which get filtered and recrystallized with ethanol and dried out in vacuum.

Synthesis of metal complex: Ethanolic solution of metal ion $ZrOCl_2 \cdot 8H_2O$, $CoCl_2 \cdot 6H_2O$, $CuCl_2 \cdot 2H_2O$, $Cr(NO_3)_3 \cdot 9H_2O$, $AgNO_3$, $PdCl_2$ was added in ethanolic solution of (4-[2{5-[(4-methoxybenzylidene)amino][1,3,4]thiadiazole-2-yl}phenyl-imino)methyl]phenol in 1:2 ratio. The reaction mixture was heated for 0.5 h. The coloured precipitate was obtained get filtered and recrystallized with ethanol.

RESULTS AND DISCUSSION

The elemental analysis and other physical data of ligand and its metal complexes are shown in Table-1. The molecular formula of compounds was suggested on the basis of elemental analysis (CHNS), spectral characterization, magnetic moment and conductivity measurement. The molar conductance of synthesized complexes were recorded at room temperature. All complexes were found to be low molar conductivity values in the range of 43-55 ohm^{-1} cm^2 mol^{-1}. It signify that all the synthesized metal complexes are non-electrolytic and neutral in nature (Table-1). The magnetic susceptibility were measured at room temperature by using Gouy method. Mercuric tetrathiocyanatocobaltate(II) was used as a standard for susceptibility measurement. The magnetic moment values are also given in Table-1.

IR analysis: The key spectral IR data of novel Schiff base and their metal complexes are given in Table-2. Ligand shows a broad band in the region 3063 cm^{-1} revealed the presence of ν(O-H) stretching. Infrared spectrum of ligand showed the appearance of band at 1250 cm^{-1} indicating ν(C-O) stretching. In addition, band observed at 3009 cm^{-1} represent aromatic (C=H) stretching in ligand. The azomethine (C=N) band observed at 1635 cm^{-1} region, the shifting of band from ligand to metal ion region by 10-15 cm^{-1} indicates complex were formed. In ligand as well as its metal complexes methyl (C-H) stretch observed at ~2950 and 2838 cm^{-1}. Frequency corresponds to (C-O-C) asymmetric stretching at 1301 cm^{-1}, while 1001 cm^{-1} for symmetric stretching is due to presence of methylated group attached to aromatic ring [12]. All the synthesized compounds show spectrum band at region 603 cm^{-1} assigned to ring stretching of (C-S) stretching. New peaks appear in the region of 523-406 cm^{-1} and 523-500 cm^{-1}. These bands were observed in metal complexes while absent in ligand may be attributed to vibration of ν(M-N) and ν(M-O), respectively [13].

NMR: The ^{1}H NMR spectra were recorded on DMSO-d_6. The ^{1}H NMR spectra of ligand showed δ 9.83 ppm for –OH, –N=CH and aromatic protons signals at δ 6.84 ppm and in the

TABLE-1
PHYSICO-CHEMICAL ANALYSIS DATA OF NOVEL SCHIFF BASE CONTAINING 1,3,4-THIADIAZOLE MOIETY AND ITS METAL COMPLEXES

Compound	Colour	m.p. (°C)	Elemental analysis (%): Found (calcd.)						χ_m (A/m)	Λ_m (ohm^{-1} cm^2 mol^{-1})
			C	H	N	S	O	M		
$C_{23}H_{18}N_4O_2S$	Red	130	66.81 (66.32)	4.14 (4.10)	13.55 (13.32)	7.75 (7.61)	7.74 (7.60)	–	–	42
$C_{46}H_{36}N_8O_6SZr$	Orange	128	61.30 (60.82)	2.27 (2.14)	13.03 (12.87)	7.02 (6.94)	6.98 (6.58)	9.84 (9.25)	Diamag.	47
$C_{46}H_{34}N_8O_4S_2Co$	Green	125	61.27 (60.07)	2.97 (2.82)	13.06 (12.84)	6.68 (6.40)	6.24 (6.03)	6.36 (6.14)	3.85	52
$C_{46}H_{34}N_8O_4S_2Cu$	Yellow	124	61.93 (61.41)	3.85 (3.72)	12.50 (12.23)	7.20 (6.85)	7.19 (7.03)	7.11 (6.98)	1.64	50
$C_{46}H_{38}N_8O_6S_2Cr$	Red	197	58.96 (58.76)	4.11 (3.96)	11.85 (11.42)	6.80 (6.51)	6.73 (6.48)	11.27 (11.12)	3.92	53
$C_{46}H_{34}N_8O_4S_2Ag$	Green	126	60.92 (60.74)	4.88 (4.03)	12.68 (12.45)	7.05 (6.82)	10.36 (9.85)	4.58 (4.21)	Diamag.	40
$C_{46}H_{34}N_8O_4S_2Pd$	Red	195	58.67 (58.32)	3.85 (3.14)	12.19 (12.10)	6.01 (5.87)	6.12 (5.85)	11.60 (11.13)	0.72	42

TABLE-2
KEY IR (cm^{-1}) SPECTRAL DATA OF NOVEL SCHIFF BASE CONTAINING 1,3,4-THIADIAZOLE AND ITS METAL COMPLEXES

Compound	ν(O-H)	Ar(C-H)	(C=C)	ν(C=N)	ν(C-S)	ν(M-O)	ν(M-N)
$C_{23}H_{18}N_4O_2S$	3063	3009	1442	1635	603	–	–
$C_{46}H_{36}N_8O_6S_2Zr$	–	3107	1440	1632	605	513	416
$C_{46}H_{34}N_8O_4S_2Co$	–	3108	1448	1630	602	518	420
$C_{46}H_{34}N_8O_4S_2Cu$	–	3111	1450	1634	605	514	434
$C_{46}H_{38}N_8O_6S_2Cr$	–	3110	1452	1634	606	515	418
$C_{46}H_{34}N_8O_4S_2Ag$	–	3109	1449	1630	604	515	448
$C_{46}H_{34}N_8O_4S_2Pd$	–	3110	1448	1631	606	516	432

range of δ 7.53-8.77 ppm, respectively. The ^{1}H NMR spectra for C4 complex showed lower chemical shift for –OH at δ 8.98 ppm, –N=CH, aromatic protons and –OCH_3 signal centering at δ 6.82 ppm, in the range of δ 7.19-8.09 ppm and δ 3.92 ppm, respectively.

^{13}C NMR of ligand was characterized by presence of –(N=CH) of azomethine group, which appeared as a signal at δ 3.75 ppm. The chemical shift of C-atom in ring appeared at δ 123.57-131.96 ppm. The spectra appeared low field at δ 175.32 ppm, which was assigned for CH=N of thiozole ring. The ^{13}C NMR spectral data of complexes is shown in Table-3. The spectra of C5 complex was characterized by presence of (N=CH) of azomethine group which appeared a signal at δ 111.62 ppm. Chemical shift of C atoms in aromatic appeared at ring δ 122.85-135.58 ppm. The spectra appeared at low field at δ174.28 ppm, which was assigned to CH=N of thiozole ring [14].

Electronic spectra: The electronic spectra of ligand exhibited a high intensity band appeared as a singlet due to intra ligand transition, the band which appeared at 318 nm (31447 cm^{-1}) was assigned to π-π* transition of the conjugated system. A lower intensity band appeared at the region 425 nm (23529 cm^{-1}) was assigned to n-π*. The electronic spectrum of Zr(IV) complex exhibited absorption band at 240 nm (41600 cm^{-1}) and 248 nm (40322 cm^{-1}) assigned to CT transition, indicating octahedral geometry. The electronic spectrum of Co(II) complex exhibited absorption bands at 632 nm (15822 cm^{-1}) and 391 nm (25575 cm^{-1}) signify $^4A_2$ (F) $\rightarrow$ $^4T_1$ (P) and MLCT transition shows complex is tetrahedral. The Cu(II) complex shows band at rage of 644 nm (15527 cm^{-1}), 5711 nm (17573 cm^{-1}), 513 nm (19493 cm^{-1}) is due to $^2B_{1g}\rightarrow{}^2A_{1g}$, $^2B_{1g}\rightarrow{}^2E_g$, CT transition respectively. This indicate square planar geometry of complex (Table-4).

The spectrum of Cr(III) shows band at 644 nm (15527 cm^{-1}), 491 nm (20328 cm^{-1}), 354 nm (28221 cm^{-1}) assigned for $^4A_{2g}\rightarrow{}^4T_{2g}$ (F), $^4A_{2g}\rightarrow{}^4T_{1g}$ (F), $^4A_{2g}\rightarrow{}^4T_{2g}$ (P) indicate presence of octahedral geometry. Ag(I) complex shows band at 284 nm (40322 cm^{-1}), 305 nm (32786 cm^{-1}), 348 nm (28735 cm^{-1}) given for π-π* transition, n-π* transition and Ag→L (CT) transition. This shows that complex display square planar geometry. Palladium(II) complexes appears at 448 nm (22321 cm^{-1}), 402 nm (24875 cm^{-1}), 318 nm (31446 cm^{-1}), which are due to $^1A_{1g}\rightarrow{}^1B_1g$, $^1A_{1g}\rightarrow{}^1E_g$, L→Pd indicating square planar geometry (Table-4).

TABLE-3
NMR (^{1}H NMR, ^{13}C NMR, δ ppm) SPECTRAL DATA OF NOVEL SCHIFF BASE CONTAINING 1,3,4-THIADIAZOLE MOIETY AND ITS METAL COMPLEXES

Compound	^{1}H NMR				^{13}C NMR		
	N=CH	Aromatic	OH	O-CH_3	N=CH	Thiozol ring (CH=N)	Aromatic
$C_{23}H_{18}N_4O_2S$	6.84(s)	7.53-8.77(m)	9.82(s)	3.75(s)	115.76	175.32	123.57-131.96
$C_{46}H_{36}N_8O_6S_2Zr$	6.89(s)	7.66-8.72(m)	–	2.51(s)	112.64	171.45	124.65-133.63
$C_{46}H_{34}N_8O_4S_2Co$	6.90(s)	7.19-8.09(m)	–	3.78(s)	114.46	170.63	122.23-135.81
$C_{46}H_{34}N_8O_4S_2Cu$	6.93(s)	7.21-8.68(m)	–	2.45(s)	112.12	176.42	125.38-133.62
$C_{46}H_{38}N_8O_6S_2Cr$	6.82(s)	7.19-8.09(m)	–	3.92(s)	116.87	174.74	123.52-134.74
$C_{46}H_{34}N_8O_4S_2Ag$	6.87(s)	7.74-8.77(m)	–	3.80(s)	111.62	174.28	122.85-135.58
$C_{46}H_{34}N_8O_4S_2Pd$	6.89(s)	7.65-8.73(m)	–	3.65(s)	112.83	173.47	121.46-134.86

TABLE-4
ELECTRONIC TRANSITION DATA OF NOVEL SCHIFF BASE CONTAINING 1,3,4-THIADIAZOLE AND ITS METAL COMPLEXES

Compound	Absorption	Bond assignment	Geometry
$C_{23}H_{18}N_4O_2S$	318 nm (31447 cm^{-1}), 425 nm (23529 cm^{-1})	(π-π*), (n-π*) transition	–
$C_{46}H_{36}N_8O_6S_2Zr$	240 nm (41600 cm^{-1}), 248 nm (40322 cm^{-1})	CT transition	Octahedral geometry
$C_{46}H_{34}N_8O_4S_2Co$	632 nm (15822 cm^{-1}), 391 nm (25575 cm^{-1})	$^4A_2(F)\rightarrow{}^4T_1^{(P)}$, MLCT	Tetrahedral geometry
$C_{46}H_{34}N_8O_4S_2Cu$	644 nm (15527 cm^{-1}), 571 nm (17573 cm^{-1}), 513 nm (19493 cm^{-1})	$^2B_{1g}\rightarrow{}^2A_1g$, $^2B_1g\rightarrow{}^2Eg$, CT transition	Square planar geometry
$C_{46}H_{34}N_8O_4S_2Ag$	284 nm (40322 cm^{-1}), 305 nm (32786 cm^{-1}), 348 nm (28735 cm^{-1})	(π-π*) transition, (n-π*) transition, Ag→L (CT) transition	Square planar geometry
$C_{46}H_{34}N_8O_4S_2Pd$	448 nm (22321 cm^{-1}), 402 nm (24875 cm^{-1}), 318 nm (31446 cm^{-1})	$^1A_1g\rightarrow{}^1B_1g$, $^1A_1g\rightarrow{}^1Eg$, L→Pd	Square planar geometry

Thermal analysis: Thermal analysis of metal complexes were carried in thermal range of 40 to 830 ºC at 20 ºC/min under nitrogen flow. All the metal complexes undergoes decomposition in stepwise manner. The Zr(II) complex shows the weight loss of (3.76% calcd., 3.83% found) correspond to the removal of two water molecules at temperature range 80-180 ºC. At temperature range 250-350 ºC, weight loss was 25.15% calcd. (25.42% found) indicate the removal of two molecules of C_8H_8O. The 400-450 ºC correspond to the removal of two molecules of $C_8H_4N_3S$ with a weight loss of 36.47% calcd. (36.53% found). The next step occured within the temperature range 500-600 ºC, which shows the weight loss of 5.66% calcd. (5.72% found) which might be loss of two molecules of CHN moiety. Afterwards, the gradual decrease in TGA mass loss occured at temperature < 700 ºC resulting in the formation of metal oxide (ZrO_2).

The complexes **C2** and **C3** show the weight loss at 250-330 ºC (24.19% calcd., 24.23% found) and at 330-520 ºC was (27.37% calcd., 27.84% found) removed two molecules of C_7H_7O and C_8H_8O. In second step, at temperature 330-450 ºC, the weight loss was 38.64% calcd. (38.66% found) and at 520-650 ºC (39.10% calcd., 37.62% found) with the loss of two molecules of $C_8H_4N_3S$ moiety. At 450-700 ºC and 650-800 ºC (23.25% calcd., 23.87% found) and (23.87% calcd., 22.67% found) with loss of CHN and $C_{14}H_{10}N_2O$, respectively. The last residue (MO) were found at temperature < 800 ºC. The C4 complex at temperature range 300-450 ºC results in the loss of two water molecules (3.94% calcd., 3.99% found). The next step shows at temperature range 450-590 ºC results with the loss of two molecules of $C_9H_5N_3S$ (weight loss of (26.72% found; 26.69% calcd.). At 600-750 ºC show loss of two molecules of CHN and the last step show residue part of complex at temperature < 800 ºC. The metal complexes C5 and C6 complexes show the weight loss of 23.03% found (22.91% calcd.) at temperature of 250-330 ºC with removal of two molecules of C_7H_7O. Afterwards the weight loss of 37.74% found (37.25 % calcd.) found at temperature 450-600 ºC shows removal of two molecules of $C_{16}H_8N_6S_2$ and $C_8H_4N_3S$. In the last step, there is weight loss of 23.82% found (23.76% calcd.) and 23.85% found (23.79% calcd.) at temperature range 600-750 ºC with loss of $C_{14}H_{10}N_2O$. The results are listed in Table-5.

Antibacterial activity: In this method, the given compound solution of DMSO which was put on a Muller-Hinton Agar (Hi-Media) agar plate containing tested bacteria. Plates get incubated for 24 h at 37 ºC. After 24 h diameter of inhibition zone in (mm) was determined. The *in vitro* antibacterial screening activity and MIC of ligand and their metal complexes (**C1-C6**) are given in Tables 6 and 7. The synthesized Schiff base ligand and its metal complexes were studied as antibacterial and antifungal activity against *E. coli* (MTCC443), *S. aureus* (MTCC1688), *P. aeruginosa* (MTCC96), *C. albicans* (MTCC227), *A. niger* (MTCC82) strain using disc diffusion technique. Ampicillin was used as a standard drug, which show activity

TABLE-5
THERMAL ANALYSIS DATA OF NOVEL SCHIFF BASE CONTAINING 1,3,4-THIADIAZOLE MOIETY AND ITS METAL COMPLEXES

Compd. No.	m.f.	m.w.	Temperature rage of decomposition (TG) (°C)	Moiety loss	Mass loss (%)	
					Calculated	Found
C1	$C_{46}H_{36}N_8O_6S_2Zr$	954.13	80-180	$2H_2O$	3.76	3.83
			250-350	$2C_8H_8O$	25.15	25.42
			400-450	$2C_8H_4N_3S$	36.47	36.53
			500-600	2CHN	5.66	5.72
			650-700	$2C_6H_5$	16.14	16.28
			< 750	ZrO_2	12.89	12.93
C2	$C_{46}H_{34}N_8O_4S_2Co$	885.81	300-350	$2C_7H_7O$	24.19	24.27
			350-400	$2C_9H_5N_3S$	38.64	38.73
			450-500	2CHN	54.05	54.13
			500-650	$2C_{12}H_{10}O$	19.20	19.25
			< 700	CoO	8.47	8.52
C3	$C_{46}H_{34}N_8O_4S_2Cu$	890.42	350-400	$2C_8H_8O$	27.10	27.12
			450-550	$2C_8H_4N_3S$	39.10	39.11
			550-600	$2C_{14}H_{10}N_2O$	24.94	24.97
			< 700	CuO	8.87	8.95
C4	$C_{46}H_{38}N_8O_6S_2Cr$	914.90	80-180	$2H_2O$	3.96	3.97
			250-350	$2C_6H_4NO_2$	26.15	26.73
			400-450	$2C_9H_5N_3S$	40.91	40.95
			500-600	2CHN	5.66	5.70
			650-700	$2C_6H_5$	9.14	9.20
			< 750	1\2CrO_2	22.89	22.91
C5	$C_{46}H_{34}N_8O_4S_2Ag$	934.74	350-400	$2C_7H_7O$	22.91	22.93
			450-550	$2C_{16}H_8N_6S_2$	37.25	37,30
			550-600	$2C_{14}H_{10}N_2O$	23.76	23.78
			< 700	$1/2Ag_2O$	24.73	24.80
C6	$C_{46}H_{34}N_8O_4S_2Pd$	933.29	350-400	$2C_7H_7O$	22.94	22.96
			450-500	$2C_8H_4N_3S$	37.29	37.32
			500-650	$2C_{14}H_{10}N_2O$	23.77	23.79
			< 700	PdO	13.07	13.09

TABLE-6
ANTIMICROBIAL ACTIVITY OF DATA OF NOVEL SCHIFF BASE CONTAINING 1,3,4-THIADIAZOLE MOIETY AND ITS METAL COMPLEXES

Compound	Zone of inhibition (mm)				
	E. coli (MTCC443)	*P. aeruginosa* (MTCC96)	*S. aureus* (MTCC1688)	*C. albicans* (MTCC227)	*A. niger* (MTCC282)
$C_{23}H_{18}N_4O_2S$	13	14	14	25	13
$C_{46}H_{36}N_8O_6S_2Zr$	12	12	15	10	14
$C_{46}H_{34}N_8O_4S_2Co$	16	11	18	12	23
$C_{46}H_{34}N_8O_4S_2Cu$	18	13	14	16	21
$C_{46}H_{38}N_8O_6S_2Cr$	11	10	13	22	18
$C_{46}H_{34}N_8O_4S_2Ag$	14	13	12	20	12
$C_{46}H_{34}N_8O_4S_2Pd$	12	09	14	14	22
Ampicillin	16	15	16	–	–
Nystatin	–	–	–	28	24

TABLE-7
in vitro ANTIBACTERIAL/ANTIFUNGAL ACTIVITIES AND MINIMUM INHIBITORY CONCENTRATION VALUES (MIC) OF NOVEL SCHIFF BASE CONTAINING 1,3,4-THIADIAZOLE MOIETY AND ITS METAL COMPLEXES

Compound	*E. coli* (MTCC443)			*S. aureus* (MTCC1688)			*C. albicans* (MTCC227)			*A. niger* (MTCC282)		
µg/mL	25	50	100	25	50	100	25	50	100	25	50	100
$C_{46}H_{36}N_8O_6S_2Zr$	++	+	++	++	+	+	++	++	+++	++	++	++
$C_{46}H_{34}N_8O_4S_2Co$	+	++	+++	+	++	++	++	+	+++	+	++	++
$C_{46}H_{34}N_8O_4S_2Cu$	++	+	++	++	++	+++	+	++	+	++	++	+++
$C_{46}H_{38}N_8O_6S_2Cr$	+++	+	++	++	+	++	+++	++	++	+	++	++
$C_{46}H_{34}N_8O_4S_2Ag$	++	++	+	+++	++	+	++	+	+	++	++	+++
$C_{46}H_{34}N_8O_4S_2Pd$	+	++	+	++	++	+	+	++	++	+	+	++
Ampicillin	++	+++	+++	++	++	+++	–	–	–	–	–	–
Nystatin	–	–	–	–	–	–	+	++	+++	+	+	+++

against bacteria while Nystatin was used as a standard drug antibiotic against fungus. Complex **2** show most effective against *S. aureus* with maximum zone of inhibition of 18 mm and MIC of 62.5 µg/mL.

Conclusion

All the synthesized metal complexes containing novel Schiff base [4-[2{5-[(4-methoxybenzylidene)amino][1,3,4]-thiadiazole-2-yl}phenylimino)methyl]phenol] were sucessfully synthesized and characterized. All the compounds are stable at room temperature. The IR spectroscopy assisted that Schiff base is O,N donor, bidentate ligand and coordinated *via* phenolic oxygen and azomethine nitrogen. From biological studies, some synthesized complexes were found to be as that effective as that of effective as standard drug.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interests regarding the publication of this article.

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Study Of Impact Of Covid-19 Pandemic On Weather

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Abstract

As per the World Meteorological Organization (WMO), the COVID-19 pandemic is adversely influencing the amount and nature of climate perceptions and conjectures, just as barometrical and environment checking. Meteorological estimations taken from airplane have without a doubt dropped by a normal 75-80 percent contrasted with typical. As the Atlantic tropical storm season is drawing closer, the effect of COVID-19 pandemic on climate figures might worsen multi-danger chances at a solitary nation level. The WMO urges governments to focus on their public early admonition and climate noticing limits.

Introduction

Covid illness 2019 (COVID-19) first distinguished in Wuhan, China in December 2019 (Liu et al. 2020) has become a worldwide general wellbeing concern having been announced a worldwide pandemic by World Health Organization (WHO) on March 11, 2020 (WHO 2020). Disease of COVID-19 could give a wide range of manifestations advise regarding fever, hack, sore throat, the runs, weariness, trouble in breathing, kidney disappointment and conceivable casualty (WHO 2020; Linton et al. 2020). As of August 5, 2020, information from WHO have displayed more than 18,354,342 affirmed cases and 696,147 passings have been accounted for around the world (WHO 2020). Because of quick spread of the sickness, numerous nations carried out various alleviation and concealment programs. Various mixes of measures like conclusion of worldwide visitors, fractional/all out lockdown of a nation or a city, restriction on parties, incessant hand washing with cleanser under running water, physical separating, isolate and disconnection were acquainted as prompt reaction with the episode. Testing, contact following and treatment, necessary wearing of face veils in broad daylight spaces were extra measures accordingly or at the same time presented.

The new extreme intense respiratory condition Covid 2 (SARS-CoV-2) pandemic was first perceived toward the finish of 2019 and has caused perhaps the most genuine worldwide general wellbeing emergencies somewhat recently. In this paper, we audit current writing on the impact of climate (temperature, moistness, precipitation, wind, and so on) and environment (temperature as a fundamental environment variable, sunlight based radiation in the bright, daylight span) factors on SARS-CoV-2 and talk about their effect on the COVID-19 pandemic; the survey likewise alludes to individual impact of metropolitan boundaries and air contamination. Most examinations recommend that a negative connection exists between encompassing temperature and mugginess from one viewpoint and the quantity of COVID-19 cases on the other, while there have been contemplates which support the shortfall of any relationship or even a positive one. The metropolitan climate and explicitly the air ventilation rate, too as air contamination, can presumably influence, additionally, the transmission elements and the case casualty pace of COVID-19.

Effect of Coronavirus on environment

Visual examination of world guides shows that Covid sickness 2019 (COVID-19) is less predominant in nations nearer to the equator, where warmth and stickiness will in general be higher. Researchers differ how to decipher this perception on the grounds that the connection between COVID-19 and climatic conditions might be jumbled by numerous elements. We relapse the

logarithm of affirmed COVID-19 cases for each million occupants in a country against the nation's separation from the equator, controlling for key frustrating components: air travel, vehicle fixation, urbanization, COVID-19 testing power, wireless utilization, pay, advanced age reliance proportion, and wellbeing use. A one-degree expansion in supreme scope is related with a 4.3% increment in cases per million occupants as of January 9, 2021 (p value < 0.001). Our outcomes suggest that a country, which is found 1000 km nearer to the equator, could expect 33% less cases per million occupants. Since the adjustment of Earth's point towards the sun among equinox and solstice is about 23.5°, one could expect a distinction in cases for each million occupants of 64% between two speculative nations whose environments contrast to a comparative degree as two neighboring seasons. As indicated by our outcomes, nations are required to see a decrease in new COVID-19 cases during summer and a resurgence during winter. Nonetheless, our outcomes don't suggest that the sickness will evaporate during summer or won't influence nations near the equator. Maybe, the higher temperatures and more extreme UV radiation in summer are probably going to help general wellbeing measures to contain SARS-CoV-2.

Given the fast spread of serious intense respiratory condition Covid 2 (SARS-CoV-2) in winter 2020/2021 in the Northern Hemisphere, numerous occupants and policymakers in the relating nations expect assuage when the climate gets hotter and more daylight arrives at the Earth's surface in spring and summer. Without a doubt, numerous viral intense respiratory parcel contaminations, for example, flu An and B, rhinovirus, respiratory syncytial infection, adenovirus, metapneumovirus, and Covid, are environment ward and offer such occasional patterns1. Some infections might have better security in low-temperature, low-mugginess, and low-UV radiation environments2,3. Also, individuals will in general accumulate more in indoor spots in winter, which can work with the spread of sicknesses; and nutrient D levels in people will in general decrease in winter, which might debilitate the safe reaction.

Be that as it may, with regards to Covid sickness 2019 (COVID-19), the illness brought about by SARS-CoV-2, there is as yet sparse proof on the side of this hypothesis4. On March 9, 2020, the World Health Organization (WHO) expressed that "from the proof up until this point, the COVID-19 infection can be communicated in all spaces, incorporating regions with sweltering and damp weather"5. On April 7, 2020, the U.S. Public Academies of Sciences, Engineering, and Medicine inferred that "albeit test contemplates show a connection between higher temperatures and dampness levels, and diminished endurance of SARS-CoV-2 in the lab, there are numerous different factors other than ecological temperature, mugginess, and endurance of the infection outside of the host that impact and decide transmission rates among people in reality'... 'with regular history considers, the conditions are pertinent and mirror this present reality, yet there is normally little control of natural conditions and there are many perplexing factors"4.

Among May and November 2020, the European Respiratory Society distributed a few articles examining the theory that temperature and the spread of COVID-19 are contrarily related. Utilizing information from 224 urban communities in China, one article distributed in May tracked down no such association6. In August 2020, another investigation utilizing information from China suggested a non-direct relationship to the degree that temperature and COVID-19 are not related under 7 °C yet that a frail negative affiliation exists over that threshold7. One more examination distributed in November tracked down a huge negative relationship among temperature and the spread of COVID-19 utilizing worldwide data8. While, as a rule, the proof is blended and the discussion is as yet progressing, lab contemplates found that SARS-CoV-2 is profoundly helpless to warmth and UV-radiation9,10,11,12,13,14.

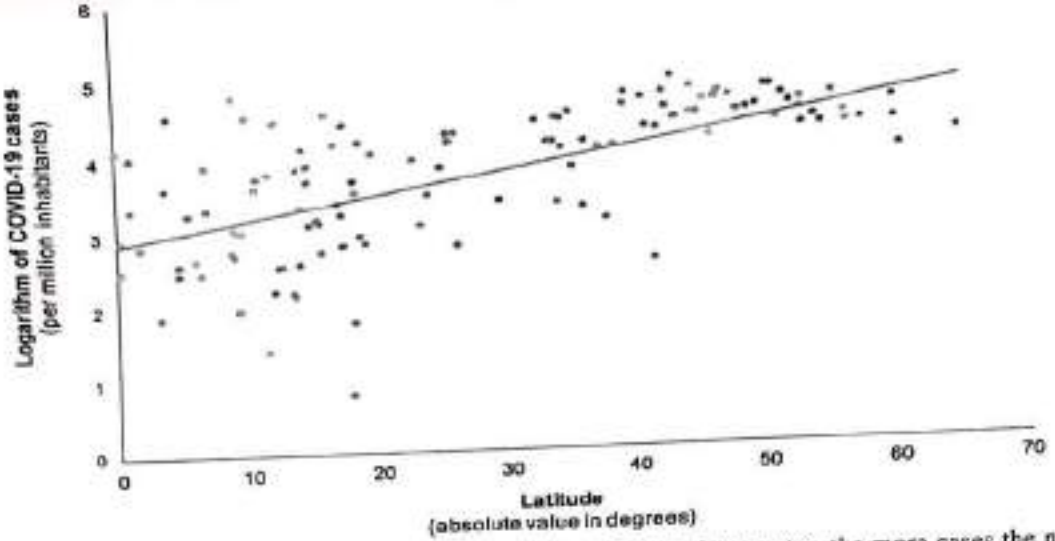
To add proof according to an alternate point of view, we utilize worldwide information to inspect the connection between climatic conditions and the spread of COVID-19 controlling for a few significant jumbling factors. To this end, we relapse the predominance of COVID-19

(logarithmically changed) at the nation level against the scope of a country. Scope catches each environment, on the grounds that various scopes on Earth get various measures of daylight. The farther from the equator a nation is found, the lower is the point of the sun's beams that arrive at it, the less UV radiation it gets, and the lower is its temperature. Besides, scope likewise influences dampness, since water vanishing is temperature dependent15.

To control for key confounders at the nation level, our investigation incorporates (1) information on air travel16 (to catch a potential method of transmission of SARS-CoV-2 across nations yet additionally the distance of a spot, which may expand the requirement for air travel); (2) vehicle concentration17 and urbanization16 (to catch contrasts in the transmission capability of SARS-CoV-2 inside a country18); (3) COVID-19 testing intensity19,20 (to control for the life of a country's COVID-19 reaction and for COVID-19 identification inclination in crosscountry comparisons21,22); (4) wireless usage16 (to control for the speed at which data on conduct change for COVID-19 avoidance goes inside a country18,23); and (5) wellbeing use (to catch contrasts in nations' obligation to populace wellbeing); advanced age reliance proportion (to catch crosscountry contrasts in age construction and family arrangements, which can influence the spread of SARS-CoV-2), and income16 (to control for contrasts in monetary turn of events and in the accessibility of general assets to contain the spread of SARS-CoV-224,25,26).

Methodology

We assessed both the bivariate detail of the relapse of the logarithm of COVID-19 cases for each million occupants on scope just as settled models with control factors. We prohibited nations in which under 100 COVID-19 cases were accounted for as of January 9, 2021, to utilize just information from nations where the pandemic was spreading (a couple of cases could be simply imported). Our principle openness variable is the outright scope of a country in degrees. The control factors included: (1) air travel, estimated by the quantity of air travelers per capita in a nation; (2) vehicle focus, estimated by the quantity of enlisted vehicles per capita; (3) urbanization, estimated by the level of the populace living in urban areas; (4) testing force, estimated by the quantity of tests per hundred occupants; (5) cell utilization, estimated by the quantity of PDAs per capita; (6) pay, estimated by buying power-changed per-capita GDP in a nation; (7) advanced age reliance proportion, which is the proportion of the populace over the age of 65 to the working-age populace; (8) wellbeing consumption, which is the portion of per-capita GDP spent on wellbeing. We utilized 2018 information for air travel, vehicle focus, pay, urbanization, PDA utilization, advanced age reliance proportion, and wellbeing consumption, on the grounds that later information were not accessible in the World Development Indicators, our information hotspot for these variables16. Testing power depended on testing information assembled for each country19,20. We utilized strong standard blunders to represent heteroscedasticity. We utilized Stata 16 for our multivariable relapse examinations. We assessed missing country covariate information in various (15) ascriptions, utilizing the mibeta Stata order.



As a general rule, the farther a nation is situated from the equator, the more cases the nation has comparative with the quantity of occupants. This relationship is noticeable in the scatterplot in Fig. 1 and in the coefficient assessments of scope (which address semi-versatilities, i.e., rate changes in the quantity of COVID-19 cases for each million for one-degree changes in scope), in the diverse relapse determinations displayed in Table 1. In the common least squares (OLS) relapse, in which we control for all possible puzzling elements, an increment somewhere far off from the equator by one level of scope is related with an increment of the commonness of COVID-19 by about 4.3% (Table 1, Model 4). This outcome is exceptionally critical and infers that a country that is found 1000 km nearer to the equator could expect 33% less cases per million occupants, different things equivalent (given that a level of scope makes an interpretation of on normal into a distance of 111 km). Since the adjustment of Earth's point towards the sun among equinox and solstice is about 23.5°, one could expect a distinction in cases for each million occupants of 64% between two speculative nations whose environments vary to a comparable degree as two neighboring seasons.

Conclusion

Coronavirus pandemic is contrarily influencing the amount and nature of climate perceptions and gauges, just as barometrical and environment observing. Meteorological estimations taken from airplane have undoubtedly dropped by a normal 75-80 percent contrasted with ordinary. Since the adjustment of Earth's point towards the sun among equinox and solstice is about 23.5°, one could expect a distinction in cases for each million occupants of 64% between two speculative nations whose environments contrast to a comparable degree as two adjoining seasons.

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उदाहरण म्हणजे गोंड समाजाचे देवाजी तोफा होत. यांनी दिलेला मंत्र संपूर्ण गावाने पाळला आणि आज हे गाव [illegible] किर्तीला पात्र ठरले.

"दिल्ली मुंबई आमचे सरकार,
आमच्या गावात आम्हीच सरकार"

या घोषणेने संपूर्ण गाव पर्यावरणाला जोडले गेले. या गावातील सामाजिक जीवन संपूर्णपणे पर्यावरणास वाहून घेतलेले आहे. या सोबतच गडचिरोली जिल्ह्यातील [illegible] हेमलकसा प्रकाश आमटे यांचे प्रकल्प आदिवासी सोबतच वन्यप्राणी आणि झाडे यांचे देखील संवर्धन करत आहे. तरीदेखील चंद्रपूर सारख्या ठिकाणी अनेक प्रकल्प आज वाढत आहे. तरीदेखील पर्यावरण संवर्धन चंद्रपूरमध्ये अभावानेच दिसते.

चंद्रपूरमध्ये अनेक प्रकल्प असल्यामुळे दाट वस्ती आढळून येते. या दाट वस्तीमुळे अतिशय मृदा प्रदूषण होत आहे. पाण्याचे स्त्रोत हळूहळू नष्ट होत असल्यामुळे जलप्रदूषण देखील वाढलेले दिसते. परिस्थितीकीय तत्त्व जास्त प्रमाणात कोळशाचे आणि रेतीचे खनन झालेले आहे. यामुळे मृदा आणि पाणी दोन्ही मोठ्या प्रमाणावर खराब झालेले आहे. जास्त प्रमाणात वाहनांची संख्या असल्यामुळे ध्वनीप्रदूषण वाढीस लागलेले आहे. C.T.P.S., W.C.L., M.E.L. यासारख्या कारखान्यांमुळे वायुप्रदूषण होत आहे. सामाजिक जीवनामध्ये या सर्व घटकातून आजाराचे प्रमाण वाढत आहे. त्यातून विविध आजार आणि उष्णता तसेच विकार या सर्वांचा प्रभाव सर्वसामान्यांवर दिसून येतो. ताडोबा व्याघ्रप्रकल्प असून देखील आज वन्य प्राणी इतरत्र भटकलेले दिसतात.

एकंदरित पाहता पर्यावरणाचा सामाजिक जीवनावर प्रभाव म्हणजेच सण समारंभ हे पारंपारिक पद्धतीने न राहता केवळ दिखाव्याचे तयार झालेले आहे. समाजाच्या द्वारे पर्यावरण संवर्धन या बाबीकडे संपूर्णपणे दुर्लक्ष केल्या जात आहे. उलट पर्यावरणाला घातक असेच वातावरण तयार होतांना दिसून येते. प्रत्येक डिजे, या तयार त्यामधून वायू आणि ध्वनीप्रदूषणात भर पडत आहे. शिक्षणाचे राजकीय नेतृत्व सुद्धा मिळाला योग्य मार्गदर्शन न करता दुर्लक्ष द्वारे पर्यावरणाला घातक अशा घटकांना प्रोत्साहन देत आहे. गणपती, देवी यातून पाण्याचे प्रदूषण वाढत आहे. आर्थिक दृष्टीकोणाने देखील एका बाजूला प्रचंड पैसा तर दुसऱ्या बाजूला पोटभरायला दोनवेळेची जेवण देखील नाही अशी परिस्थिती केवळ पर्यावरणाचा संतुलन न राहल्यामुळे होत आहे.

आताच आलेली कोरोनाची साथ ही देखील सामाजिक जीवनातील पर्यावरणीय प्रभाव दाखवते. जसजसा पर्यावरण विरोधात आपण कार्य करू तसतसा निसर्ग विविध प्रकारचे आजार निर्माण करून मानवावर अंकुश घालत जाईल. आपण जर पर्यावरण संवर्धन केले तर आपल्याला पोषक समाज, पोषक वातावरण प्राप्त होईल.

संदर्भसूची :

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शेतकऱ्यांची समस्या आणि उपाय

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जय जवान जय किसान असे श्री. लालबहादूर शास्त्री म्हणाले होते, पण याच शेतकऱ्याची व्यथा ऐकून मन दुःखी झाल्याशिवाय राहणार नाही. याच जगाच्या पोशिंद्याला आज आत्महत्या करण्याची वेळ का आली? स्वतः दिवस रात्र शेतात राबणारा माझा शेतकरी प्रेमाने, मनापासून संपूर्ण बळ एकवटून पीक घेतो. कधी दुष्काळ, कधी अतिवृष्टि, ही निसर्गनिर्मित संकटे त्याच्यापुढे कायम आधिपासुन उभे राहतात तरी माझा शेतकरी ढगमगत नाही तो सह्याद्री प्रमाणे कणखर उभा असतो, या संकटावर मात करून तो मायेने लावलेले, जपलेले पिक घेतो पण अजून त्याची परीक्षा संपलेली नसते. शाळेत शिकणाऱ्या मुलाला देखील वर्षात फक्त दोनदाच परीक्षेला सामोरे जावे लागते पण शेतकऱ्याला प्रत्येक क्षणाला परीक्षेला सामोरे जावे लागते. एक समस्या सुटली की दुसरी त्याच्यासमोर आ वासुन उभी असते. शेतमालाला हमीभाव नाही. त्याने घेतलेल्या पिकाला योग्य भाव मिळत नाही. या अवस्थेस शेतकरी काय करणार?

शेतीची सुरूवात केली तेव्हा डोंगर टेकड्यावर लाकडाच्या सहाय्याने शेती करून त्यापासून धान्याची पैदास केली जायची. काही काळानंतर मानव एक जागी स्थित झाला, त्यानंतर त्याने अधिक प्रमाणात क्षेत्रावर शेती करण्यास सुरूवात केली. कालांतराने, भारत देशामध्ये हरितक्रांती झाल्यानंतर देशाच्या धान्य उत्पादन क्षमतेमध्ये खूप मोठे बदल झाले. अन्न धान्याची उत्पादन क्षमतेमध्ये मोठी वाढझाली, परंतु त्या काळी प्रश्न होता तोच की, उत्पादित केलेले धान्य साठवण्याची पुरेशी व्यवस्था नसल्यामुळे तसेच वाटपाचे नियोजन नसल्यामुळे त्या उत्पादनापेक्षा जास्त प्रमाणात धान्याची नासाडी अधिक होत असे, देशातील गरिबांना हे धान्य मिळतही नव्हते. व्यवस्थित न साठवल्याने त्याची मोठी नासाडी होत असायची. आज आपल्या देशातील शेतकरी हा जास्तीत जास्त प्रमाणात खेड्यापाड्यात राहतो, आणि हा शेतकरी शेती पूरक व्यवसाय म्हणून गाई, म्हशींचे संगोपन करतो, त्यापासून मिळणारे दूध यापासून तो दैनंदिन जीवन जगण्यासाठी काही प्रमाणात उदरनिर्वाहासाठी त्याची विक्री करून पैसे मिळवतो. परंतु पूर्वीपासून उत्पादित फळभाज्या, पालेभाज्या, फळे, यांना जास्तीत जास्त दिवस कसे टिकवता येईल या गोष्टी शेतकऱ्यांना माहीत नाहीत. धान्य हे काही दुधासारखे नाशवंत नसते, म्हणून धान्याची नासधूस दुधाच्या प्रमाणापेक्षा कमी होत असते. आपल्या देशात या तीन नाशवंत मालाचे जेवढे उत्पादन होते त्याच्या ४० ते ५० टक्के एवढे उत्पादन वाया जाते, नासते आणि कुजते व्यर्थ जाते.

भारताच्या भाज्या आणि फळांच्या उत्पादनात दुसरा क्रमांक आहे. भारताने ठरवले तर निम्म्या जगाला दुध आणि भाज्या पुरवू शकतो. तेवढे उत्पादन आपल्याकडे घेतले जाते परंतु ते जगाला न पुरवता आणि त्यातला जवळपास निम्मा माल नासवून, कुजवून डंकिरड्यावर फेकतो. त्यामुळे मालाची तर नासाडी होतेच पण डंकिरड्यावर टाकल्याने त्याच्या दुर्गंध उठून रोगराई पसरते. निर्माण झालेला हा माल साठवण्याच्या पुरेशा सोयी सुविधा नसल्याने शेतकऱ्यांना नुकसान सहन करावे लागत आहे. आपले हे नुकसान ४४० अब्ज डॉलर एवढे प्रचंड आहे. ते रूपयात मोजायचे झाल्यास साधारण २४ लाख कोटी रूपये इतके आहे. आपण उत्पादन वाढवण्याचा प्रयत्न भारतातील शेतकरी वर्गाने केला आहेत परंतु त्यांना साठवण्याची योजना आखली नाही. त्याचा आपल्याला हा परिणाम भोगावा लागत आहे. ही उत्पादने अशी नासून आपले हे मोठे नुकसान टाळावे यासाठी त्यांना गोदामे आणि कोल्ड स्टोरेज उपलब्ध करून दिले पाहिजेत परंतु सध्या तरी यावर एक मार्ग आहे, तो म्हणजे या मालावर प्रक्रिया करणे. त्यामुळे नासाडी तर टळतेच पण प्रक्रिया केलेल्या मालाला जास्त भाव मिळून शेतकऱ्यांना जास्त पैसे मिळतात.

कृषि प्रधान देशातच शेतकऱ्यांच्या आत्महत्या?

आज महाराष्ट्रात शेतकरी आत्महत्या करतोय. पिकांचे योग्य मूल्य न मिळाल्यामुळे आणि कर्जबाजारी झाल्यामुळे आज शेतकरी शेती विकून दुसरे काम करायला विवश झाले आहेत. कोणी युवक शेती करायला मागत नाही. शेतकरी खरंतर स्वतःचा मालक असतो, पण आजकाल त्याला कर्ज घेऊन सुद्धा फायदा नाही होत. कृषिप्रधान म्हणून ओळखल्या जाणाऱ्या देशात शेतकऱ्यांची अशी दशा लज्जास्पद आहे. शेतकऱ्यांच्या कोणत्याच पिकाला हमी भाव दिला जात नाही, त्यामुळे दलाल शेतकऱ्यांकडून शेतीमाल कमी भावाने घेऊन शहराच्या ठिकाणी कितीतरी अधिक भावाने विकतात. शेतमालाची बाजार पेठ शेतकऱ्यांच्या हातात नाही तिथे मारवाडी किंवा इतर लोक असतात. भारतात कोणत्याही वस्तूची फिक्स किंमत आहे तर मग शेती मालाचिच का नाही.

शेती आणि शेतकऱ्यांच्या आत्महत्या

भारतात १२.५६ कोटी मध्यम व छोटे शेतकरी आहेत. त्यांच्याकडे सरासरी जास्तीत जास्त जमीन दोन हेक्टर आहे. बहुतेक शेतकरी भुसार पिकं काढतात, कोरडवाहू शेती करताना सरासरी शेतकऱ्याचा उत्पादन खर्च (दोन हेक्टरसाठी) १० हजार रूपये होतो. त्याचं सरासरी उत्पन्न २०,४०० रूपये होतं. म्हणजे वर्षाकाठी त्याला शुमारे १० हजार रूपये खर्चायला मिळतात. त्यामध्ये त्यानं शिक्षण, आरोग्य, लग्न, सण, करमणूक इत्यादी गोष्टी सांभाळायच्या. मशागत, पेरणी, कापणी बी–बियाणं खतं, जंतुनाशकं इत्यादी साठी पैसे लागतात. घर चालवताना जीव मेटाकुटीला येतो, पैस उरत नाहीत, कर्ज घ्यावं लागतं, सहकारी बँक, शेती बँक, कमर्शियल बँक कर्ज देते. कर्ज मिळण्यात अडचणी येतात, अनेकांकडं तारण नसतं, अनेकांचं आधीचं कर्ज थकलेलं असतं. बँकांच्या अटी अव्यावहारिक असतात. बँक म्हणजे की फक्त उत्पादनासाठी कर्ज देणार. शेतकरी म्हणतो, की त्याला जगण्यासाठी ही पैसे हवेत, शिक्षणासाठी, लग्नासाठी पैसे हवेत. बँकांच्या नियमात ते बसलेच असं नाही. नाना अडचणी पार करून शेतकरी कर्ज घेतात.

रिझर्व बँकेचे आकडेवारी सांगते, की १२ कोटी शेतकऱ्या पैकी ५ कोटी शेतकऱ्यांची कमर्शियल सरकारी बँकात खाती आहेत, २० टक्के शेतकरी खाजगी, महाग, कर्ज घेतात. अर्ध्यापेक्षा अधिक शेतकरी कर्जबाजारी आहेत. त्यांच्यावर सरासरी ४७ हजार रूपयाच्या कर्ज आहे. शेती करून कसंबसं जगलं, तरीही पैसे उरत नाहीत म्हटल्यावर कर्ज फेडणार कसं? आत्महत्या होते. पन्नासेक कोटी माणसं जगण्या मरण्याच्या संकटात आहेत. त्यातून वाट कशी निघणार? देशभरची राज्य आणि केंद्र सरकार शेतकऱ्यांना सुखी करण्यासाठी अनेक योजना जाहीर करतात. त्यांचा परिणाम होताना दिसत नाही. शेतकऱ्यांचे उत्पन्न दुप्पट करायचं असेल, तर त्याचं शेतमालाचं उत्पन्न वाढयला हवं. शेतमालाचं उत्पादन आणि दर एकरी उत्पादन क्षमता वाढायला हवी. उत्पादन वाढवण्याचा एकच सिद्ध झालेला मार्ग म्हणजे रसायनिक खतांचा वापर.

कृषी कायद्याने हित कुणाचे

संसदेत तीन कृषी सुधारणा विधेयके पारित होताच देशातील कृषी क्षेत्रसाठी एक नवीन सुरूवात झाली. ही तिन्ही विधेयके केंद्रीय कृषी मंत्रालया अंतर्गत येत असली तरी वेगवेगळी आहेत. एक विधेयक हे कृषी उत्पादन व्यापार आणि वाणिज्य (प्रोत्साहन व सहाय्य) विधेयक आहे, हे कृषी उत्पन्न बाजार समिती (एपीएमसी) ला पर्यायी व्यवस्था देणाऱ्या कायद्याचे आहे. दुसरे विधेयक हे शेतकरी (सबलीकरण व संरक्षण) हमीभाव करार व कृषी सेवा विधेयक (कॉन्ट्रॅक्ट फार्मिंग) संदर्भातले आहे. तर तिसरे विधेयक हे अत्यावश्यक वस्तू (सुधारणा) विधेयक हे कृषिमाल साठवण मर्यादा संदर्भातले आहे. या तिन्हि विधेयकांची वेगवेगळी विशेषता व वेगवेगळ्या तरतुदी आहेत. मात्र या सुधारणा विधेयकातून शेतकऱ्यांचे हित जपले जाईल का? असा प्रश्न उपस्थित होतं आहे. या कायद्याला विरोध म्हणून दिल्ली सीमेवर पंजाब, उत्तर प्रदेश सह देशातील शेतकरी आंदोलनातर बसले आहे. ज्यांच्या हातात सत्ता आहे, त्यांना या देशातल्या कष्टकरी, शेतकरी बांधवांबद्दल आस्था नाही. साठ दिवस झाले, उन्हातान्हाचा, थंडीचा विचार न करता शेतकरी रस्त्यावर बसला आहे. देशाच्या पंतप्रधानांनी त्यांना विचारपूस केला का? पंजाब म्हणजे पाकिस्थान आहे का? स्वातंत्र्याच्या संघर्षात जबरदस्त योगदान देणारा, स्वातंत्र्यानंतरही खलिस्थान चळवळी विरूद्ध पेटून उठणारा, १३० कोटी जनतेला दोन वेळचं अन्न देणारा बळीराजा प्रामुख्याने पंजाबातला आहे. पश्चिम उत्तर प्रदेशाला आहे. नाकर्तेपणाची भूमिका सरकारने घेतली आहे.

त्यामुळे देशभर संताप व्यक्त होत असताना लोकशाही भारतात जनता राजा की नेते अशी विचित्र परिस्थिती निर्माण झाली आहे.

शेतकऱ्यांच्या जेवढ्या समस्या पाहण्यात दिसून येतील आहे. आज शेतकऱ्यांची दशा आणि त्यांचा भाकरी कोण पाहून घेतील हा प्रश्न आहे. शेतकऱ्यांच्या हिताचेच तर कायदेच आहेत त्यात सरकार आमुड ओढून राहिलेले कायदे देखील काढून घेण्यास तयारी करीत नाही.

शेतकरी वर्गासाठी कायदेच नीट शासनाला तर्क झाल्या तरी काळोखात सुधारतील. मुख्य म्हणजे शाळेपासून शेती हा विषय मुख्य अभ्यासाला पाहिजे. शेतकऱ्यांना करीता साठवणुकीची केंद्र मोफत किंवा अतिशय माफक दरात असायला हवीत. साठवणुकीची केंद्रे बेरोजगारांच्या पद्धतीने असावी त्यात प्रामुख्याने प्रत्येक जिल्ह्यानुसार त्यांची साठवणूक व्यवस्था हवी. प्रत्येक गावात असे गोदाम केंद्र हवेत. यात प्रामुख्याने शेतमाल हवीत म्हणजे कोणत्याही माल नष्ट व्हायला नाही. शेतकऱ्यांचा साठवणुकीचा प्रश्न असल्यामुळेच पीक निघाले की ते विकावे लागते. जर या प्रकारे गोदाम असतील तर शेतकरी आपला माल त्यात साठवून ठेवू शकेल. माल साठवून शेतकरी ठेवू शकला तर योग्य दरात आपला माल विकू शकेल. अर्थात यामुळे त्याला त्याचे कायदे निश्चित करता येईल. शेती पूरक व्यवसाय शेतकरी पूर्वी काळापासून करीत आहे. त्यांना देखील त्याला शासकीय योग्य मदतीचे होईल. शेतकऱ्यांना अन्नप्रक्रिया हा घटक त्यासोबत संबंधित जोड्या सहाय्याने आणि त्यासाठी संबंधित शिक्षण दिले तर आणखी बदल घडून येणार. शेतकरी कष्टाच्या हातात पैसा खेळवू शकणार.

कोणताच शेतकरी कर्जमाफी मागत नाही. पण प्रत्येक शेतकऱ्याला मनापासून वाटते त्याच्या शेतमालाला हमीभाव भेटावं. तेवढा मिळाला तरी शेतकरी खुश होणार. आत्महत्येनंतर ५ लाख देण्यापेक्षा हंगामाच्या सुरुवातीलाच २५ हजार दया शेतकरी त्यातूनच शेतीतून सोन उगवून दाखवेल. संसदेत आलेले तीन कायदे रद्द व्हावे.

ज्या शेतकऱ्यांनी भारताची भूक भागवली त्यानाच सरकार असे वाऱ्यावर उभे करत असेल तर जनता कधीच माफ करणार नाही. भारत परत एकदा सुजलाम सुफलाम हवा असेल तर बळी चे राज्य यायलाच हवे.

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CASTE BASED SOCIAL CHANGE

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Abstracts:

Dr. Babasaheb Ambedkar brought about the greatest Social revolution in the world and great social change in India and gave equal rights to all the people here through the constitution. But after Babasaheb, the work of spreading his ideas across the country was not done properly by the people here, so it was limited to Maharashtra only Later, Kashi Ramji's Leadership emerged and he spread the ideas of great man all over the Country. He sought out great man of every caste and set them as role models for the people of that caste. His intention was that people would abandon old customs and traditions following the ideology of great men of their caste and this would Lead to new social change on the country. Great men were accepted by every caste but without accepting their views, they were confined to caste and those who were Omnipresent great men like Dr. Babasaheb Ambedkar, Mahatma Phule (fule), Shivaji Maharaj were also limited to caste, Now, people just take to the streets for caste, They don't want to do any of the other questions. This situation is very dire for the country, for which timely and appropriate measures need to be taken.

Keywords: A Caste, change, great men, Ideologists, revolution, social stunts.

Preface:-

Dr. Babasaheb Ambedkar fought hard to literate the people of India from the shackles of the caste systems. Not only was he freed, but he was given the right to be enshrined in the Constitution so that he would not have to suffer any further. Everyone gave equal rights with the right to education. The right to own property, the right to do whatever one wants, the people at the bottom of India started getting education. They began to change, women got equal rights, women began to work alongside men Among the Dalits, the Buddhist's who were with Babasaheb Ambedkar in Dhammadiksha in 1956, Mahar(Bouddha) got rid of the gods & goddesses in his house, abandoned the old tradition and started a new social life and fram that, Social Change began.

Social Status From 1956 to 1990

After 1956, social change began, the Buddhists abandoned the old customs but the people from other societies did not abandon the old customs but made progress in the field of education Mahatma Phule, Shahu Maharaj, Dr. Babasaheb Ambedkar. Who brought about the greatest social revolution here greed the society from the scruting of many orthodox traditions, so these great men became Omnipresent who were revered by all society. Dr. Babasaheb Ambedkar came to be known as the creator of the constitution but only the people of Maharashtra knew the work done by these great men by creating a constitution for the people of the whole country, they were given equal rights and they started exerting them but only a few people in the country knew who got it and how much they had to fight for it only a few people knew Dr. Babasaheb Ambedkar. The leaders of the Bahujans here imprisoned Babasaheb in Maharashtra and did not allow him to go outside Maharashtra in 1980. When Kashiram's leadership benefited the masses, the brought a wave of social change of all over the country and spread the ideas of Babasaheb and other great men all over the country and so people, all over India started recognizing Dr. Ambedkar and other great men. Later Kashiramji persuaded the people of every cast and religion to spread their Ideas in front of the great men of their own caste in order to get them out of the quagmire (Conflict) of gods & goddesses and traditions as a result, each caste got its great man and started carrying him. Those who were omnipresent great men were confined to one caste, from which the new caste based social transformation began.

Past 1990 caste based social change

After 1990, Caste based Social change started in Kunbi community. Shivaji Maharaj, Mahar Community, Babasaheb Chambar Community, Ravidas Teli Community, Santaji Maharaj Mali Community, Mahatama Phule were picked up by many people & stamped them for their caste and limited them to caste and their ideas, which were ubiquitous were limited to one caste only. Although our county is so advance in terms of education people still do not know much about the work of great men because once this caste based social change had an effect on this caste, The castes become stronger.

Consequences of Caste based Social Change

1) Mahatma Phule, Shivaji Maharaj, Shahu Maharaj and Dr. Babasaheb Ambedkar were limited to the great caste all their comprehensiveness diminished.

2) Every society that used to take to the streets as a plural society now takes to the streets only for its own caste.

3) The caste system became even stronger.

4) Old customs and traditions are still alive.

5) People use only the names of the great men of the caste, they alter names but their ideas have not been accepted yet which means their ideas have not spread.

6) The purpose for which these changes were made does not seem to be succeeding here.

Conclusion

The overall condition of the country is deteriorating due to caste based social change. The whole Society is still entangled in the caste system and it is getting entangled even more for this, the thoughts of great men need to be given a global from without being limited to caste only when the country progresses otherwise the county cant not progress.

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पर्यावरणाचा सामाजिक जिवणावरील प्रभाव

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एक दिवस सहजपणे टी.व्ही बघत असतांना सृष्टी नावाची कार्टून फिल्म डोळयासमोर आली. ती पाहता–पाहता स्वत:लाही विसरलो. अगदी सहज पणे पर्यावरण आणि माणुस तसेच पर्यावरणाचा समतोल दाखवला होता. छोटया मुलाचा म्हातारपणाचा प्रवास आणि त्याचा असलेला वृक्षमित्र (झाडे) मुलाच्या लहाणपणी ते झाड त्याच्यासाठी पतंग बनलं. त्याचा कुमार वयात त्याला भुक भागवणारे फळ देणारे यंत्र होते. तरुण पणे त्याचे घर उभारण्यासाठी स्वत:च्या फांदया देऊ करतं. त्याचा प्रौढ पनात स्वत:च्या बुंध्याचा नाव म्हणून उपयोग करायला देतो. या सर्व वेळेस तो वृक्ष आपल्या मानव मित्राला आनंदाने सुखी रहा माझ्या मित्रा अश्या सदिच्छा व्यक्त करतो. आणि प्रत्येक वेळेस हा मानव दु:खी होऊन त्या वृक्षाकडून मदत घेऊन जात असते. संपूर्ण जग फिरून आल्यावर देखील त्याला सुख, शांती आणि समाधान कुठेच लाभत नाही. परत आपल्या जन्मगावी आल्यानंतर त्याला प्रचिती होते माझा मित्र देतांना सुखी होता आणि मि घेता असतांनाही दु:खी होतो. गावात आल्यावर व्यतो तर काय संपूर्ण टेकडी ओसाळ झालेली असते. नदीचं पाणी आटलेलं असते हा आपल्या वृक्ष मित्राजवळ जातो आणि त्याला जाणवतो अजूनही वेळ गेलेली नाही. तो सर्व उरलेल्या बुंधाना दुरून घाघरेने आणून पाणी टाकतो. संपूर्ण सृष्टी परत हिरवीगार होते आणि आपोआपच आज पर्यंत शोधत असलेला आनंद त्याला गवजतो यातूनच मला विषय सूचला पर्यावरणाचा समाजिक जिवणावरील प्रभाव.

पर्यावरणाचा विचार करतांना मानव आणि मानवा सभोवतालचा परिस्थितीचा विचार ही येतो. आज पर्यावरणाची समस्या ज्वलंतपणे आपल्या समोर उभी टाकली आहे. मराठी विश्वकोषानुसार महाजैवविविधता राष्ट्रामध्ये भारताचा दहावा कमांक आहे. असे असून देखील भारत प्रदूषण युक्त आहे त्यातील चंदपूर शहर. है तर प्रदूषणाबाबत अतीउच्च शिखरावर पोहोचले आहे. पर्यावरण आणि समाजिक जिवणाचा समतोल साधतांना एक बाब प्रकर्षाने जाणवतो. तो म्हणजे आपले असलेले नैसर्गिक पर्यावरण आणि भौतिक पर्यावरण या संबंधाबाबत असलेले सामाजिक जीवन.

मराठी विश्वकोष खंड क.१ यानुसार पर्यावरणाची व्याख्या स्पष्ट केलेली आहे. विविध प्रकारची जीवसृष्टी तसेच मानवी समूह व समाज ज्या परिसरात राहतात व विकसित होतात त्या परिसरातील सर्व घटकांना एकत्रित रित्या पर्यावरण म्हणतात. पर्यावरणाचा अभ्यास करतांना सामाजिक सांस्कृतिक, राजकिय घटक दूर्लक्ष करता येत नाही. पर्यावरण ही समस्या सर्व–समावेशक, बहू–आयामे, बहूव्यापक या स्वरूपात असलेली दिसते. पृथ्वीवरील जीवनावर प्रभाव पाडणारी अग्नसाखळी, जलचक्र, वातावरण या सोबतच जल, वायू, भूमी, जंगल, धर्म, प्रथा परंपरा, विश्वास, भाषा, सामाजिक संस्था, समूह या सर्वाचा विचार येतो.

1950 पासून पर्यावरण या शास्त्राचा स्वतंत्र अभ्यास सुरू झाला. औद्योगिक क्रांतिमुळे भरमसाठ गोष्टी समाजात यायल्या लागल्या. लोकांचा राहणीमानाचा दर्जा बदलत गेला. जैवविविधतेचे मोठया प्रमाणात दोहन झाले. या बदलाला काही खुमारच नसल्यामुळे सर्व घटक बदलत गेले. निसर्ग निर्मित समस्यांमध्ये भूकंप, ओला व कोरडा दूष्काळ, ज्वालामुखी, ढगी बादळ व अनेक प्रकारचे आजार निर्माण झाले. या सोबतच मानवनिर्मित पर्यावरणामध्ये जल, वायू, धूर, धूरके होणारे असख्य प्रमाणातील जमिनीचा दर्जावरील घात त्यातून झालेले जमिनीचे खनन अतिवृक्षतोड या सर्वाचा समावेश झाला आहे. यामधून निर्माण झालेला हल्लीच प्रचंड कोरोना सारखा सामाजिक जीवनावर प्रश्न निर्माण करत आहे. यामध्ये राजकीय परिस्थितीच नाहीते सामाजिक जणजीवन देखील विस्कळित झाले आहे.

पर्यावरणाचा बदाच प्रभाव पडल्यानंतर पर्यावरण संरक्षणासाठी कायदे करण्यात आले परंतु या कायद्याची अंमल बजावणी करणारे देखील कुठेतरी नाते संबंधाला जुपतेमाप देत आहे. त्यामुळच ओझोनचा थर विस्कटलेला दिसून येतो.मानवी जिवनाचा पर्यावरण या घटकांचे स्थान लक्षात घेता सुंदरलाल बहुगुणा यांचे झालेले चीपको, आंदोलन नर्मदा बचाव आंदोलन, मोठया धरणाविषयाची आंदोलने, विहरी बांध आंदोलन आणि अगदी अलीकडी बिश्नोई समाजाचे आंदोलन या सर्वाचा उल्लेख पर्यावरणाचा सामाजिक जीवनावरील प्रभावांचे परिणाम दिसून येतो. मुळात नविन पिढीला आपण आपल्या प्रतापरंपरा, सणसमारंभ सांगत असतांना केवळ धर्माची गोकेपट्टी करून सांगत असतो त्यामुळे नविन पिढी आपल्या प्रतापरंपरांना जुनाट उससलेले विचार भागते. सामाजिक जीवनानुसार विचार केल्यास भारतातील अनेक परंपरा पर्यावरणासोबतच जोडलेल्या दिसून येतात मुलांना योग्य प्रकारे मार्गदर्शन करून सणांचे महत्त्व जरी घटवले तरीही सामाजिक जीवनावरील पर्यावरणाचा मोठया प्रमाणात समतोल साधला जाईल.

उदाहरणार्थ घ्यायच झालं तर नागपंचमी हा सण साप हा शेतकऱ्यांचा मित्र असतो म्हणून साजरा केला जातो. शेतामध्ये घरामध्ये दुध, लाया, फुटाने नैवैदय म्हणून ठेवतात. पण हे अन्न नाग, सापाचे नाही हे खाण्यासाठी उंदीर बाहेर येतात आणि उंदराला खाण्यासाठी नागसाप बाहेर येतात. त्यामुळे उंदराचा नायनाट होतो. ईतके साधे तत्व ज्ञान आपण मुलांना देत नाही मग मुलाच्या मनात देखील पर्यावरणीय आस्था निर्माण होत नाही.

पर्यावरणाबद्दल भगवान बुद्धांनी आणि बुद्ध धर्मात देखील बऱ्याच बाबी स्पष्ट केल्या आहे. यामध्ये प्रामुख्याने अहिंसाक जीवन जीवनसृष्टीतील प्रत्येक घटकांचा आदर त्याविषयी असलेले जगा आणि जगू दया हा मंत्र सामाजिक जीवनाला आदर्श ठरणार आहे. आपल्याकडील आदी व जमातींनी पर्यावरणाचा समतोल राखला होता त्यांच्यासाठी जंगल, हवा, पनी, डोंगर, दऱ्या, पशुपक्षी हे सर्व देवाचे स्वरूप होते, केवळ वाळलेल्या झाडांच्याच फांदया तोडायच्या जगण्याला असमर्थ असलेल्या प्राण्या–पक्ष्याची शिकार करायची निसर्ग रोज भरभरून देतो त्याचा आस्वाद घ्यायचा, साठवणूक करायची नाही. हा मंत्र आजचे आदीवासी मात्र विसरलेले आहे. पैशाचा हव्यास सूख लौलूपता, स्वार्थानिरता या सर्वांचा बाढ झाल्यामुळे मानवी जीवन पर्यावरणा सारखेच ढवळून निघालेले आहे.

राजकीय जीवनामध्ये पर्यावरणाला अनेक हादरे बसलेले दिसत आहे. त्यामधून युवा जीवन नरकटले आहे, सामाजिक जीवनातील सांस्कृतिक सोबतच राकीय आर्थिक जीवन देखील खराब झालेले दिसून येते. एकीकडे मानवाचा पैशाप्रती वाढलेला हाव दूसरीकडे प्रेमाचा ओलावा शोधून घेत आहे. नातेसंबंध चांगली मैत्रि जिव्हाळा कोठेच आढळून येत नाही. स्पर्धेच्या या जाळात सगळे जग एका खेडयात रूपांतरीत होत आहे. त्याच बेलेस पर्यावरणाचा समतोल ढासळल्यामुळे होणाऱ्या नापीकीमुळे शेतकरी आत्महत्या करत आहे. पर्यावरण ढासळल्यानंतर अनेक आजारांचा आपण सामना करू. जर समाज व्यवस्था ढासवली तर मानवाने कुठे जायचे हा यक्ष प्रश्न मात्र कायम आपल्या समोर राहील. याने मन हादरून जाते सामाजिक जिवन वाचवायचे असेत तर आजही गरज आहे ती म्हणजे मानव पर्यावरण आणि पृथ्वीमधल्या ओल्याव्याची.

महत्त्वाची बाब म्हणजे पर्यावरण आणि मानवात प्रत्येक वेळात जागेत आणि काळात आंतरक्रिया होत राहते. पर्यावरण एक अशी बाब आहे जी बाहेरील भौतिक अवस्था असते. आणि जि शरीर रचनेच्या विकास आणि संवर्धनाला टिकवून ठेवते. बाहेरील भौतिक पर्यावरण वास्तवात वस्तुनिष्ठ त्यांना आपल्या इंद्रियाद्वारे समजू शकते. पर्यावरणाचा दुसरा भाग व्यक्तिनिष्ठ आहे. व्यक्तिनिष्ठ भाग स्वतःच्या व्यक्तिनिष्ठतेने सामाजिक आणि सांस्कृतिक आहे. बाहय भौतिक आणि सामाजिक सांस्कृतिक घटना ज्यामध्ये व्यक्तिसोबत पारस्पारीक संबंध निर्माण होतात.

पर्यावरणाचा संबंध चेतनेशी येतो सामाजिक जिवन देखील पर्यावरणामधून निर्माण होत असतात. जेव्हा व्यक्ति आपल्या आजू–बाजूच्या पर्यावरणाची माहिती ठेवतो तेव्हाच त्याच्यानध्ये अस्तित्व निर्माण करण्याची शक्यता असते. उदा. एखादा जलाशयाचे ठिकाण मानवाच्या वस्तीचे ठिकाण तयार करते याला कारण म्हणजे त्याच्या पाण्याची, शेतीची, स्वच्छतेची वैयक्तिक अशा सर्वच गरजा ते पूर्ण करत असते. जंगलामधून त्याला जलनासाठी लाकुड प्राप्त होतो. झाडांपासून अन्नघटक, कपडे, निवारा या सर्वांचा इंधन तर समुद्र आणि ईतर पाण्यापासून मासळी सारखे अन्न घटक मिळतात. मानवाला सुरूवाती पासुन्च पर्यावरणाच्या चेतनेबाबत पूर्णपणे माहिती आहे. म्हणूनच पर्यावरण आणि मानवाला वेगवेगळे न मानता एकमेकांशी पूरक मानल्या जातात.

यामधील आणखी एक बाब मांडता येईल त्यामध्ये प्रामुख्याने नैसर्गिक पर्यावरण मानव निर्मित नाही आणि ते संपणारच नाही असेही नाही. आपल्या ईथे असलेली खनिजे, पाण्याची स्त्रोत कधीही नष्ट होऊ शकतात म्हणजेच पर्यावरण सतत देखरेखी खाली असायला हवे.

मागील दोन शतकांपासुन पर्यावरणाबाबत बरीच जागरूकता निर्माण झालेली या सर्व घटकात शासकिय आणि खाजगी यांच्या प्रयत्नाने बरीच चेतना निर्माण झालेली आहे. सर्वसामान्य पणे पर्यावरणा संबंधी सामाजिक जीवनावर प्रभाव पडून नैसर्गिक साधनसंपत्तीचा वापर योग्य प्रकारे करण्यावर भर दिला आहे. येणाऱ्या पिढीला त्याचा लाभ जास्तीत जास्त घेण्यासाठी नियोजीत आर्थिक विकास लोकसंख्या थांबवेल. योग्य राजकिय नेतृत्व सामाजिक सांस्कृतिक घटकांचा योग्य प्रकारे विकास महत्त्वाचा आहे. आज लोकसंख्या विस्फोटामुळे पर्यावरणही जंगल, जमीन आणि पाणी संपण्याचा मार्गावर आहे. त्यासोबतच वाढणाऱ्या प्रदुषणातून ध्वनी प्रदुषण यामध्ये देखील भर घातल्या जात आहे. परिस्थिती की आणि समाजात जी अनुकुलता होती ओझोनचा थर ज्या प्रमाणे होता हे जवळपास सर्व समाप्तीच्या मार्गावर आहे.

सामाजिक सांस्कृतिक जीवन आणि पर्यावरण

प्राचीन काळापासून आदिवासींनी स्वतःला पर्यावरणासोबत बांधून घेतले. स्वतःचा विकास करतांना देखील पर्यावरण आणि नैसर्गिक साधन संपत्तीला धक्का बसनार नाही याकडे त्यांनी लक्ष दिले. जंगल वृक्ष, शेती जनावरे या सर्वांना देवाच्या स्वरूपात मानुन त्यांचे रक्षण केले, गढचिरोली सारख्या जिल्हयात लेखामेंढा येथे असलेल्या देवाजी तोफा यांनी चालवलेली चळवळ आज जागतिक स्तरावर प्रसिद्ध आहे. जंगले वाचवून देखील आपण वर्षाला करोडो रूपये कमावू शकतो याच उत्कृष्ट

उदाहरण माडीया गोंड समाजाचे देवाजी तोफा होत. यांनी दिलेला मंत्र संपूर्ण गावांनी पाळला आणि आज हे गाव जागतिक किर्तिला पात्र ठरले.

"दिल्ली मुंबई आमचे सरकार,
आमच्या गावात आम्हीच सरकार"

या वाक्याने संपूर्ण गाव पर्यावरणाला जोडले गेले. या गावातील सामाजिक जीवन संपूर्णपणे पर्यावरणाला वाहून घेतलेले आहे. या सोबतच गढचिरोली जिल्हयातील राणीभंग, अभयभंग यांचा सर्च तर हेमलकसा प्रकाश आमटे यांचे प्रकल्प आदिवासी सोबतच वन्यप्राणी आणि झाडे यांचे देखील संवर्धन करत आहे. तरीदेखील चंद्रपूर सारख्या ठिकाणी अनेक प्रकल्प आज वाढत आहे. तरीदेखील पर्यावरण संवर्धन चंद्रपूरमध्ये अभावनिच दिसते.

चंद्रपूरमध्ये अनेक प्रकल्प असल्यामुळे दाट वस्ती आढळून येते. या दाट वस्तीमुळे आधिच मृदा प्रदुषण होत आहे. पाण्याचे स्त्रोत हळूहळू नष्ट होत असल्यामुळे जलप्रदुषण देखील वाढलेले दिसते. परिस्थितिकिय रास जास्त प्रमाणात कोळसाचे आणि रेतीचे खणन झालेले आहे. यातून मृदा आणि पाणी दोन्ही मोठया प्रमाणावर खराब झालेले आहे. जास्त प्रमाणात वाहनांची संख्या असल्यामुळे ध्वनीप्रदूषण वाढीस लागलेले आहे. C.T.P.S., W.C.L., M.E.L. यासारख्या कारखान्यांमुळे वायूप्रदूषण होत आहे. सामाजिक जीवनामध्ये या सर्व घटकातून आजाराचे प्रमाण वाढत आहे. त्यातून विविध आजार आणि उष्णता त्वचा विकार या सर्वांचा प्रभाव सर्वसामान्यांवर दिसून येतो. ताडोबा व्याघ्यप्रकल्प असून देखील आज वन्य प्राणी इतरत्र भटकलेले दिसतात.

एकंदरित पाहता पर्यावरणाचा सामाजिक जीवनावर प्रभाव म्हणजेच सण समारंभ हे पारंपारिक पद्धतीने न राहता केवळ दिखाव्याचे तयार झालेले आहे. सणाच्या द्वारे पर्यावरण संवर्धन या बाबीकडे संपूर्णपणे दूर्लक्ष केल्या जात आहे. उलट पर्यावरणाला घातक असेच वातावरण तयार होतांना दिसून येते. प्रचंड डि.जे. चा गजर त्यामधून वायू आणि ध्वनीप्रदुषणात भर पडत आहे. मोठमोठे राजकीय नेतृत्व युवा पिढिला योग्य मार्गदर्शन न करता इव्हेन्ट द्वारे पर्यावरणाला घातक अशा घटकांना प्रोत्साहन देत आहे. गणपती, देवी यातून पाण्याचे प्रदुषण वाढत आहे. आर्थिक दृष्टीकोणाने देखील एका बाजूला प्रचंड पैसा तर दुसऱ्या बाजूला पोटभरायला दोनवेळेची जेवन देखील नाही अशी परिस्थिती केवळ पर्यावरणाचा संतूलन न राखल्यामुळे होत आहे.

आत्ताच आलेली कोरोनाची साथ ही देखील सामाजिक जीवनातील पर्यावरणीय प्रभाव दाखवतो. जसजसा पर्यावरण विरोधात आपण कार्य करू तसतसा निसर्ग विविध प्रकारचे आजार निर्माण करून मानवावर अंकूश घालत जाईल. आपणच जर पर्यावरण संवर्धन केले तर आपल्याला पोषक समाज, पोषक वातावरण प्राप्त होईल.

संदर्भसूची :

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CASTE BASED SOCIAL CHANGE

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Abstracts:

Dr. Babasaheb Ambedkar brought about the greatest Social revolution in the world and great social change in India and gave equal rights to all the people here through the constitution. But after Babasaheb, the work of spreading his ideas across the country was not done properly by the people here, so it was limited to Maharashtra only Later, Kashi Ramji's Leadership emerged and he spread the ideas of great man all over the Country. He sought out great man of every caste and set them as role models for the people of that caste. His intention was that people would abandon old customs and traditions following the ideology of great men of their caste and this would Lead to new social change on the country. Great men were accepted by every caste but without accepting their views, they were confined to caste and those who were Omnipresent great men like Dr. Babasaheb Ambedkar, Mahatma Phule (fule), Shivaji Maharaj were also limited to caste, Now, people just take to the streets for caste, They don't want to do any of the other questions. This situation is very dire for the country, for which timely and appropriate measures need to be taken.

Keywords: A Caste, change, great men, Ideologists, revolution, social stunts.

Preface:-

Dr. Babasaheb Ambedkar fought hard to literate the people of India from the shackles of the caste systems. Not only was he freed, but he was given the right to be enshrined in the Constitution so that he would not have to suffer any further. Everyone gave equal rights with the right to education. The right to own property, the right to do whatever one wants, the people at the bottom of India started getting education. They began to change, women got equal rights, women began to work alongside men Among the Dalits, the Buddhist's who were with Babasaheb Ambedkar in Dhammadiksha in 1956, Mahar(Bouddha) got rid of the gods & goddesses in his house, abandoned the old tradition and started a new social life and fram that, Social Change began.

Social Status From 1956 to 1990

After 1956, social change began, the Buddhists abandoned the old customs but the people from other societies did not abandon the old customs but made progress in the field of education Mahatma Phule, Shahu Maharaj, Dr. Babasaheb Ambedkar. Who brought about the greatest social revolution here greed the society from the scruting of many orthodox traditions, so these great men became Omnipresent who were revered by all society. Dr. Babasaheb Ambedkar came to be known as the creator of the constitution but only the people of Maharashtra knew the work done by these great men by creating a constitution for the people of the whole country, they were given equal rights and they started exerting them but only a few people in the country knew who got it and how much they had to fight for it only a few people knew Dr. Babasaheb Ambedkar. The leaders of the Bahujans here imprisoned Babasaheb in Maharashtra and did not allow him to go outside Maharashtra in 1980. When Kashiram's leadership benefited the masses, the brought a wave of social change of all over the country and spread the ideas of Babasaheb and other great men all over the country and so people, all over India started recognizing Dr. Ambedkar and other great men. Later Kashiramji persuaded the people of every cast and religion to spread their Ideas in front of the great men of their own caste in order to get them out of the quagmire (Conflict) of gods & goddesses and traditions as a result, each caste got its great man and started carrying him. Those who were omnipresent great men were confined to one caste, from which the new caste based social transformation began.

Past 1990 caste based social change

After 1990, Caste based Social change started in Kunbi community. Shivaji Maharaj, Mahar Community, Babasaheb Chambar Community, Ravidas Teli Community, Santaji Maharaj Mali Community, Mahatama Phule were picked up by many people & stamped them for their caste and limited them to caste and their ideas, which were ubiquitous were limited to one caste only. Although our county is so advance in terms of education people still do not know much about the work of great men because once this caste based social change had an effect on this caste, The castes become stronger.

Consequences of Caste based Social Change

1) Mahatma Phule, Shivaji Maharaj, Shahu Maharaj and Dr. Babasaheb Ambedkar were limited to the great caste all their comprehensiveness diminished.

3) Every society that used to take to the streets as a plural society now takes to the streets only for its own caste.

4) The caste system became even stronger.

5) Old customs and traditions are still alive.

6) People use only the names of the great men of the caste, they alter names but their ideas have not been accepted yet which means their ideas have not spread.

8) The purpose for which these changes were made does not seem to be succeeding here.

Conclusion

The overall condition of the country is deteriorating due to caste based social change. The whole Society is still entangled in the caste system and it is getting entangled even more for this, the thoughts of great men need to be given a global form without being limited to caste only when the society progresses otherwise the county cant not progress.

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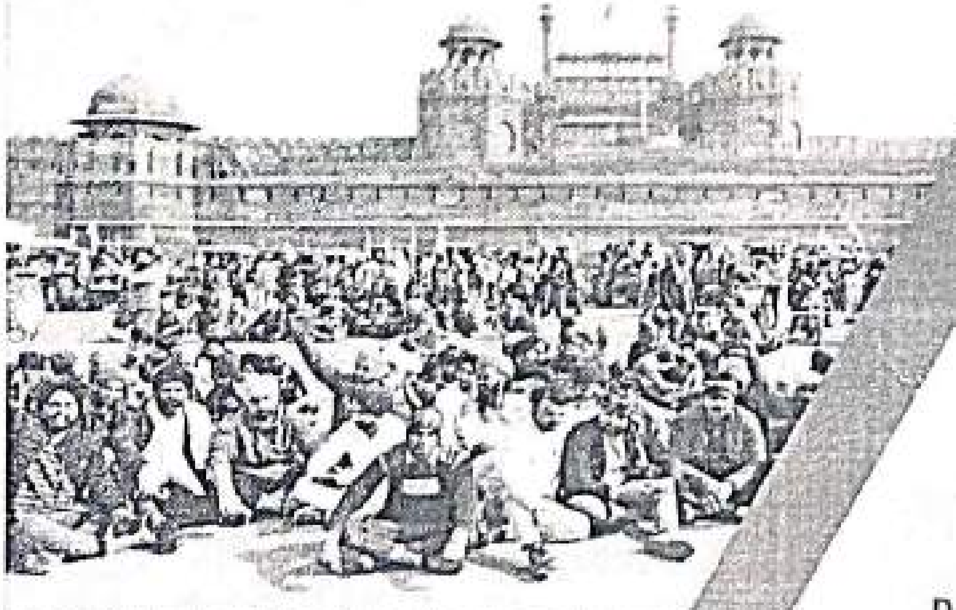

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शेतकऱ्यांची समस्या आणि उपाय

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जय जवान जय किसान असे श्री. लालबहादूर शास्त्री म्हणाले होते, पण यात शेतकऱ्यांची व्यथा ऐकून मन दु:खी झाल्याशिवाय राहणार नाही. यात जगाच्या पोशिंद्याला आज आत्महत्या करण्याची वेळ का आली? स्वत: दिवस रात्र शेतात राबणारा माझा शेतकरी प्रेमाने, मनापासून संपूर्ण बळ एकवटून पीक घेतो. कधी दुष्काळ, कधी अतिवृष्टि, ही निसर्गनिर्मित संकटे त्याच्यापुढे कायम आधिपासुन उभे राहतात तरी माझा शेतकरी ढगमगत नाही तो सहयाद्री प्रमाणे कणखर उभा असतो, या संकटावर मात करून तो मायेने लावलेले, जपलेले पिक घेतो पण अजून त्याची परीक्षा संपलेली नसते. शाळेत शिकणाऱ्या मुलाला देखील वर्षात फक्त दोनदाच परीक्षेला सामोरे जावे लागते पण शेतकऱ्याला प्रत्येक क्षणाला परीक्षेला सामोरे जावे लागते. एक समस्या सुटली की दुसरी त्याच्यासमोर आ वासुन उभी असते. शेतमालाला हमीभाव नाही. त्याने घेतलेल्या पिकाला योग्य भाव मिळत नाही. या अवस्थेस शेतकरी काय करणार?

शेतीची सुरूवात केली तेव्हा डोंगर टेकड्यावर लाकडाच्या सहाय्याने शेती करून त्यापासून धान्याची पैदास केली जायची. काही काळानंतर मानव एक जागी स्थित झाला, त्यानंतर त्याने अधिक प्रमाणात क्षेत्रावर शेती करण्यास सुरूवात केली. कालांतराने, भारत देशामध्ये हरितक्रांती झाल्यानंतर देशाच्या धान्य उत्पादन क्षमतेमध्ये खूप मोठे बदल झाले. अन्न धान्याची उत्पादन क्षमतेमध्ये मोठी वाढझाली, परंतु त्या बाबी प्रश्न होता तोच की, उत्पादित केलेले धान्य साठवण्याची पुरेशी व्यवस्था नसल्यामुळे तसेच वाटपाचे नियोजन नसल्यामुळे त्या उत्पादनापेक्षा जास्त प्रमाणात धान्याची नासाडी अधिक होत असे, देशातील गरिबांना हे धान्य मिळतही नव्हते. व्यवस्थित न साठवल्याने त्याची मोठी नासाडी होत असायची. आज आपल्या देशातील शेतकरी हा जास्तीत जास्त प्रमाणात खेड्यापाड्यात राहतो, आणि हा शेतकरी शेती पूरक व्यवसाय म्हणून गाई, म्हशींचे संगोपन करतो, त्यापासून मिळणारे दूध यापासून तो दैनंदिन जीवन जगण्यासाठी काही प्रमाणात उदरनिर्वाहासाठी त्याची विक्री करून पैसे मिळवतो. परंतु पूर्वीपासून उत्पादित फळभाज्या, पालेभाज्या, फळे, यांना जास्तीत जास्त दिवस कसे टिकवता येईल या गोष्टी शेतकऱ्यांना माहीत नाहीत. धान्य हे काही दुधासारखे नाशवंत नसते, म्हणून धान्याची नासधूस दुधाच्या प्रमाणापेक्षा कमी होत असते. आपल्या देशात या तीन नाशवंत मालाचे जेवढे उत्पादन होते त्याच्या ४० ते ५० टक्के एवढे उत्पादन वाया जाते, नासते आणि कुजते व्यर्थ जाते.

भारताच्या भाज्या आणि फळांच्या उत्पादनात दुसरा क्रमांक आहे. भारताने ठरवले तर निम्म्या जगाला दुध आणि भाज्या पुरवू शकतो. तेवढे उत्पादन आपल्याकडे घेतले जाते परंतु ते जगाला न पुरवता आणि त्यातला जवळपास निम्मा माल नासवून, कुजवून उकिरड्यावर फेकतो. त्यामुळे मालाची तर नासाडी होतेच पण उकिरड्यावर टाकल्याने त्याच्या दुर्गंध उठून रोगराई पसरते. निर्माण झालेला हा माल साठवण्याच्या पुरेशा सोयी सुविधा नसल्याने शेतकऱ्यांना नुकसान सहन करावे लागत आहे. आपले हे नुकसान ४४० अब्ज डॉलर एवढे प्रचंड आहे. ते रूपयात मोजायचे झाल्यास साधारण २४ लाख कोटी रूपये इतके आहे. आपण उत्पादन वाढवण्याचा प्रयत्न भारतातील शेतकरी वर्गाने केला आहेत परंतु त्यांना साठवण्याची योजना आखली नाही. त्याचा आपल्याला हा परिणाम भोगावा लागत आहे. ही उत्पादने अशी नासून आपले हे मोठे नुकसान टाळावे यासाठी त्यांना गोदामे आणि कोल्डड स्टोरेज उपलब्ध करून दिले पाहिजेत परंतु सध्या तरी यावर एक मार्ग आहे, तो म्हणजे या मालावर प्रक्रिया करणे. त्यामुळे नासाडी तर टळतेच पण प्रक्रिया केलेल्या मालाला जास्त भाव मिळून शेतकऱ्यांना जास्त पैसे मिळतात.

कृषि प्रधान देशातच शेतकऱ्यांच्या आत्महत्या?

आज महाराष्ट्रात शेतकरी आत्महत्या करतोय. पिकाला योग्य मूल्य न मिळाल्यामुळे आणि कर्जबाजारी झाल्यामुळे आज शेतकरी शेती विकून दुसरे काम करायला विवश झाले आहेत. कोणी सुरक्षक शेती करायला मागत नाही. शेतकरी खरंतर स्वतःचा मालक असतो, पण आजकाल त्याला कर्ज घेऊन सुद्धा फायदा नाही होत. कृषिप्रधान म्हणून ओळखल्या जाणाऱ्या देशात शेतकऱ्यांची अशी दशा लज्जास्पद आहे. शेतकऱ्यांच्या कोणत्याच पिकाला हमी भाव दिला जात नाही, त्यामुळे दलाल शेतकऱ्यांकडून शेतीमाल कमी भावाने घेऊन शहराच्या ठिकाणी कितीतरी अधिक भावाने विकतात. शेतमालाची बाजार पेठ शेतकऱ्यांच्या हातात नाही तिथे मारवाडी किंवा इतर लोक असतात. भारतात कोणत्याही वस्तूची फिक्स किंमत आहे तर मग शेती मालालाच का नाही.

शेती आणि शेतकऱ्यांच्या आत्महत्या

भारतात १२.५६ कोटी मध्यम व छोटे शेतकरी आहेत. त्यांच्याकडे सरासरी जास्तीत जास्त जमीन दोन हेक्टर आहे. बहुतेक शेतकरी भूसार पिकं करतात, कोरडवाहू शेती करताना सरासरी शेतकऱ्याला उत्पादन खर्च (दोन हेक्टरसाठी) १० हजार रूपये होतो. त्यानं सरासरी उत्पन्न २०,४०० रूपये होतं. म्हणजे वर्षाकाठी त्याला सुमारे १० हजार रूपये खर्चायला मिळतात. त्यामध्ये त्यानं शिक्षण, आरोग्य, लग्न, सण, यात्रामणूक इत्यादी गोष्टी सांभाळायच्या. मशागत, पेरणी, कापणी बी–बियाणं खतं, जंतूनाशकं इत्यादी साठी पैसे लागतात. घर चालवताना जीव मेटाकुटीला येतो, पैसे उरत नाहीत, कर्ज घ्यावं लागतं, सहकारी बँक, शेती बँक, कमर्शियल बँक कर्ज देते. कर्ज मिळण्यात अडचणी येतात, अनेकांकडं तारण नसतं, अनेकांनं आधीच कर्ज थकलेलं असतं. बँकांच्या अटी अव्यावहारिक असतात. बँक म्हणजे की फक्त उत्पादनासाठी कर्ज देणार. शेतकरी म्हणतो, की त्याला जगण्यासाठी ही पैसे हवेत, शिक्षणासाठी, लग्नासाठी पैसे हवेत. बँकांच्या नियमात ते बसलेलं असं नाही. नाना अडचणी पार करून शेतकरी कर्ज घेतात.

रिझर्व बँकेने आकडेवारी सांगते, की १२ कोटी शेतकऱ्या पैकी ५ कोटी शेतकऱ्यांनी कमर्शियल सरकारी बँकेत खाती आहेत, २० टक्के शेतकरी खाजगी, महाग, कर्ज घेतात. अर्ध्यापेक्षा अधिक शेतकरी कर्जबाजारी आहेत. त्यांच्यावर सरासरी ४७ हजार रूपयाच्या कर्ज आहे. शेती करून कसंबस जगलं, तरीही पैसे उरत नाहीत म्हटल्यावर कर्ज फेडणार कसं? आत्महत्या होते. पन्नासेक कोटी माणसं जगण्या मरण्याच्या संकटात आहेत. त्यातून वाट कशी निघणार? देशभरची राज्य आणि केंद्र सरकार शेतकऱ्यांना सुखी करण्यासाठी अनेक योजना जाहीर करतात. त्यांचा परिणाम होताना दिसत नाही. शेतकऱ्यांचे उत्पन्न दुप्पट करायचं असेल, तर त्यानं शेतमालाचं उत्पन्न वाढवायला हवं. शेतमालाचं उत्पादन आणि दर एकरी उत्पादन क्षमता वाढायला हवी. उत्पादन वाढवण्याचा एकच सिद्ध झालेला मार्ग म्हणजे रासायनिक खतांचा वापर.

कृषी कायद्याने हित कुणाचे

संसदेत तीन कृषी सुधारणा विधेयके पारित होताच देशातील कृषी क्षेत्रसाठी एक नवीन सुरूवात झाली. ही तिन्ही विधेयके केंद्रीय कृषी मंत्रालया अंतर्गत येत असली तरी वेगवेगळी आहेत. एक विधेयक हे कृषी उत्पादन व्यापार आणि वाणिज्य (प्रोत्साहन व सहाय्य) विधेयक आहे, हे कृषी उत्पन्न बाजार समिती (एपीएमसी) ला पर्यायी व्यवस्था देणाऱ्या कायद्याने आहे. दुसरे विधेयक हे शेतकरी (सबलीकरण व संरक्षण) हमीभाव करार व कृषी सेवा विधेयक (कॉन्ट्रॅक्ट फार्मिंग) संदर्भातले आहे. तर तिसरे विधेयक हे अत्यावश्यक वस्तू (सुधारणा) विधेयक हे कृषिमाल साठवण मर्यादा संदर्भातले आहे. या तिन्हि विधेयकांनी वेगवेगळी विशेषता व वेगवेगळ्या तरतूदी आहेत. मात्र या सुधारणा विधेयकातून शेतकऱ्यांचे हित जपले जाईल का? असा प्रश्न उपस्थित होत आहे. या कायद्याला विरोध म्हणून दिल्ली सीमेवर पंजाब, उत्तर प्रदेश सह देशातील शेतकरी आंदोलनावर बसले आहे. ज्यांच्या हातात सत्ता आहे, त्यांना या देशातल्या कष्टकरी, शेतकरी बांधवांबद्दल आस्था नाही. साठ दिवस झाले, ऊनातान्हाचा, थंडीचा विचार न करता शेतकरी रस्त्यावर बसला आहे. देशाच्या पंतप्रधानांनी त्यांना विचारपूस केला का? पंजाब म्हणजे पाकिस्थान आहे का? स्वातंत्र्याच्या संग्रर्षात जबरदस्त योगदान देणारा, स्वातंत्र्यानंतरही खलिस्थान चळवळी विरूद्ध पेटून उठणारा, १३० कोटी जनतेला दोन वेळचं अन्न देणारा बळीराजा प्रामुख्याने पंजाबातला आहे. पश्चिम उत्तर प्रदेशाला आहे. नाकर्तेपणानी भूमिका सरकारने घेतली आहे.

त्यामुळे देशभर संताप व्यक्त होत असताना लोकशाही भारतात जनता राजा की नेते अशी विचित्र परिस्थिती निर्माण झाली आहे.

शेतकऱ्यांच्या जेवढ्या समस्या पाहाव्यात तेवढ्या कमीच आहे. आज शेतकऱ्याची दशा आणि व्यथा पाहता कोण यातून सोडवेल हा प्रश्नच आहे. शेतकऱ्यांना निसर्गाने तर मारलेच आहेत त्यात सरकार आसूड ओढून राहिलेले कातडे देखील काढून घेण्यास कमी करीत नाही.

शेतकरी वर्गासाठी काहीच गोष्टी शासणा तर्फे झाल्या तरी बळीराजा सुखावेल. मुख्य म्हणजे शाळेपासून शेती हा विषय मुख्य असायला पाहिजे. शेतकऱ्या करीता साठवणुकीची केंद्र मोफत किंवा अतिशय माफक दरात असायला हवीत. साठवणुकीची केंद्र वेगवेगळ्या पातळीतील असावी त्यात प्रामुख्याने प्रत्येक पिकानुसार त्याची साठवणूक व्हायला हवी. प्रत्येक गावात असे गोदाम केंद्र हवेत. यात प्रामुख्याने शीतगृहे हवीत म्हणजे कोणताही माल नाश पावणार नाही. शेतकऱ्याना साठवणुकीचा प्रश्न असल्यामुळेच पीक निघाले की ते विकावे लागते. जर या प्रकारे गोदाम असतील तर शेतकरी आपला माल त्यात साठवून ठेवू शकेल. माल साठवून शेतकरी ठेवू शकला तर योग्य दरात आपला माल विकू शकेल. अर्थात यामुळे त्याला त्याचे कष्टाचे चिज करता येईल. शेती पूरक व्यवसाय शेतकरी पूर्वी काळापासून करीत आहे. त्याना देखील त्याला उपयोग योग्य पध्दतीने होईल. शेतकऱ्यांना अन्नप्रक्रिया हा घटक त्यासोबत संबंधित छोट्या मशनरी आणि त्याच्याशी संबंधित शिक्षण दिले तर आणखी बदल घडून येणार. शेतकरी स्वत:च्या हातात पैसा खेळवू शकणार.

कोणताच शेतकरी कर्जमाफी मागत नाही. पण प्रत्येक शेतकऱ्याला मनापासून एकच वाटते त्याच्या शेतमालाला हमीभाव भेटावं. तेवढा मिळाला तरी शेतकरी खुश होणार. आत्महत्तेनंतर ५ लाख देण्यापेक्षा हंगामाच्या सुरूवातीलाच २५ हजार दया शेतकरी त्यातूनच शेतीतून सोनं उगवून दाखवेल. संसदेत आलेले तीन कायदे रद्द व्हावे.

ज्या शेतकऱ्यांनी भारताची भूक भागवली त्यानाच सरकार असे वाऱ्यावर उभे करत असेल तर जनता कधीन माफ करणार नाही. भारत परत एकदा सुजलाम सुफलाम हवा असेल तर बळी चे राज्य यायलाच हवे.

ग्रंथसंपदा

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प्रस्तावना

आजचे आधुनिक युग हे स्पर्धेचे युग आहे. आज प्रत्येक व्यावसायीकाला आपल्या व्यवसायात स्थैर्य प्राप्त करावयाचे असल्यास त्याला नविन प्रक्रिया आत्मसात कराव्या लागतात. डिलीटलायझेशन आणि जागतिकीकरणामुळे तसेच आर्थिक व्यवस्थेत झालेल्या बदलामुळे नविन संकल्पना समोर येत आहे. यात आता राष्ट्रीय तसेच अंतराष्ट्रीय व्यापाराला चालना देण्यासाठी लॉजिस्टीक उद्योग ही संकल्पना रूढ झाली. ही सर्वप्रथम १९७०च्या कालावधीमध्ये रशियामध्ये चालु झाली. त्यानंतर अनेक देशांनी ही संकल्पना उपयोगात आणली आता तर राष्ट्रीय तथा अंतराष्ट्रीय व्यापाराला चालना देण्यासाठी लॉजिस्टीक उद्योग ही नविन संकल्पना रूढ झाली. लॉजीस्टीक आणि मालवाहतुक उद्योग वेगाने विकसीत होत आहे. आणि भारतातील अर्थव्यवस्थेचा कणा मानला जातो कारण तो संपूर्ण भारतातील मालाची जलद कार्यक्षम आणि किफायतशीर वाहतुक सुनिश्चीत करतो. आणि व्यावसायिक क्षेत्र त्यावर अवलंबुन असतात नाविण्यपुर्ण आणि प्रगत तंत्रज्ञानामुळे भारतातील लॉजीस्टीक उद्योग वाढीव कार्यक्षमता आणि एकत्रित ऑपरेटींग मॉडेल प्रदान केले आहे "लॉजिस्टीक म्हणजे उत्पन्नाच्या बिंदुपासुन वापरात असलेल्या बिंदुपासुन सेवा आणि संबंधीत माहितीसह कार्यक्षम व प्रभावी वाहतुकीचे संचयन, नियोजन अंमलबजाबणी आणि नियंत्रण वाहतुकीचा उद्देश ग्राहकांच्या गरजा पुर्ण करणे होय." या परिभाषेमध्ये अंतर्गामि बर्हिगामी तसेच विदेशी बाहय हालचालींचा समावेश होतो.

लॉजीस्टीक असे जाळे आहे की, जी प्रत्येक उद्योगाला व्यवसायाशी जोडला गेला आहे. ग्राहकांच्या गरजा पुर्णकरण्याकरीता लॉजीस्टीक असे व्यवस्थापन करते की उत्पादीत वस्तु व सेवांचे वितरण ते उपभोग या कियामध्ये ज्या सर्व किया येतात उदा. प्रभावी वाहतुक, संचयन, नियोजन नियंत्रण, वितरण इत्यादी कियेव्दारे व्यवस्थापन करतात. लॉजिस्टीक पार्क धोरण, २०१८ मध्ये लागु झाला "सोप्या शब्दात लॉजीस्टीक पार्क म्हणजे वस्तुची वाहतुक" मा. नरेंद्र मोदींनी 'मेक इन इंडिया' ही महत्वाकांक्षी योजना राबविली आहे. ही महत्वाकांक्षी योजना यशस्वी करण्यासाठी लॉजीस्टीक पार्कचा उपयोग मोठया प्रमाणावर होतो आहे. वस्तु व सेवाचे आदान–प्रदान तसेच आवश्यक ठिकाणी मागणी–पुरवठयाचे संतुलन, त्याकरीता आपल्याकडे भौगोलिकदृष्टया व्युहरचनेचा आधार घेवुन लॉजीस्टीक पार्क अद्यावत करणे गरजेचे झाले आहे. आजही अनेक शहरात आधुनिक तंत्रज्ञानाने नटलेली लॉजीस्टीक पार्कच्या सोई सुविधा उपलब्ध नाही. म्हणुन प्रत्येक शहरी भागात तसेच औद्यागिक क्षेत्रात लॉजिस्टीक पार्कची गरज आहे राष्ट्रीय व आंतराष्ट्रीय पातळीवर वस्तु व सेवांची उलाढाल होऊन मोठया प्रमाणावर आंतराष्ट्रीय चलनात वाड होऊ शकते. ही क्षमता लॉजिस्टीकमुळे शक्य होईल.

उद्देश

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आधुनिक दशकातील संदेशवहनाचे माध्यम :— ट्विटर

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सारांश :—

ट्विटर हे इंटरनेटवरील सर्वात मोठे सामाजीक नेटवर्क आहे आणि हे साधन विनामुल्य उपभोक्त्यांना उपलब्ध आहे. ट्विटरव्दारे आपण जगाला अगदी जवळ केलेले आहे, याव्दारे तुम्ही देश विदेशातील लोकांशी सहजतेने संवाद साधु शकतात माहिती प्राप्त करू शकतात तसेच एखाद्या विषयात समस्या उद्भवल्यास ट्विटरव्दारे समस्येचे निराकरण करू शकतो म्हणूनच ट्विटरला व्यक्त होणारे साधन म्हटले जाते केवळ देशांतर्गत व्यवसायालाच नव्हे तर देशविदेशातील व्यावसायीकांना तसेच उपभोक्त्यांचा विचार केला तर व्यवसायाच्या दृष्टीने असलेल्या सर्व प्रकारची माहिती, आकडेवारी, बदल, याची माहिती सहजतेने उपलब्ध होऊ शकते.

बिज शब्द :— Communication, स्पॅम, मायक्रोब्लॉगींग, डॉयलॉगींगलुप, real time

प्रस्तावना :—

संदेशवहनाला इंग्रजीमध्ये Communication म्हणतात तर हिंदीमध्ये संदेशवहन म्हणतात. संदेशवहनाची सुरवात केव्हापासून झाली याचा विचार केला तर अगदी जेव्हापासुन भाषा आली आणि व्यक्ती ऐकमेकांशी बोलायला लागले किंवा संवाद साधायला लागले. मानवीय भावनांचा, विचारांचा, उद्देशांचा, मानवीय विकारांचे मनोगत व्यक्त करण्याकरीता संदेशवहनाचा उपयोग केला जातो. संदेशवहन म्हणजे एका व्यक्तीकडून दुसऱ्या व्यक्तीकडे किंवा एका ठिकाणाहुन दुसऱ्या ठिकाणी निरोप, माहिती, सुचना, आदेश, निर्देश पोहचविण्याची प्रकिया होय. तसेच संदेशवहनात मार्गदर्शन करणे, प्रेरणादेणे, काम करवून घेणे, माहिती मागविणे इत्यादी कार्ये केली जातात. त्यामुळे फार पुर्वीच्या काळी संदेशवहन वेगवेगळया स्वरूपात केले जात होते. उदा. लखोटयात लेख स्वरूपात मग ते कबुतराव्दारे किंवा थोडयावर स्वार शिपाईव्दारे पाठवत असे तर मध्यकाळात पोस्टाव्दारे, पत्राव्दारे, पोस्ट कार्ड, तार तसेच टेलीफोन व्दारे लेखी व तोंडी स्वरूपाचे संदेश दिल्या जात असे. परंतू जसजसा कालावधी जाऊ लागला व आपण गेल्या १० वर्षाचा विचार केला तर सर्व माध्यमे अतिशय जलद स्वरूपाचे झाले आहे. आणि आपण २०—२५ वर्षापुर्वीचाविचार केला असता की जगाच्या पाठीवर कुठेही असलेल्या व्यक्तीशी आपण सहज बोलु बघु शकतो तर ती गोष्ट अशक्य वाटली असती परंतु आजकालच्या जलद संदेशवहनाच्या माध्यमाने ते शक्य झाले आहे. आधुनीक काळाचा जर विचार केला तर संदेशवहनाचे अनेक माध्यमाचा वापर करून जग अगदी जवळ आहे आहे असे म्हटले तरी चालेल सध्याच्या काळात विविध प्रकारची माध्यमे अस्तित्वात असली तरी, नवयुवक, प्रौढ, राजकीय नेते, उद्योगपती, मोठे व्यवसायीक, प्रसिध्द खेळाडू, अभिनेते ट्विटर या संदेशवहनाच्या माध्यमाचा वापर करतांना दिसत आहे ट्विटरचा वापर आपले एखाद्या विषयाबाबतचे मत, किंवा एखाद्या व्यक्तीबाबतचे मत, व्यवसायाची प्रसिध्दी असे अनेक कार्ये ट्विटरव्दारे करण्यात येत आहे.

ट्विटरची स्थापना २१ मार्च २००६ मध्ये सॅनफ्रॅन्सीसको (कॅली फोर्नीया) (USA) संयुक्त राष्ट्र येथे करण्यात आली. ट्विटरचे संस्थापक जॅक डोर्सी एव्हन विल्यम्स, नोआ ग्लास, बिझ स्टोन हे आहेत ट्विटरही अमेरीकेतील मायक्रोब्लॉगींग सोशल नेटवर्कींग संगणकीय जाळे सेवा आहे. ट्विटर हे प्रचलित सोशल सामाजिक माध्यम म्हणून ओळखले जाते. ३३० दशलक्षाहुन अधिक

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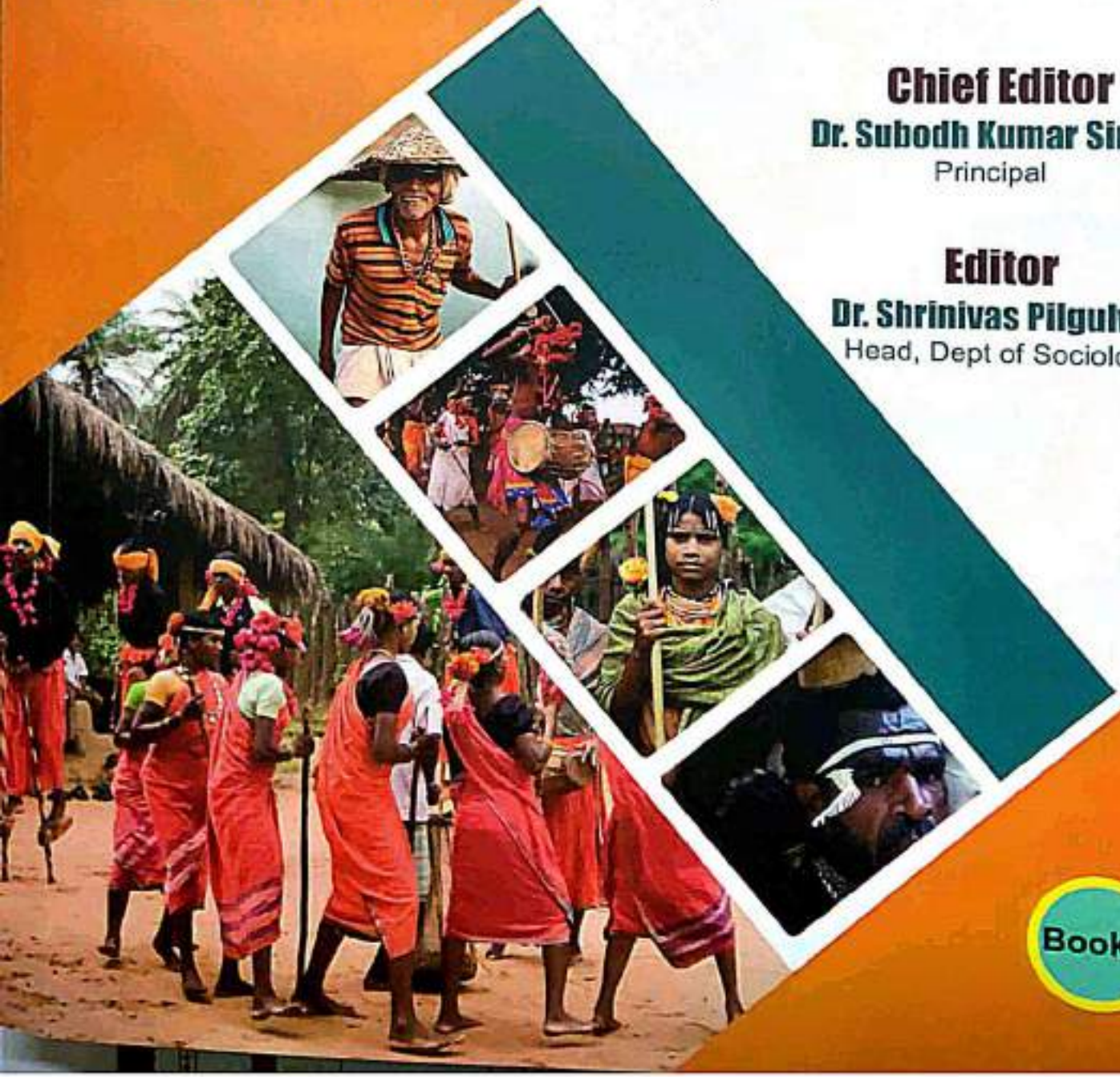

Book-2

आदिवासी समाजातील शैक्षणिक समस्येचे अध्ययन

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सारांश

सामाजिक समस्या ह्या सार्वत्रिक (Universal) आहेत. पृथ्वीतलावर असा एकही समाज नाही की त्या समाजात कसल्याही प्रकारच्या समस्या नाहीत. त्याचप्रमाणे आदिवासी समाज देखील समस्यांपासून वंचित राहिलेला नाही. डोंगर दऱ्या-खोऱ्यात राहणारा, प्रतिकूल परिस्थितीत जीवन जगणाऱ्या साध्या आदिवासी समाजाला देखील आर्थिक, धार्मिक, राजकीय, आरोग्यविषयक, कौटुंबिक आणि शैक्षणिक समस्यांना सामोरे जावे लागत आहे. प्रस्तुत शोधनिबंधात आदिवासी समाजातील शैक्षणिक समस्येचे अध्ययन करण्यात आले.

जटील आणि गुंतागुंतीच्या समाजात जीवन जगण्यासाठी प्रत्येक व्यक्ती साक्षर असणे गरजेचे आहे. आदिवासी समाजात २०११ च्या जनगणनेनुसार ३१.०४% निरक्षरता आहे. शैक्षणिक संस्था मध्ये आदिवासी विद्यार्थ्यांनी प्रवेश घेण्याचे प्रमाण कमी आहे. शिकणाऱ्या आदिवासी विद्यार्थ्यांनी शैक्षणिक वर्षामध्ये किंवा काही वर्ष शिक्षण घेऊन मधेच शाळा सोडण्याचे प्रमाणही इतर समुदायाच्या तुलनेत जास्त आहे. लिंग असमानतेचा प्रभाव आदिवासी समाजातील शैक्षणिक जीवनावर पडलेला आहे. आदिवासी मुलांच्या तुलनेत मुलींचे शिक्षण घेण्याचे प्रमाण कमी आहे. समाजातील शैक्षणिक प्रगतीसाठी शिक्षणाच्या सोयी- सुविधाची उपलब्धता आवश्यक असते परंतु आदिवासी समाजात मात्र याउलट परिस्थिती दिसून येते. काही शाळामध्ये शिक्षक, इमारत, खडू-फळा, पुस्तके, प्रयोगशाळा, क्रीडांगण, इत्यादी सुविधा पुरेशा प्रमाणात नाहीत. तसेच त्यामध्येही भ्रष्टाचार झालेला आढळून येतो.

महत्वाच्या संकल्पना: *लिंगभेद, साक्षरता, निरक्षरता, शैक्षणिक गळती*

संशोधनाची उद्दिष्टये

आदिवासी समाजातील निरक्षरतेची समस्या, विद्यार्थ्यांचे शैक्षणिक संस्थामध्ये प्रवेश घेण्याचे प्रमाण कमी असणे, शैक्षणिक गळतीचे जास्त प्रमाण असणे, लिंग असमानतेचा शैक्षणिक जीवनावर पडलेला प्रभाव आणि शैक्षणिक सोयी सुविधाच्या उपलब्धतेच्या समस्येचे अध्यपन करणे.

संशोधन पध्दती

ज्ञानेन्द्रियाला आलेल्या अनुभवाच्या आधारे एखादी घटना, प्रसंग, वस्तू, व्यक्ती याविषयी केलेल्या वस्तूस्थिती दर्शक विधानाला तथ्य म्हणतात. प्रस्तुत संशोधनासाठी ग्रंथ, संशोधन अहवाल, वैयक्तिक लेख, वर्तमान पत्रे, साप्ताहिके, मासिक इत्यादी दुय्यम तथ्य सामुग्रीचा उपयोग करण्यात आला.

प्रस्तावना

जीवाचे आंतरिक प्रस्फुटन होऊन उत्क्रांतीच्या प्रक्रियेतून मानवाची निर्मिती झाली. मानवाला आपण एकाकी जीवन जगू शकत नाही हे लक्षात आले. कारण मानव हा आपल्या आवश्यकतेच्या पुर्ततेबाबतीत परावलंबी आहे. त्याला आपल्या गरजाच्या पूर्ततेसाठी इतरावर अवलंबून राहवे लागते. त्यासाठी मानव हा एकत्रीत राहू लागला यातच समाज निर्मितीचे मूळ आहे. प्रारंभिक काळात तो टोळीच्या रूपाने राहू लागला. लैंगिक गरज, मुलांचे पालन पोषण, भावनिक आणि शारीरिक संरक्षण इत्यादी आवश्यकतेच्या पूर्ततेसाठी

कुटुंबाची निर्मिती झाली. कालांतराने अनेक शोध लागले आणि स्थिर जीवनाचा प्रारंभ झाला. हळूहळू खेडे निर्माण झाली. खेड्याचे रूपांतरण नगरामध्ये झाले. या प्रक्रियेत मुळच्या भूमीपुत्रांनी दुर्गम भागात, डोंगर कपाऱ्यात, नदी नाल्याच्या शेजारी, घनदाट जंगलात वस्ती करून राहिले ते आदिवासी होय. देशात त्यांना वेगवेगळ्या नावानी ओळखले जाते. रिस्ले, एल्वीन, ठक्कर यांनी आदिवासींना 'मुळचे रहिवासी' तसेच डॉ. जी.एस. घुर्ये यांनी 'मागासलेले हिंदू' असे म्हटले आहे. तर भारतीय संविधानामध्ये 'अनुसूचित जमाती' (Scheduled Tribes) असे म्हटले जाते.

सामाजिक समस्या ह्या सार्वत्रिक आहेत. प्रगत-अप्रगत, विकसित-अविकसित, लहान-मोठा, पारंपारिक-आधुनिक असा कोणताही समाज सामाजिक समस्येपासून वंचित राहु शकत नाही. त्याचप्रमाणे आदिवासी समाज देखील समाजिक समस्येपासून दूर राहिलेला नाही. आर्थिक, राजकीय, शैक्षणिक, सांस्कृतिक, धार्मिक, आरोग्यविषयक इत्यादी समाजिक समस्या असलेले आढळून आले. प्रस्तुत शोध निबंधामध्ये वरील समस्यापैकी शैक्षणिक समस्येचे अध्ययन करण्यात आले.

आदिवासी जमातीचे लोकसंख्यात्मक स्वरूप

भारतीय राज्यघटनेतील कलम ३४२(१) नुसार ज्यांचा समावेश अनुसूचित जमातीच्या यादीत केला आहे त्यास आदिवासी म्हणून ओळखले जाते. डोंगराळ प्रदेशात आणि जंगलात वास्तव्य करणाऱ्या आणि जे आधुनिक संस्कृती तसेच जीवनपद्धती पासून अलिप्त आहेत, तसेच त्यांच्या मध्ये एकसमान बोलीभाषा बोलली जाते. आपली उत्पती एकाच पुर्वजापासून झाली असे समजतात. या संदर्भात डॉ. डी.एन. मुजुमदार म्हणतात "जमात किंवा आदिवासी समाज हा समान जीवन पद्धती असणारा, समान भाषा बोलणारा व व्यवसाय, विवाह वगैरे बाबतीत समान निषेध नियमाचे पालन करणारा आणि एकाच भूप्रदेशावर वास्तव्य करणाऱ्या कुटुंबाचे किंवा कुटुंब समूहाचे एकत्रीकरण आहे."१

Scheduled Tribe Population(in millions)

Census Year	Total Population	Scheduled Tribe Population
1961	439.2	30.1
1971	547.9	38.0
1981	665.3	51.6
1991	838.6	67.8
2001	1028.6	84.3
2011	1210.8	104.3

Source: Statistical Profile of Scheduled Tribes in India 2013 Report P. 2

अनुसूचित जमातीच्या सूचीनुसार भारतात 414 आदिम जमाती आहेत. आदिवासीच्या लोकसंख्ये बाबतीत भारताचा जगात दुसरा क्रमांक असून पहिला क्रमांक आफ्रिकेचा आहे. भारतात 2011 च्या जनगणनेनुसार 104.3 लाख असून देशाच्या एकुण लोकसंख्येच्या तुलनेत त्याचे प्रमाण 8.6 एवढे आहे.

शैक्षणिक समस्येविषयीच्या तथ्याचे विश्लेषणात्मक निर्वचन:

निरक्षरतेची समस्या :

समाजाच्या प्रगतीसाठी शिक्षण अत्यंत महत्वाचे आहे. ग्रामीण आणि शहरी समुदायाच्या तुलनेत आदिवासी समाज आजही शैक्षणिक बाबतीत मागासलेला आहे. स्वातंत्र्यपूर्वकाळात तर आदिवासीं शैक्षणिक बाबतीत मागासलेले होते. पाश्चात्य देशांच्या आगमना नंतर यामध्ये परिवर्तन झाले. त्यांच्याच प्रयत्नामुळे आधुनिक शिक्षणाची सुरवात झाली. स्वातंत्र्या नंतर शैक्षणिक जनजागृती आणि शासनाच्या

प्रयत्नामुळे भारतात साक्षरता दर वाढलेला आहे. यामध्ये ग्रामीण आणि नागरी समुदायाच्या तुलनेत आदिवासी समुदायात साक्षरतेचे प्रमाण कमी आहे. ही बाब पुढील सारणीवरून अधिक स्पष्ट होईल.

Comparative Literacy Rate of ST and Total Population

Category/ Census Year	1961	1971	1981	1991	2001	2011
Total Population	28.3	34.45	43.57	52.21	64.84	72.99
Scheduled Tribes	8.53	11.30	16.35	29.60	47.10	58.96
Gap	19.77	18.15	19.88	22.61	18.28	14.03

Source: Statistical Profile of Scheduled Tribes in India 2013 Report P. 13

वरील संख्यात्मक तथ्यावरून आपणास असे निर्वचन करता येईल की 2011 च्या जनगणनेनुसार एकुण आदिवासी लोकसंख्येपैकी 31.04% आदिवासी लोकसंख्या निरक्षर आहे. एकुण लोकसंख्येच्या तुलनेत हे प्रमाण 14.03% नी कमी आहे.

शैक्षणिक संस्थामध्ये आदिवासी विद्यार्थ्यांचा कमी प्रवेश:

शासनाकडून आदिवासी विद्यार्थ्यांना अनेक प्रकारच्या सोयी सवलती देऊनही शैक्षणिक संस्थामध्ये आदिवासी विद्यार्थ्यांनी प्रवेश घेण्याचे प्रमाण कमीच आहे. याचाच परिणाम म्हणून आदिवासी मध्ये साक्षरतेचा दर देखील तेवढा चांगला नाही. अनेक आदिवासी कुटुंबाना शिक्षणाचे महत्वच समजले नाही. अनेक आदिवासी परिवार तर दारिद्र्य स्थितीत जीवन जगतात. त्या परिवारासाठी मुल ही आर्थिक स्त्रोत म्हणून बघितले जाते. मुलांचा शाळेत प्रवेश न घेता त्यांचा परंपरागत व्यवसाय कारणेच पसंद करतात. त्यांच्या मध्ये शिक्षणाविषयीचे अनेक गैरसमज आहेत. या संदर्भात डॉ. बी.एम. कन्हाडे लिहितात "गडचिरोली जिल्ह्यातील 'माडिया' लोकात आजही अनेक गावात एकही शिक्षित मिळणार नाही अशी वस्तुस्थिती आहे. आज शाळा-अंगणवाडी प्रत्येक गावात पोहचली. अंगणवाडी शिक्षिका स्थानिक गावातीलच असावी असे धोरण आहे. परंतु गावात चौथा वर्ग शिकलेली महिला मिळत नाही अशी स्थिती आहे."२ आदिवासी समाजातील शैक्षणिक संस्थात विद्यार्थ्यांना प्रवेश घेण्यासंबंधीच्या मानसिकतेचा परिणाम शैक्षणिक जीवनावर झालेला दिसून येतो. शैक्षणिक संस्थात विद्यार्थ्यांना प्रवेश घेण्यासंबंधीचे संख्यात्मक तथ्य खालील सारणीत दर्शविण्यात आले.

Percentage Enrolment ST Student to all categories

Year	Parimary	Upper Primary	Secondary
1995-1996	8.8	6.1	4.9
1996-1997	9.2	6.3	4.9
1998-1999	9.6	6.7	5.1
1999-2000	9.4	6.9	5.0
2000-2001	9.7	7.2	5.4
2002-2003	9.7	6.9	5.4
2003-2004	9.8	7.5	5.6
2004-2005	10.5	8.1	5.6
2005-2006	10.6	8.5	5.7
2006-2007	10.8	8.5	6.1
2007-2008	10.8	8.2	6.3
2009-2010	11.2	8.6	6.3
2010-2011	11.0	8.7	6.4

Source: Selected Educational Statistics, MHRD, 2010-11

वरील सारणीमधील 1995 – 2011 पर्यंतच्या सांख्यकीय तथ्यावरून आदिवासी समुदायात शैक्षणिक संस्थेत विद्यार्थी प्रवेश घेण्याचे प्रमाण अतिशय कमी आहे. 2011 मध्ये प्राथमिक शिक्षणासाठी 11.00%, उच्च प्राथमिकसाठी 8.7 तर माध्यमिकसाठी 6.4 एवढ्या विद्यार्थ्यांनी प्रवेश घेतला हे प्रमाण अतिशय कमी आहे.

शैक्षणिक गळतीची समस्या:

आदिवासी विद्यार्थ्यामध्ये शैक्षणिक वर्षातून मध्येच अथवा काही वर्ष शिक्षण घेऊन शिक्षण पूर्ण न करताच मध्येच शाळा सोडण्याचे प्रमाण जास्त आहे. यासाठी त्यांची आर्थिक स्थिती, शिक्षणाविषयीचे त्यांचे गैरसमज, निरक्षरता इत्यादी घटक जबाबदार आहेत. 2010-11 च्या शैक्षणिक वर्षात केलेल्या सर्वेनुसार एकूण विद्यार्थ्याच्या शैक्षणिक गळतीच्या प्रमाणामध्ये आदिवासी विद्यार्थ्याचे प्रमाण किती आहे ही बाब खालील सारणीत दर्शवण्यात आली.

Drop Out Rates (in percent)

Class	Boys	Girls	Total				
	ST	All	ST	All	ST	All	Gap
Classes I-V	37.2	28.7	33.9	25.1	35.6	27.00	8.6
Classes I-VIII	54.7	40.3	55.4	41.00	55.00	40.6	14.4
Classes I-X	70.6	50.4	71.3	47.9	70.9	49.3	21.6

Source: Selected Educational Statistics, MHRD, 2010-11

2010-11 च्या शैक्षणिक वर्षात पहिली ते पाचवी या वर्गातील विद्यार्थ्याच्या शैक्षणिक गळतीच्या प्रमाणामध्ये आदिवासी विद्यार्थ्याचे शाळा सोडण्याचे प्रमाण 35.6% आहे. पहिली ते आठवी पर्यंतच्या विद्यार्थ्याचे प्रमाण 55.00% एवढे आहे. पहिली ते दहावी पर्यंतच्या विद्यार्थ्यानी शाळा सोडण्याचे प्रमाण 70.9% एवढे आहे.

लिंगभेदाची समस्या:

समाजातील कौटुंबिक, वैवाहिक, आर्थिक, शैक्षणिक, धार्मिक आणि राजकीय इत्यादी प्रत्येक क्षेत्रात कमी अधिक प्रमाणात लिंग असमानता दिसून येते. त्याला आदिवासी समाज देखील अपवाद नाही. ग्रामीण आणि शहरी समुदायाच्या तुलनेत आदिवासी समाजात देखील कमी अधिक प्रमाणात लिंगभेद आढळून येतो. यातून आदिवासी समाजातील शैक्षणिक क्षेत्र देखील सुटलेले नाही. याबाबतीत डॉ.धर्मवीर महाजन व डॉ.कमलेश महाजन म्हणतात "अनुसूचित जनजातियो में शिक्षा की समस्या की गम्भिरता इस तथ्य से पता चलती है कि, समाजिक दृष्टि से इन जनजातियो में शिक्षा सम्बन्धी अनेक असमानताए मौजूद है जैसे (i) पुरुषो की अपेक्षा स्त्रियो में शिक्षा प्राय: नगण्य है (ii) विभिन्न प्रदेशो में अनुसूचित जनजातियो की प्रगति में असमानताए पाई जाती है"३ पुरुषाच्या तुलनेत स्त्रियांना दिले जाणारे शिक्षणाचे प्रमाण नगण्य आहे. आदिवासी समाजात शिक्षण क्षेत्रात कशाप्रकारे लिंगभेद होतो ही बाब दर 100 मुलांच्या मागे मुलींचे शिकण्याचे असणारे प्रमाण पुढील सारणी वरून अधिक स्पष्ट होईल.

Number of Girls per hundred boy

Class	Schedued Tribes	All categaries
I-V	94	92
VI-VIII	91	89
IX-X	81	82
XI-XII	74	79

Source: Statistics of school education , 2010-11

वरील 2010-2011 च्या आकडेवारीवरून 100 मुलांच्या मागे आदिवासी मुलीचे प्रमाण हे कमी असलेले आढळून येते. I-V या वर्गात शिकणाऱ्या मुलींचे प्रमाण 94, VI-VIII या वर्गात 91, IX-X मध्ये 81 तसेच XI-XII यामध्ये 74 एवढे प्रमाण आहे. यावरून मुलांच्या तुलनेत मुलींचे प्रमाण कमी असलेले आढळून येते.

अपुऱ्या शैक्षणिक सुविधा:

स्वातंत्र्या नंतर भारतात ज्या गतीने शिक्षणाचा प्रसार झाला त्याच्या तुलनेत शैक्षणिक सुविधा मात्र कमी पडल्या. सरकारी शाळांची स्थिती म्हणावी तेवढी चांगली नाही. खाजगी शाळा आदिवासी क्षेत्रात पोहचल्या नाहीत. आदिवासी क्षेत्रातील शाळामध्ये मुलांना बसण्याचीही व्यवस्था नाही. मुले जमिनीवर बसतात. राहण्यासाठी पुरेशी वसतिगृहे नाहीत. ज्याठिकाणी आहेत तेथे मोठ्याप्रमाणात भ्रष्टाचार झालेला आढळून येतो. ही बाब पुढील संदर्भावरून अधिक स्पष्ट होईल "भारत में जिस द्रुत गति से शिक्षा संस्थान खुले और शिक्षा का गणनात्मक प्रसार हुआ, उस गति से शैक्षणिक सुविधाए प्रदान नाही की गई। आज भी शहरो से लगे गावो के सरकारी पाठशालाओ में हालत यह है कि बच्चे जमीन पार बैठते है, बच्चो के बैठने के लिऐ पट्टीया भी नाही है, कार्यालय में मेज-कुर्सी और अलमारी की भी व्यवस्था नही है। विज्ञान(सायन्स) में प्रवेश अधिक है तो प्रयोगशाळा में पर्याप्त साधन नाही है, फिर छात्रावासो का तो नितान्त अभाव है "४ म्हणजेच धोडक्यात आदिवासी विद्यार्थ्यांना मिळणाऱ्या शैक्षणिक सुविधा ह्या अपुऱ्या आहेत.

निष्कर्ष:

१) जटील आणि गुंतागुंतीच्या समाजात जीवन जगण्यासाठी प्रत्येक व्यक्ती साक्षर असणे गरजेचे आहे. आदिवासी समाजात २०११ च्या जनगणनेनुसार ३१.०४% निरक्षरता आहे. ही समस्या त्यांचा जीवनस्तर उंचावण्यात अडसर ठरत आहे.

२) आदिवासी समाजातील आर्थिक परिस्थिती, शिक्षणाविषयीचा आदिवासी लोकांचा दृष्टिकोन, जनजागरणाचा अभाव इत्यादी कारणामुळे शैक्षणिक संस्था मध्ये आदिवासी विद्यार्थ्यांनी प्रवेश घेण्याचे प्रमाण कमी आहे.

३) आदिवासी विद्यार्थ्यांनी शैक्षणिक वर्षामध्ये किंवा काही वर्ष शिक्षण घेऊन मध्येच शाळा सोडण्याचे प्रमाणही इतर समुदायाच्या तुलनेत जास्त आहे.

४) लिंग असमानतेचा प्रभाव आदिवासी समाजातील शैक्षणिक जीवनावर पडलेला आहे. आदिवासी मुलांच्या तुलनेत मुलींचे शिक्षण घेण्याचे प्रमाण कमी आहे.

५) समाजातील शैक्षणिक प्रगतीसाठी शिक्षणाच्या सोयी- सुविधाची उपलब्धता आवश्यक असते परंतु आदिवासी समाजात मात्र याउलट परिस्थिती दिसून येते. काही शाळामध्ये शिक्षक, इमारत, खडू-फळा, पुस्तके, प्रयोगशाळा, क्रीडांगण, इत्यादी सुविधा पुरेशा प्रमाणात नाहीत. तसेच त्यामध्येही भ्रष्टाचार झालेला आढळून येतो.

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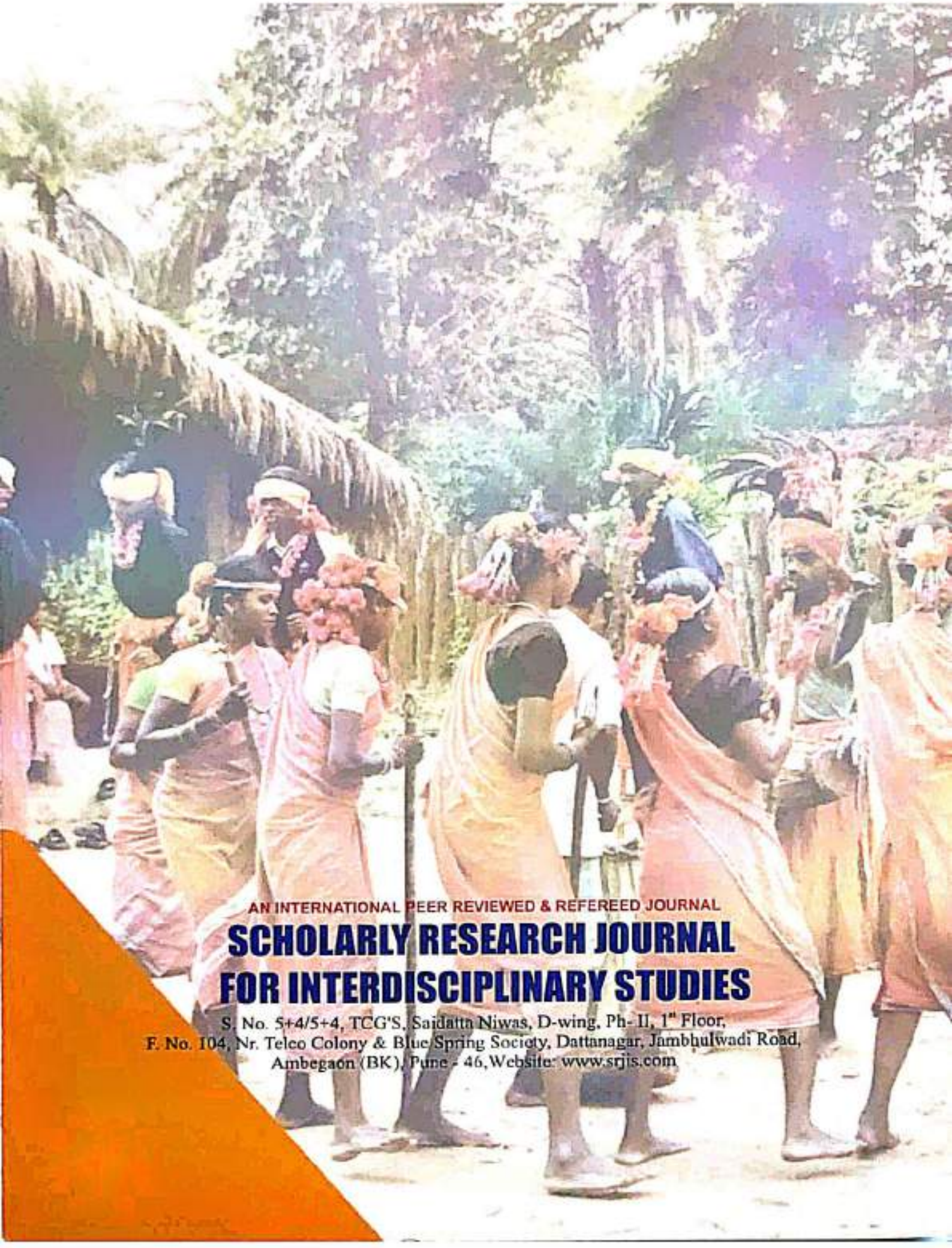

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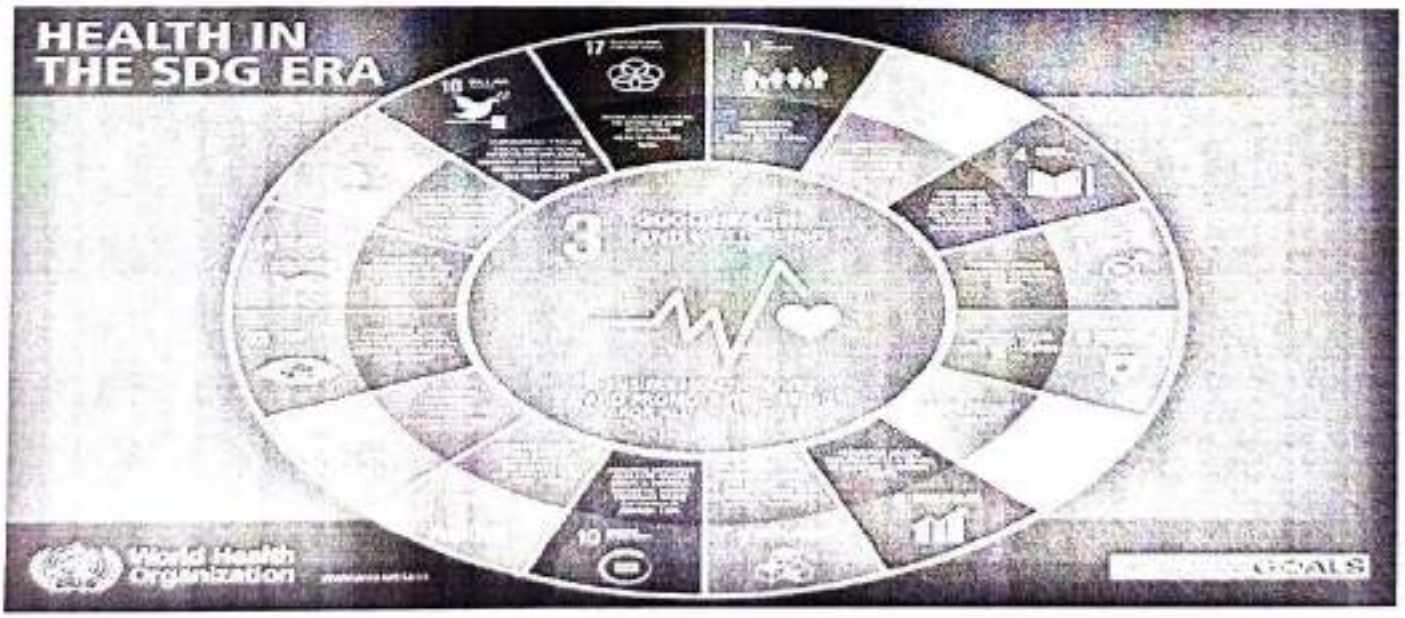

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Impacts of Environmental Changes on Sports Events

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Abstract

Winter and summer sports the same will be affected by environmental change. Hotter winters and less snow will affect winter sports. The Tokyo 2020 long distance race occasion was moved because of warmth concerns, no snow at the Vancouver 2010 Olympics, and dirtied waters in Rio 2016 made it dangerous to swim in the water. Another model is the FINA Open Water 10KM world cup in Fujairah, a few swimmers were treated for heat depletion. A later model is the Doha long distance race, "where boiling conditions made various competitors breakdown and practically a large portion of the field neglected to complete." We need to perceive that the games business has a natural impression. Sports might be succumbing to environmental change, however they are likewise a contributor to the issue. Every one of the trips of the competitors, training, mission staff and fans, fabricating the scenes, the energy burned-through to run offices, all the single-use plastics that will be given out at occasions, and surprisingly the firecrackers utilized during functions. Everything has direct, and circuitous effects on the climate.

Introduction

The climate can essentially influence competitors and how they perform. The range of the climate can work with or restrain execution, or it can cause genuine ailment or demise. The extent of ecological conditions is tremendous, from warmth to cold and height to hyperbaric mediums. Partaking in a variety of exercises in an assortment of natural conditions can be invigorating and safe, if one has an intensive comprehension of the dangers and is appropriately ready. As our mom earth warms up, contending in or in any event, looking as observers, numerous open air sports is turning out to be progressively difficult as environment boundaries brings harsher warmth waves, extreme downpour, and different dangers. The issue emerges when things turn out badly and need to depend on our generally crude, underdeveloped, and physiological safeguards. The results of their limits incorporate hypothermia, cold injury, hyperthermia, and barotrauma. Watching sports in 2020 is a surprising encounter. Allies didn't will see the Olympics in 2020, yet they saw a ball "bubble" with virtual fans and a Premier League with counterfeit cheering. While the Covid has slowed down and modified games, a report on sports and environment from this mid year cautions: "Yet destroying as this has been, something significantly more tricky is standing ready for the brandishing bazaar." That's the environment emergency. Before the Tokyo Olympics were delayed because of the pandemic, coordinators at last chose to move the long distance race occasion from the Japanese cash-flow to the cooler Sapporo, since Tokyo heat in summer 2018 arrived at a boiling 106 degrees Fahrenheit. That is only one model that is uncovered how environment is changing the manner in which sports are being burned-through, both for players of nearby, local area sports, and onlookers of the worldwide alliances. High temperatures and absence of snowfall are compromising skiing, fires are causing chronic weakness for cricket major parts in Australia (and baseball major parts in California), and rising ocean levels are flooding fairways.Sports, however, might have the option to some extent help themselves recuperate; while games are survivors of environmental change, they likewise have high carbon impressions. The 2016 Rio Olympics delivered 3.6 million tons of carbon dioxide, and the 2018 Russia World Cup 2.16 million (and those computations reject the effect of developing numerous new arenas). Also, while different ventures have been designated as guilty parties, sports have to a great extent gotten off delicately. "There has been no lack in ecological mottos in the games world since [the Sydney Olympics]," Goldblatt says in the report, "yet there has been priceless little activity, particularly among the overseeing groups of game and the main expert and business associations." While different areas and governments need to roll out genuine improvements to arrive at the objectives set out by the Paris Agreement, sports classes, clubs, and arranging bodies can likewise do their part. "All things considered, [sport has] got a lopsidedly enormous obligation on account of the administrative role it has," Simms says. The U.N's. Sport for Climate Action Framework, from 2016, plans to urge wearing substances to assist with arriving at the Paris objectives. Yet, just a few bodies have marked the vow: FIFA, UEFA, IOC, NFL, NBA have; NHL and MLB haven't. It's been endorsed by the worldwide Olympic organizations of just judo, wrestling, and cruising for summer, and ice hockey and skiing in winter—"which makes one can't help thinking about what individuals responsible for luge and bobsleigh think they will be sliding on later on," Goldblatt composes. Yet, the vow isn't sufficient, Simms says, on the grounds that the U.N's. system needs multifaceted procedures, hard

targets, and desperation. He says counterbalancing emanations—a "escape carbon prison free card"—is additionally not as powerful as slicing fossil fuel byproducts. One course could be for associations to eliminate petroleum derivative and high-carbon way of life supporters like carriers, petrochemical organizations, and SUV producers. The Bundesliga, the top German soccer association, has shown how individual groups can have an effect: Bayern Leverkusen utilizes 100% clean energy, just single-use plastics, and well water for water system.However, it's a little group in England, Forest Green Rovers, that is driving the charge, as the world's first U.N.- ensured sans carbon soccer club, which flaunts 100% environmentally friendly power, water reusing, and vegetarian just food—and has arranging consent to construct another without carbon, wooden arena. "Presently, you have the other more first class clubs and top-end clubs rushing to make up for lost time," Simms says.Because of the limitations during the Covid, fossil fuel byproducts from sports in 2020 have most likely plunged, as groups have scaled back movement, arena use, and halftime razzamatazz. What's more, the report proposes that there are exercises from the pandemic that can get over into the environment emergency. A portion of their activities have included planting trees, reestablishing water, a food recuperation drive, NHL focused on balancing discharges related with post-season air travel. The IOC-Dow association helps the National Olympic Committee's and International Federations gauge and diminish their carbon impressions. This program will help IF's and NOC's that are carrying out substantial activity to handle fossil fuel byproducts from their game associations and games. One thing happening is the utilization of manufactured grass delivered from sugar stick inferred plastic that will be utilized to make the pitch for the field hockey competitions in Tokyo 2020. The sugar stick that is utilized to create the bio-polyethylene is a material that catches carbon dioxide. This is the sort of development that we should be carbon negative in all parts of our lives. Tokyo 2020 has an objective of zero carbon and zero waste, utilizing sustainable power to control the Games, killing consumable pieces of food squander, decreasing bundling of materials, and their 2020 award project where all decorations are produced using reused materials. Game associations need to move to a carbon negative, and ultimately a carbon positive working model. This implies considering the offices that are utilized by associations. A National Sport Organization or International Sport Federation can execute approaches that state they will just hold occasions that are held in offices that are controlled by 100% environmentally friendly power, arrangements that will bring down food waste and single use plastics at occasions, and different strategies that alleviate the effect of enormous (and little) games on the climate. Game associations can likewise discover imaginative methods of giving contest data. Many games likewise have a great deal of gear that is made out of plastic (for instance, swimming produces numerous silicon and latex swim covers, and when they break, they are thrown away.) Uniforms, and hardware are adding to squander creation of groups and competitors all throughout the planet, making hardware that keeps going longer, or that is recyclable is important. How could we upcycle these into new items? Would we be able to make this gear out of various materials? Sporting gear likewise should be tended to in natural strategies. Compromise with the climate implies that we need to join it into arranging of game occasions. The London 2012 Queen Elizabeth Olympic Park (cover photograph) is an extraordinary illustration of an Olympic Park expanding the green space that is accessible for occupants nearby. Game and the climate can cooperate, however we need to design in like manner.

Conclusion

The impacts of climate on sport are shifted, for certain occasions incapable to happen while others are changed significantly. The exhibition of members can be diminished or improved, and some brandishing world records are invalid whenever set under certain climate conditions. While open air sports are generally influenced, those played inside can in any case be affected by unfriendly or beneficial climate conditions.

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Research Article

Impact of physical education and sports promoting social values among youth

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ABSTRACT

The reason for this examination is to explore the effect of actual training and sports in advancing social qualities among youth. Actual training and sports assume an indispensable part in teaching the young with respect to the significance of social qualities in their day-to-day existence. Checked on writing researched that the significance of relationship in teaching the two personalities and body. Further, it likewise energizes the social qualities among youth that permit them to foster social relations with their local area. Furthermore, the advantages of actual schooling and sports can impact both scholastic learning and active work of the adolescent. Humanism of game, on the other hand, alluded to as sports social science is a sub-discipline of social science which centers around sports as friendly wonders. It is a space of study worried about the connection among social science and sports, and furthermore different socio-social designs, examples, and associations or gatherings engaged with sport. This space of study talks about the positive effect sports have on unique individuals and society in general monetarily, monetarily, and socially. Humanism of game endeavors to see the activities and conduct of sports groups and their players through the eyes of a social scientist.

INTRODUCTION

Game is managed by guidelines and rules of conduct, spatial and time requirements, and has administering bodies. It is arranged toward an objective, which spreads the word about both the champ and the failure. It is cutthroat and ludic. All games are socially arranged, entwined with the worth frameworks, and force relations inside the host society. The rise of the social science of game (however not simply the name) dates from the finish of the nineteenth century when first friendly mental trials managing bunch impacts of contest and speed making occurred. Other than social human studies and its advantage in games in the human culture, one of the main endeavors to contemplate sports in a more broad manner was Johan Huizinga's Homo Ludens or Thorstein Veblen's Theory of the Leisure Class. Homo Ludens examines the significance of the component of play in culture and society. Huizinga proposes that play, explicitly sport, is essential to and a vital state of the age of culture. These composed works added to the ascent of the investigation of social science of game. In 1970, sports social science acquired huge consideration as a coordinated, real field of study. The North American Society for the Sociology of Sport was shaped in 1978 with the goal of considering the field. Its exploration outlet, the Sociology of Sport Journal, was framed in 1984.

In the present period, actual instruction and sports is a fundamental piece of training. It contributes straightforwardly to the improvement of actual ability and wellness. It likewise assists the adolescent with monitoring the value of driving an actually dynamic way of life. The solid and actually dynamic youth is bound to be scholastically propelled, mindful, and promising. As such, we can say that actual training and sports are select to the school main subjects. It is the solitary program that gives the chances to youth to acquire engine abilities, progress mental and actual wellness. The advantages of physical acquired from active work such as illness anticipation, security and injury aversion, diminished horribleness and untimely mortality, and expanded emotional well-being. The actual instruction is just the course where youth find out pretty

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much the entirety of the advantages acquired from being truly dynamic just as the abilities and information to join protected, fulfilling active work into their lives, furthermore, how to interface with others (National Association for Sport and Physical Education, 2001). Besides, it is seen that actual training meetings ought to be not difficult to get from preschool until optional. It focus to manage an assortment of proactive tasks and energize the individuals who are the absence of inclining to take up arranged serious games. This includes dispose of ordinary techniques for actual schooling educating and zeroing in additional on the people's necessities and capacities, as an option of the happiness regarding active work. As an ideal opportunity for actual training is for the most part restricted inside the educational time timetable and educational plan, its substance should be important and creative (Fox and Harris, 2003). Further, Gonzalez *et al.* (2010) accepted that curricular actual schooling inside any game, ability improvement plot as well as a high advancement in friendly qualities among youth. Thusly, the motivation behind this examination is to research the job of actual schooling in advancing social qualities among youth.

PHYSICAL EDUCATION PROGRAM

Physical training educational programs can offer youth with the suitable information, abilities, practices, and certainty to be genuinely dynamic forever. In addition, actual instruction is the premise of a school's active work program. Along these lines, investment in physical movement is corresponded with scholastic benefits such as further developed focus, memory, and homeroom conduct. As indicated by the World Health Organization (2001), it incorporates the improvement of actual capacities and practical preparation; propelling the understudies to proceed with sports and active work, and giving diversion exercises.

Improvement of Physical Abilities and Physical Conditioning

Actual schooling works with to develop and rehearse actual wellness involves fundamental engine abilities (Barton *et al.*, 1999) and gets hold of the skill to perform different proactive tasks and activities. Actual wellness constructs intellectually more honed, truly agreeable, and furthermore ready to manage the everyday requests (Jackson, 1985). Further, perseverance, adaptability, strength, and coordination are the vital parts of actual wellness. Furthermore, to execute the actual activities and game, youth should be created fundamental engine abilities.

ROUSING THE STUDENTS TO CONTINUE SPORTS AND PHYSICAL ACTIVITY

Educators consistently persuade the young to contribute in sports and proactive tasks just as scholarly instruction programs. Further, they in every case coordinate and educate them, sports and active work are crucial piece of scholastic schooling. They have additionally directed the adolescent; we cannot think healthy advancement of human character without sports and physical training. In addition, they have additionally to deal with a gathering in which examines their folks about the significance of sports and active work just as scholarly instruction. Further, educators should draw in parent or relatives in actual work, for instance, by giving youth actual work 'schoolwork' which could be performed along with the parent's viz., family strolls after dinner or playing in the recreation center (WHO, 2001).

GIVING DIVERSION EXERCISES

Organizations must spotlight on the execution of actual work course which works with to make pleasant interest to all adolescent in active work program which gives the young an assortment of thoughts for dynamic games and exercises and the abilities and wellness to play them (Fox and Harris, 2003) to lessen the pressure, uneasiness, substance addictions, and corpulence.

ADVANCING THE SOCIAL VALUES AMONG YOUTH

Actual training and sports assume an indispensable part in advancing the social qualities among the young. Furthermore, actual training is considered as a school subject, which works with to set up the adolescent for a sound way of life and spotlights on their, generally speaking, physical and mental turn of events, just as bestowing significant social qualities among the young like reasonableness, self-restraint, fortitude, solidarity, resistance and reasonable play (Bailey, 2005). Social science of game, also called sports social science, is a discipline of humanism that reviews sports as a social wonder. Sports sociologists basically inspect the capacities, effects, and jobs that sports have on various social orders. The humanism of game incorporates research in different fields such as political theory, history, and human studies (Maguire 2013). This article depicts the beginning of the social science of sports as a sub-field of social science. It then, at that point pushes forward to detail the four significant sociological hypotheses that are utilized in the investigation of sports. These are the functionalist hypothesis, struggle hypothesis, interactionist hypothesis and women's activist hypothesis. Subsequently, the subjects of sexual orientation and race and identity are addressed. The article closes with a depiction of what's in store for the space of sports human science.

ORIGIN OF SOCIOLOGY OF SPORT

Sports social science started to arise as a conventional discipline in the second 50% of the twentieth century. By the

1960s, TV had begun to devote abundant measures of time to sports. Proficient associations for different games, for example, baseball and football started to arise in the United States. This was joined by the Olympics being a jungle gym for the Cold War. During this period, numerous social researchers such as David Reisman, Charles Page, and Erving Goffman distributed works identified with sports. In 1978, the North American Society for the Sociology of Sport was established with the goal of investigating this field.

CONCLUSION

Sports and globalization have acquired ubiquity among sociologists and new spaces of examination are managing the connection between friendly turn of events and sports inside creating nations. A few sociologists have additionally utilized subjective and quantitative information to reveal insight into the connection among sports and social class. Finally, democratization contemplates has acquired huge prominence inside the most recent couple of years inside the field of sports. Later on, issues of cooperation in sports will likewise be concentrated through the focal points of social rejection and incorporation ("Sociology of Sport" 2018).

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A Comparative Study: Strength Ability And Dynamic Balance Between Volleyball And Basketball Players In Chandrapur District

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Abstract

Playing sports gives significant advantages to youthful and old the same, going from progress in wellness and wellbeing to improvement of solidarity and sensations of achievement. Discover a game that you love and you'll stay with it while simultaneously learning some fundamental life exercises and receiving positive benefits. The reason for this study is to think about Strength and Dynamic adjusts among Volleyball and Basketball players. With the end goal of the examination all out 40 players (20 Volleyball and 20 Basketball players) were chosen from Chandrapur district. To think about the Strength and Dynamic adjusts among Volleyball and Basketball Vertical bounce test (chief hop), and Modified Bass test was administrated to the subject. The age of the subject was between 15-17 years. The gathered information was broke down utilizing autonomous 't' proportion to discover the critical distinction among volleyball and Basketball players. The consequence of the examination indicated that there was noteworthy distinction on Strength and Dynamic adjusts ($t = 0.136$, $p > 0.05$) among volleyball and b-ball players.

Watchwords: Volleyball, Basketball, Strength, and Dynamic adjusts

Introduction

Basketball was imagined in 1891 by James Naismith, actual schooling educator at the YMCA Training School in Springfield, Massachusetts, USA. The game accomplished practically quick acknowledgment and ubiquity, and the primary university game, with five players in each group, was played in 1896 in Iowa City, Iowa, USA. Proficient b-ball in the United States dates from the definition of the National Basketball League in 1898, which made due for a very long time. A later NBL was shaped in 1937 and existed until 1949 when it converged with the three-year-old Basketball Association of America to turn into the National Basketball Association (NBA). Presently, there is one ladies' expert b-ball class in the United States and some of people's proficient groups around the planet. Basketball is one of the center games played at secondary schools and universities in the United States.

Physical advantages

1. Strengthens muscular endurance

Playing b-ball requires nimbleness, strength, and endurance. You should rapidly move and change headings utilizing extreme focus, brief span muscle withdrawals.

You'll likewise require solid perseverance, which is the capacity of muscles to over and over apply power for an all-encompassing period. You can expand your solid perseverance by playing ball and doing activities to develop lower and chest area fortitude. This will positively affect your endurance, energy, levels, and execution.

2. Fabricates solid bones

Playing a group activity, like b-ball, can give remarkable physical and emotional well-being benefits. Exploration from 2018Trusted Source found that playing a group based game positively affects bone strength.

Individuals who played handball and football were appeared to have more bone mineral thickness than the individuals who were inactive.

3. Improves equilibrium and coordination

As you play, you need to move your body rapidly as you bounce, turn, or alter course. Basketball expects you to utilize engine abilities like shooting, passing, and spilling. You'll additionally get talented in bouncing back and cautious moves. Keeping a solid body will assist you with playing out these developments without breaking a sweat.

4. Creates crucial development abilities

Playing b-ball offers youth the chance to build up the engine abilities important for advancement. Examination from 2018Trusted Source focuses to the adequacy of ball in upgrading the essential development abilities that kids need to master.

Playing b-ball assists with improving engine coordination, adaptability, and perseverance. It additionally supports speed, readiness, and strength. These abilities are appeared to positively affect advancing a solid body weight and empowering more actual work, which can improve cardiorespiratory wellness and confidence.

5. Improves body arrangement

In a 2018 studyTrusted Source, scientists found that playing ball positively affected generally speaking body piece. In this investigation, undeveloped men went through 3 months of road b-ball preparing, which positively affected generally wellness and body organization. After the preparation, the men expanded their fit weight and brought down their muscle versus fat ratio.

6. Lifts heart wellbeing

Standard actual work assists with improving heart wellbeing and in general wellness levels. As indicated by research from 2019, b-ball increments resting pulses, which positively affects cardiorespiratory wellness. This is connected to a lower possibility of creating cardiovascular sickness.

Volleyball was concocted in 1895 by William G. Morgan, actual head of the Young Men's Christian Association (YMCA) in Holyoke, Massachusetts. It was planned as an indoor game for financial specialists who found the new round of ball excessively fiery. Morgan called the game "mintonette," until an educator from Springfield College in Massachusetts noticed the volleying idea of play and proposed the name of "volleyball." The first standards were composed by Morgan and imprinted in the principal version of the Official Handbook of the Athletic League of the Young Men's Christian Associations of North America (1897). The game before long demonstrated to have wide interest for both genders in schools, jungle gyms, the military, and different associations in the United States, and it was accordingly acquainted with different nations.

Volleyball is an extraordinary game that can be appreciated by individuals, all things considered, and expertise levels. It tends to be played all year as it very well may be played both inside and outside. To start with, it's a pleasant method to consume calories. Playing volleyball for 40 to 45 min can wreck to 585 calories. Volleyball likewise improves muscle strength and tone. The exercises required when playing volleyball reinforce the chest area, arms, shoulders, thighs, abs, and lower legs. What's more, volleyball improves defiiness, reflexes, and balance. Likewise with any game there is a danger of injury when playing volleyball. Basic wounds in volleyball can be gathered into two classifications: abuse wounds and awful wounds. Some abuse wounds incorporate rotator sleeve tendonitis, elbow or wrist tendonitis, Patellar or Achilles tendonitis, and low back torment. Horrible wounds incorporate shoulder disengagement or division, rotator sleeve tears, wrists hyper-extends, finger breaks, Achilles ligament tears, ligamentous wounds, torn knee ligament, lower leg hyper-extends, muscle injuries and strains, and herniated plates.

To prevent injury, members ought to: Play out a warm-up comprising of extending and light high-impact action before play Take part in a complete preparing program including adaptability, strength preparing, bounce preparing, speed and readiness drills, and intense exercise
Wear proper shoe wear with slide safe soles

Utilize great strategy

Clear off the courts before play. Search for tricky spots if playing inside and search for flotsam and jetsam if playing outside in the sand or grass.
Take into account sufficient recuperation

Stay hydrated

Current life is presently solidly near. To lead a prosperous and productive life everybody needs to battle against substantial chances in each circle and phases of life. The field of games and sports is no exemption. In this field an athlete needs to against the rival, condition and against himself and along these lines he can reach at the top and still he needs to proceed with his work to stay in charge for a significant stretch. Assessment goes on, the individuals who substantiate themselves fitter in the battle for presence and adjustment, remain and the individuals who couldn't were exposed to termination. A far reaching work out schedule customized to an individual ordinarily centers around at least one explicit abilities, and on age-or wellbeing related needs, for example, bone wellbeing. Numerous sources likewise refer to mental, social and passionate wellbeing as a significant piece of in general wellness. This is frequently introduced in course books as a triangle comprised of three focuses, which speak to physical, passionate, and mental wellness. Physical wellness can likewise forestall or treat numerous ceaseless wellbeing conditions welcomed on by undesirable way of life or maturing. Working out can likewise assist individuals with resting better. To remain sound it is critical to take part in physical action. The marvel testing of competitors has consistently been a famous undertaking. There are various elements which are answerable for the presentation of an athlete. Execution in any game or sports not just relies upon physiological, mental, sociological and logical preparing factor yet additionally relies upon great physical make-up, Anthropometry, body sythesis, perseverance, adaptability, great response time, co-appointment, deftness, speed, quality and great body balance. Quality is one of the primary wellness segments significant for achievement in numerous games. Certain games, for example, weight lifting, wrestling and weight tossing, it is the most significant physical characteristic. In numerous different games, including group activities like rugby, Volleyball, Basketball great quality is likewise significant as a component of the general wellness profile.

Quality is the property of being genuinely solid (you can do, say, 100 push-ups) or intellectually solid (you can figure rates in your mind while individuals are yelling at you). Quality has a few shades of importance. The quality of something can be the proportion of how much power or weight it can withstand after some time (like a flood divider). Or on the other hand its power (like a pesticide).Or its force level (like a radio sign). Its battling capacities (like a military). Or on the other hand its claim to fame: A chameleon's quality is really in its capacity to mix in with its environmental factors. Dynamic offset is worried about the impacts of powers on the movement of a body or arrangement of bodies, particularly of powers that don't start inside the framework itself.

The study reveals that

The basketball players has higher strength ability as compared to the volleyball players. The dynamic balance were greater in volleyball players as compared to the basketball players. The above study was done and results were supported by (Vishnu Datt and Dr. Manohar Mane, 2013).Ostojic^, S.M., S. Mazic, and N. Dikic (2006) directed an examination on Profiling in ball; Physical and physiological qualities of tip top players. The reason for this examination was to depict underlying and practical qualities of tip top Serbian ball players and to assess whether major parts in various positional jobs have distinctive physical and physiological profiles. Five men's b-ball groups partook

in the investigation and contended in the expert First National League. Physiological estimations were taken of 60 players during the last seven day stretch of their preliminary preparing for rivalry. As per positional jobs, players were classified as watchmen (n = 2 0), advances (n = 20), and focuses (n = 20). Gatekeepers were more seasoned ($p < 0.01$) and more experienced ($p < .0$ 1) as contrasted and the two advances and focuses. Focuses were taller and heavier than watchmen and advances ($p < .0$ 1), though fonwards had essentially higher stature and weight than monitors ($p < 0.01$). Focuses had more muscle versus fat ($p < 0.01$) as contrasted and advances and monitors. Likewise, focuses had essentially lower assessed VOgmax esteems ($p < 0.01$) contrasted and advances and monitors. Likewise, the most elevated pulse frequencies during the last moment of the bus run test were lower in watches ($p < .0$ 1) as contrasted and advances and focuses. Vertical bounce power was altogether higher in focuses ($p < 0.01$) as contrasted and watches. The consequences of the current examination exhibit that a solid relationship exists between body organization, high-impact wellness, anaerobic force, and positional parts in world class ball.

Barfield, et al., (2010)the Performance Index Evaluation (PIE) is a b-ball explicit appraisal of actual execution. The battery comprises of things ordinarily remembered for sport appraisals, like spryness and force, yet in addition tends to a frequently disregarded exhibition segment, in particular, center strength. The motivation behind this examination was to inspect the unwavering quality (test-retest, bury rater), legitimacy (measure related, develop related), and practice impact of the PIE among mens' and womens' school ball players. Test-retest gauges were moderate for men 32 Review of Related Literature (infraclass relationship co-proficient [ICC] = 0.79) and poor for ladies (ICC = 0.35), however entomb rater unwavering quality was high (ICC = 0.95). Measure related legitimacy proof (i.e., connection among PIE and playing time) was powerless, however develop related proof was worthy (i.e., school players had higher scores than secondary school players). A training impact was likewise shown among men. All in all, unwavering quality of the battery ought to be improved before its utilization is suggested among school ball players. Furthermore, the battery doesn't give off an impression of being an indicator of execution yet seems to recognize ability levels.

Zetou, et al., (2005) created three sea shore volleyball (BV) expertise tests and afterward check their dependability and legitimacy. BV as another game requires ability tests to assess the competitor's exhibition. Consequently, after a pretest to competitors, a preparation intercession program could be followed and helpful outcomes for the mentors could be gotten. Hence, and in the wake of considering all the 37 boundaries and extraordinary qualities of the game, explicit tests were developed by master sea shore volleyball trainers for the assessment of the set, the pass and the serve ability. The example comprised of forty (N = 40) BV players (21 male and 19 female), inside an age band of 13-26 years (M =17.22, SD = 6.08). As indicated by Safrit (1986) a test should initially gauge what it was expected to quantify. Besides, it ought to be solid with unwavering quality being characterized as the level of consistency of the test. Four sorts of legitimacy were analyzed: consistent, substance, basis and develop legitimacy, and two kinds of dependability: inside consistency (intraclass) and solidness of the tests were likewise inspected in this investigation. The outcomes showed that the BV expertise tests were substantial and solid instruments and could along these lines be utilized by mentors to test the capacity of players to set, pass and serve the ball successfully.

Baskaran, (2001) developed a volleyball ability test and figured standards for school young men of various age bunches in Pondicherry State. 1,000 500 and five (1505) male school understudies in each gathering of 13 to 15 years were chosen as subjects. All the subjects were chosen from seventh, eighth, ninth, and tenth, classes in each school. For the development of new expertise tests, the agent chose pass and administration abilities. The model tests were the Brumbafch lower arm (under arm) finish volley assessment and Glady"s Scot and Easther Frenche"s administration arrangement test. Two new expertise tests were planned with appropriate court markings for the new

assistance ability test and for the underhand ability test. The dependability, legitimacy and objectivity of the new ability tests were set up. From that point standards were incorporated for the recently developed tests for every ability and for each age gathering. To develop standard, Hull scale measurable strategy was utilized. It was discovered that the recently built help expertise tests were acceptable and predictable. According to the subjective reviewing in the pass expertise, out of 1505 subjects, 73 fell in the weak classification, 194 were less than ideal, 554 normal, 483 better than expected, 180 great and 21 extraordinary. In the help expertise, according to the subjective reviewing it was discovered that out of 1505 subjects 86 fell in the faltering classification, 170 sub optimal, 543 normal, 522 better than expected, 138 great and 46 extraordinary.

Explanation of the issue

The fundamental reason for the investigation was to look at the Strength capacity, and Dynamic adjusts among Volleyball and Basketball players.

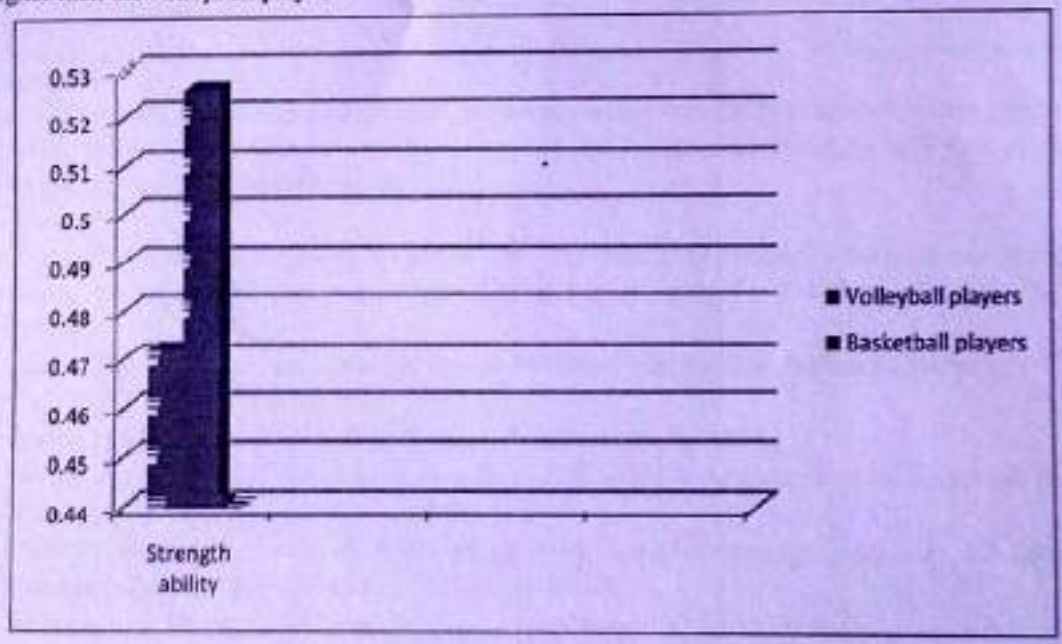
Methodology

The size and selection of the sample, the variable and the control employed the sources of data, the tools and the method of gathering data, the description of data gathering instruments and the statistical procedure used in the analysis are carefully described.To look at the Strength and Dynamic adjusts among Volleyball and Basketball Vertical bounce test (chief hop) and Modified Bass test was administrated to the subject. The age of the subject was between 15-17 years. The factors of the investigation were Strength and Dynamic adjusts. 't' Test was applied to ascertain the gathered information at 0.05 degree of significances.

Results and findings Strength ability of Volleyball and Basketball players

Variable	Source of variance	Mean	SD	t ratio
Strength ability	Volleyball Players	0.472	0.071	2.455*
	Basketball Players	0.526	0.045	

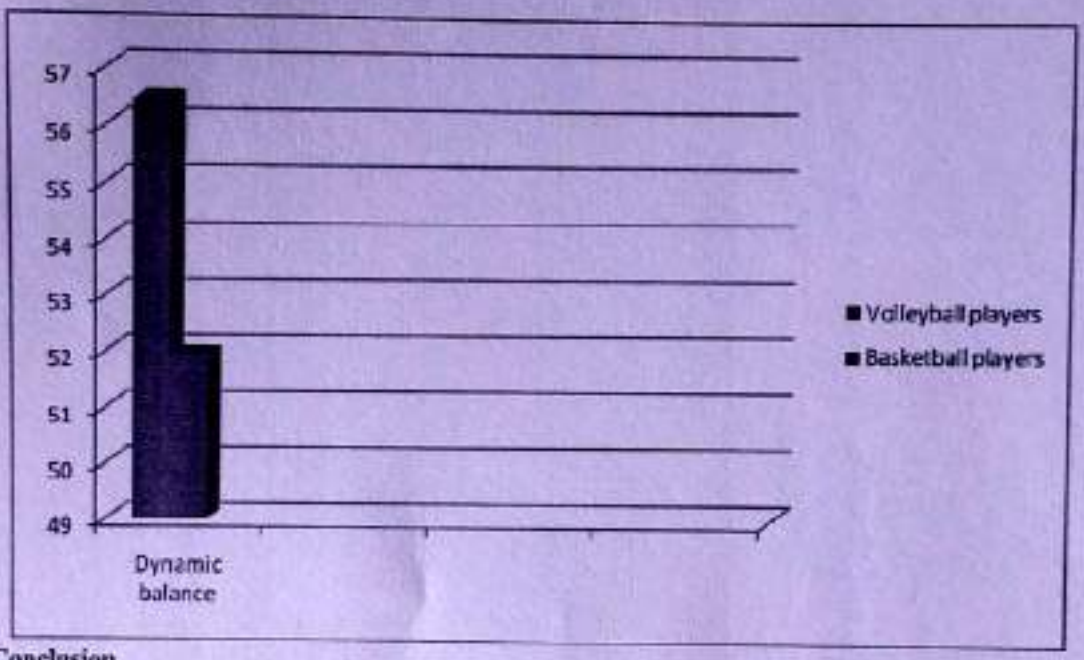
The above table indicates that there is a significant difference between the mean value of the strength ability of basketball and volleyball players. The strength ability of basketball players is higher than the volleyball players.



Dynamic balance of the Volleyball and Basketball players

Variable	Source of variance	Mean	SD	t ratio
Dynamic balance	Volleyball Players	56.47	5.44	2.628*
	Basketball players	51.95	5.15	

The above table indicates that there is a significant difference in dynamic balance between the Volleyball and basketball players. Volleyball players has higher dynamic balance compared to the basketball players.



Conclusion

The study reveals that the basketball players has higher strength as compared to the volleyball players . The significant difference has been observed. The dynamic balance of the volleyball players were greater than the basketball players.

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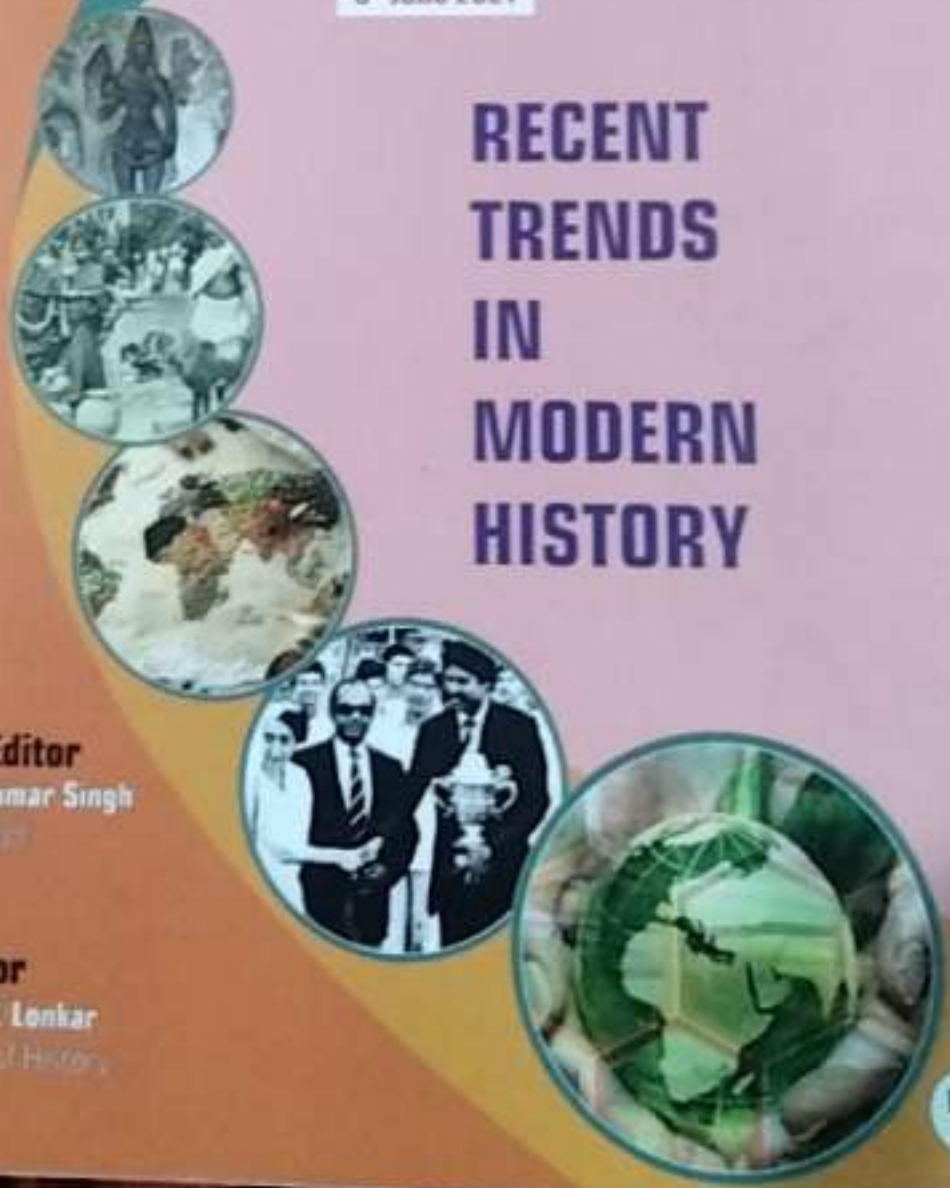

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इतिहास विभाग, सरदार पटेल महाविद्यालय, चंद्रपूर

सारांश

स्वातंत्र्योत्तर आधुनिक भारताचा इतिहास अभिजन वर्गाने लिहिलेला असल्यामुळे तो अभिजन केंद्रित झालेला असून स्वातंत्र्य चळवळीचे श्रेय त्यांना देण्यात आलेले आहे. कोणत्याही व्यापक चळवळीत जनसमुदाय, वंचित घटकांचा सहभाग महत्त्वाचा असतो. त्याशिवाय चळवळ व्यापक व प्रभावी होत नाही. परंतु आजपर्यंतच्या इतिहास लेखकांनी त्यांची दखल घेतली नाही. अशा वंचितांच्या कार्याची दखल घेण्यासाठी इतिहासात सबाल्टर्न लेखनप्रवाह उदयास आला. तळाकडून इतिहास किंवा सबाल्टर्न स्टडीज हा विचारप्रवाह मार्क्सवादी भूमिका लक्षात घेऊन १९६६ साली इंग्लंड मध्ये मांडण्यात आला. भारतामध्ये अँटोनिओ ग्रामची यांच्या प्रभावातून सबाल्टर्न हा विचारप्रवाह रुजविण्याचे कार्य डॉ. रणजित गुहा यांनी केले. महात्मा गांधींच्या विचारांनी प्रभावित होऊन अनेक देशभक्तांनी स्वातंत्र्याच्या चळवळीत उडी घेऊन आपल्या प्राणांची आहुती दिली. महात्मा गांधींना दीपस्तंभ मानणाऱ्यांना गांधीजींच्या धुरा वाहणाऱ्या व्यक्तींमुळे संपूर्ण चळवळीला वेग दिला. महात्मा गांधींनी भारतीय राष्ट्रीय काँग्रेसचे नेतृत्व स्वीकारल्यानंतर स्वातंत्र्याची चळवळ खऱ्या अर्थाने जनचळवळ बनली आणि जनसामान्यांचा विशेषत: महिलांचा सहभाग वाढला. चंद्रपूर जिल्ह्यातील लोकांनी असहकार चळवळ, झेंडा सत्याग्रह, सविनय कायदेभंग चळवळ, व्यक्तिगत सत्याग्रह आणि भारत छोडो आंदोलनात हिरीरीने सहभाग घेतला परंतु त्यांच्या कार्याची दखल घेतली गेली नाही.

महत्त्वपूर्ण शब्द– सबाल्टर्न स्टडीज, मार्क्सवादी, पुनर्मांडणी, असहकार आंदोलन, झेंडा सत्याग्रह

प्रस्तावना –इतिहास म्हणजे राजकथा, इतिहास म्हणजे राजांची गोष्ट, इतिहास म्हणजे गतकालीन राजकारण किंवा इतिहास म्हणजे संगतवार घटनांचे निवेदन अशा इतिहासाच्या विविध व्याख्या आता पूर्णपणे बदललेल्या आहे. भूतकाळ आणि वर्तमानकाळ यांच्यात सतत चालणारा संवाद म्हणजे इतिहास होय. भूतकाळातील घटनांकडे बघण्याचा दृष्टिकोन वर्तमानकाळात सतत बदलत असतो म्हणूनच इतिहास लेखन ही सतत चालणारी अखंड प्रक्रिया आहे. इतिहासाचे तज्ञ डॉ. राजा दीक्षित यांच्या मते इतिहासकार हा मायकेलेंजेलो सारखा असावा लागतो. मायकेलेंजेलो हा एक शिल्पकार होता. त्याला एकाने प्रश्न विचारला तू एवढी सुंदर मूर्ती कशी घडवलीस त्यावर मायकेलेंजेलोने उत्तर दिले की मूर्ती मी घडवीत नाही. ती दगडात असतेच मी फक्त आजूबाजूचा अनावश्यक दगड बाजूला केला. अर्थात मूर्ती जरी दगडात असली तरी ती शोधण्यासाठी तीक्ष्ण विचार आणि नजर आवश्यक असते. असेच इतिहासकाराचे देखील असते. इतिहास ही एक सर्जनशील कला आहे. एखादी व्यक्ती, स्थळ किंवा घटना यावर जरी प्रथम लेखन झालेले असले तरी पुन्हा त्यावर लेखन करता येवू शकते कारण नवनवीन संदर्भ साधनांची उपलब्धता, नवीन विचार करण्याची क्षमता व प्रत्येक व्यक्तीचा घटनेकडे पाहण्याचा वेगवेगळा दृष्टीकोन यानुसार इतिहासाची पुनर्मांडणी करता येते.

२० व्या शतकाच्या मध्यकाळापर्यंत राजे, राजवाडे, युद्ध, तह अशा राजकीय घटनांवरच इतिहासाचे लेखन झालेले आहे. समाजातील राजकीय घटनांबरोबर सामाजिक, आर्थिक व सांस्कृतिक घटनासुध्दा तेवढ्याच महत्त्वाच्या आहे. असा नवीन विचार पुढे येऊ लागला या नवविचारांमुळे प्रादेशिक, स्थानिक स्त्री–वादी, साम्राज्यवादी, राष्ट्रवादी, सबाल्टर्न, मार्क्सवादी असे विविध विचारप्रवाह व इतिहासलेखन पद्धतींचा उदय झाला. या सर्व विचारप्रवाहाच्या माध्यमातून इतिहासाची पुनर्मांडणी मोठ्या प्रमाणात होवू लागली. तळाकडून इतिहास किंवा सबाल्टर्न स्टडीज हा विचारप्रवाह मार्क्सवादी भूमिका लक्षात घेवून १९६६ साली इंग्लंड मध्ये मांडण्यात आला. ... इतिहासकारांनी, उच्चवर्गीयांनी दुर्लक्षित केलेल्या व ऐतिहासिक विकासाच्या प्रक्रियेत जड व निष्क्रिय म्हणून उपेक्षिलेल्या समाजाच्या ... स्तरातील घटकांचा अभ्यास सुरू केला. या विचार प्रवाहाला एडवर्ड थॉमसन यांनी 'हिस्ट्री ऑफ डाउन बिलो' असे संबोधले आहे. ...मध्ये अँटोनिओ ग्रामची यांच्या प्रभावातून सबाल्टर्न हा विचारप्रवाह रुजविण्याचे कार्य डॉ. रणजित गुहा यांनी केले. डॉ. ...जित गुहा यांच्यामते अभिजन म्हणजे वर्चस्वी गट होय. वर्चस्वी वर्ग रचनेत दोन गट आहे. एक परदेशी व दुसरा भारतीय. भारतीय ...गटामध्ये वरिष्ठ वर्चस्वी आणि कनिष्ठ वर्चस्वी असे पुन्हा दोन गट आहे. या दोनही भारतीय वर्चस्वी वर्गाच्या नियंत्रणाखाली ... वर्ग, शेतकरी वर्ग, भूदास, औद्योगिक क्षेत्रातील कामगार, स्त्रिया, मुले हे सर्वजन वर्षानुवर्ष दबलेली होती. अशा घटकांनाच वंचित

[illegible] त्यामुळे [illegible] इतिहास [illegible] आहे. [illegible] इतिहासाच्या [illegible]

[illegible] इतिहासात पोहचली नाही. [illegible] ऐतिहासिक [illegible] राजकीय [illegible] चळवळीत [illegible] कार्यकर्ते बनत असत. त्यात [illegible] म्हणून ही प्रसिद्ध होते.

[illegible] इ.स. १९२० हे वर्ष अत्यंत महत्त्वाचे मानले जाते कारण [illegible]

असहकार चळवळ – [illegible] तर महात्मा गांधीच्या असहकार आंदोलनाचा [illegible] असहकाराच्या कार्यक्रमात टिळकांचे मत गांधीजींनी विचारले [illegible] १९२० [illegible] असे म्हणून टिळकांनी गांधीजींच्या असहकार [illegible] मध्यमवर्गापुरती मर्यादित असणारी काँग्रेस [illegible] चळवळीत सक्रियपणे भाग घेऊ लागले. हे अधिवेशन [illegible] आत्मविश्वास कमालीचा उंचावला. महात्मा गांधींनी [illegible] असहकार चळवळीत [illegible] स्थानिक स्वराज्य संस्थातील जागांचा त्याग करावा. सरकारी [illegible] महाविद्यालये स्थापन करणे. व्यापाऱ्यांनी परकीय मालाचा [illegible] वकिलांनी वकिली सोडून या चळवळीत भाग घ्यावा [illegible] हा संपूर्ण कार्यक्रम राबवताना सर्व भारतीयांनी अहिंसक मार्गाचा अवलंब केला तर एका [illegible] महात्मा गांधींनी दिली होती. भारतीय राष्ट्रीय काँग्रेसच्या १९२० च्या नागपूर अधिवेशनात [illegible] श्री. बाजीराव फुलझेले यांनी मुद्दाम उपस्थिती लावली होती. [illegible] वकिली सोडली. याशिवाय या चळवळीत डॉ. शंकरराव वैद्य, अब्दुल [illegible] बाजीराव फुलझेले हे प्रमुखाने होते. असहकार चळवळ चालू असताना चंद्रपूरमध्ये श्री. बळवंतराव [illegible] शंकरराव वैद्य यांनी [illegible] हा कार्यक्रम राबवून असहकार आंदोलनाचे वेगळे वैशिष्ट्य दाखविले [illegible] अब्दुल [illegible] हनफी यांना सरकारने नोकरीचे आमिष दाखवून आंदोलनापासून [illegible] मिळणार नाही तोपर्यंत मी लग्न करणार नाही अशी शपथ घेतली. [illegible] अब्दुल हनफी व मारोतराव कन्नमवार इत्यादींनी विदेशी [illegible] विदेशी टोप्या काढून फेकल्या व त्यांची होळी करून [illegible] श्री [illegible] यांना सरकारने सहा महिन्यांची शिक्षा [illegible] स्वागत करण्यात आले होते.

झेंडा सत्याग्रह– १९२१ मध्ये गांधीजींनी [illegible] चिन्ह असलेला तिरंगी झेंडा हा राष्ट्रध्वज म्हणून [illegible] त्यामुळे [illegible] सरकारने त्यावर बंदी घातली. १८ मार्च १९२३ ला [illegible] झेंडा फडकविण्यात आला. त्यामुळे क्रोधित होऊन [illegible] त्यामुळे [illegible] झालेल्या काँग्रेसच्या स्वयंसेवकांनी जिल्हा काँग्रेसच्या [illegible]

[illegible]

हण्टर कमिशन – [illegible] ऑक्टोबर १९१९ रोजी [illegible] [illegible]

[illegible]

सविनय कायदेभंग चळवळ – ३१ डिसेंबर १९२९ रोजी रावी नदीच्या तिरावर लाहोर येथे भरलेले काँग्रेसचे अधिवेशन भारताच्या स्वातंत्र्य चळवळीच्या इतिहासातील मैलाचा दगड ठरले. [illegible] 'अखिल भारत स्वातंत्र्य दिन' म्हणून पाळण्याचे [illegible] ३१ डिसेंबर १९२९ पर्यंत ब्रिटिश सरकारने वसाहतीचे स्वातंत्र्य दिले नाही तर [illegible] १२ मार्च [illegible] १९३० ला अहमदाबाद येथील साबरमती आश्रमापासून [illegible] दांडी [illegible] सुरुवात केली. [illegible] 'भारत हे [illegible]' [illegible] ९ मे रोजी [illegible] [illegible]

[illegible] विकण्याचे मान्य केले [illegible] कन्नमवार, [illegible] श्रीमती [illegible] या सर्व महिलांना [illegible] श्रीमती गोपिकाबाई [illegible] होऊन राष्ट्रीय कार्य करत राहे. [illegible] उठला त्यावेळी भारताचे [illegible] मोठी राजकीय संघटना [illegible]

वैयक्तिक सत्याग्रह– [illegible] भूमिका स्पष्ट केल्यानंतरच [illegible] म्हणून भारताला [illegible] केला. [illegible] सगळ्या [illegible] कार्यक्रमावर आणि [illegible] पहिले सत्याग्रही म्हणून विनोबा भावे यांची निवड [illegible] श्री. रामचंद्र काकडे होते. त्यांना सहा महिन्यांची [illegible] दिल्लीच्या दिशेने चालत [illegible] श्री. उमाजीराव माळवे, बाजीराव फुलझेले [illegible] हिंगणघाटपर्यंत, श्री. संभाजी पडगीलवार [illegible] त्यांना अटक करून तुरुंगात डांबण्यात आले [illegible] वैयक्तिक सत्याग्रह केला त्यांनाही दोन वर्षांची शिक्षा झाली [illegible]

भारत छोडो आंदोलन– इ.स. [illegible] भारत छोडो आंदोलन भारताच्या स्वातंत्र्य संग्रामातील अतिशय व्यापक [illegible] सिंगापूर व [illegible] ब्रिटिशांची नाविक ठाणी जपानने जिंकली. [illegible] तत्कालीन परिस्थितीच्या सखोल अवलोकनानंतर [illegible] योग्य वेळ आहे म्हणून त्यांनी [illegible] बैठकीत भारत छोडोचा ठराव मांडला व तो सर्वानुमते [illegible] "करा किंवा मरा" अशी घोषणा केली व सर्व भारतीयांनी या आंदोलनात सहभाग घ्यावा असे [illegible] अटक झाल्यामुळे चंद्रपूरमध्ये त्यांच्या अटकेच्या निषेधार्थ १० ऑगस्ट [illegible] श्री. उमाजीराव माळवे, श्री. बालाजी फुलझेले, श्री कृष्णराव जोगी श्री. निळकंठराव दिवाणजी, श्री [illegible] इत्यादी मंडळी सहभागी झाले होते. १९४२ च्या स्वातंत्र्य [illegible] राष्ट्रसंत तुकडोजी महाराजांच्या पदस्पर्शाने पावन झालेल्या या भूमीत [illegible] बापू कामडी, गोपाळराव कोरेकार, बाबूराव येगडे, रामकृष्ण [illegible] नेतृत्वाखाली चिमूरमध्ये जाहिर सभा व प्रभात फेऱ्यांना [illegible] अटकाव करण्याचा प्रयत्न झाल्यानंतर पोलिस आणि [illegible] गोळीबार केला त्यात बालाजी रायपूरकर नावाचा तरुण शहीद [illegible] आग लावली याप्रसंगी अनेक सरकारी अधिकारी [illegible] अनेक नागरिक शहिद झाले. चिमूरच्या २०० स्वातंत्र्य सैनिकांवर [illegible] शिक्षा झाली परंतु पुढे सौ. अनसूयाबाई काळे यांच्या प्रयत्नामुळे [illegible] शिक्षा रद्द करण्यात आली.

समारोप– [illegible] इतिहास [illegible] आहे म्हणून त्या इतिहासातून आधुनिक भारताच्या [illegible] इतिहास म्हणजे केवळ त्यांच्या कार्यांचा कृतींचा इतिहास नव्हे तर कृतीमागील [illegible]

[illegible] आले होते. [illegible] जीवनमूल्ये [illegible] संस्था व अनुभवजन्य [illegible] विचार करणे आवश्यक आहे. [illegible] कार्याचे [illegible] राही. आधुनिक भारताच्या सामाजिक, राजकीय, राष्ट्रीय, आर्थिक, शैक्षणिक व सांस्कृतिक क्षेत्रात [illegible] योगदान महत्वाचे आहे. महात्मा गांधींच्या नेतृत्वाखाली नागपूर जिल्ह्यातील [illegible] असहकार चळवळ, [illegible] आंदोलन, [illegible] सत्याग्रह आणि भारत छोडो आंदोलनात [illegible] सहभाग घेतला. [illegible] कार्याची [illegible]

संदर्भ सूची–

कोलारकर डॉ. श. गो., आधुनिक विदर्भाचा इतिहास, मंगेश प्रकाशन नागपूर २००३

[illegible] वि. आ., आधुनिक विदर्भाचा इतिहास (१८५३–१९५०), मंगेश प्रकाशन, नागपूर, २००३

[illegible] गॅझेटियर, भारतीय स्वातंत्र्य लढा व नागपूर, [illegible], नागपूर

[illegible] डॉ. [illegible], नागपूर शहर व स्वातंत्र्य आंदोलन (१८५७–१९४७), [illegible], नागपूर २००१

[illegible] प्रसाद, भारतीय स्वतंत्रता संग्राम में नागपुर, [illegible] १९८६

[illegible] डॉ. [illegible], भारताच्या स्वातंत्र्य लढ्यात वैदर्भीय महिलांचे योगदान, मंगेश प्रकाशन, नागपूर.

[illegible] १९४२ चा चिमूर क्रांती संग्राम, अमर प्रकाशन नागपूर, २००२

[illegible] डॉ. [illegible] मार्क्सवाद व भारतीय इतिहास लेखनातील विचारधारा, समाज प्रबोधन पत्रिका अंक [illegible], [illegible]

कोठेकर डॉ. शांता, इतिहास तंत्र आणि तत्त्वज्ञान, [illegible] प्रकाशन नागपूर, २००५

२१ व्या शतकात योगशास्त्रातील प्राणायामाचे महत्व

डॉ. पुरूषोत्तम माहोरे

इतिहास विभाग,सरदार पटेल महाविद्यालय, चंद्रपूर

सारांश—

२१ व्या शतकात योग विद्येची लोकप्रियता खूप वाढलेली आहे. आज योगाचे प्रमुख लक्ष्य एक मजबूत लचकदार आणि टिकावू शरीराचा विकास करणे आहे. योग ही जीवनशैली आहे. २१ जूनला आंतरराष्ट्रीय योग दिवस भारतातच नव्हे तर सर्व जगात साजरा केल्या जाते. योग मानव शरीराचीच नव्हे तर मनाचीही आवश्यकता आहे. प्राचीन काळात मनुष्याची आवश्यकता अन्न, वस्त्र आणि निवारा पर्यंत सिमित होती. आधुनिक काळात मनुष्याने विज्ञान व तंत्रज्ञानाच्या मदतीने प्रगती केली व तो मशिनसारखे कार्य करून भौतिक सुखाच्या मागे लागलेला आहे. परंतू हे सर्व करित असतांना त्याला जीवनातील आदर्श नैतिक मूल्यांचा त्याला विसर पडत चाललेला आहे. माणसाचे आयुष्य श्वासात मोजले जाते. माणूस जन्माला आला की पहिला श्वास घेतो आणि मरतांना पहिलाच श्वास सोडतो. आपण या सृष्टीतला साधा एक श्वास ही घेवून जावू शकत नाही म्हणून पहिलाच श्वास कारण एकदा का तो जन्म समयी घेतला की तोच आपण मरतांना सोडतो. मध्यंतरीच्या काळात तो फक्त आतबाहेर करित असतो. तो प्राण बाहेर जावून ऑक्सिजन पिवून आत येतो. तो बाहेर जावून परत आलाच नाही तर मूत्यू निश्चित आहे. म्हणून योगसाधनेत, प्राणायमात, आयुर्वेदात याप्राणाला विशेष स्थान आहे. याप्राणाचा आयाम, व्यायाम केला की प्राणायाम. तो युक्तीपूर्वक केला की अनेक रोग बरे होतात आणि चुकीचा केला की नको असलेले रोगपण मागे लागतात. पूरक, कुंभक, रेचक करून हळुवार श्वास घेवून हळूवार सोडणे म्हणजे आपण कळत नकळत दोन श्वासामधले आयुष्य वाढवत असतो. दोन दोन श्वासामधले अंतर वाढले की आयुष्य वाढलेले असते असे माणले जाते. महर्षी पतंजलीच्या मते श्वास आणि प्रश्वास याच्या स्वाभाविक वेगाच्या अभावास प्राणायाम म्हणतात. प्राणायाम कसा केला, जातो त्याचे प्रकार कोणते, आणि आधूनिक युगात प्राणायाम केल्याने शरीरावर आणि मनावर त्याचे चांगले परिणाम होतात.

महत्वपूर्ण शब्द:— आसन, प्रत्याहार, धारणा, राजयोग अष्टांग योग

प्रस्तावना:—

भारतात योगाचा इतिहास जवळपास ५००० वर्षापासूनचा आहे. मानसिक, शारीरिक आणि आध्यात्मीक स्वरूपात प्राचीन काळापासून योगाभ्यास करित आहे. योगाची उत्पत्ती सर्वप्रथम भारतात झाली यानंतर तो इतर देशात लोकप्रिय झाला. महर्षी पतंजलीने योगाला आस्था, अंधविश्वास आणि धर्म यापासून वेगळे करून योग्य रूप दिले. त्यामुळेच योगाला भारतीय परंपरेची अमूल्य देनगी माणल्या जाते. महर्षि पतंजली यांनी योगसूत्र नामक पुस्तक लिहले. त्यात यम, नियम, आसन, प्राणायाम, प्रत्याहार, धारणा, ध्यान व समाधी याअष्टांग योग क्रियेला विकसित केले. आज भौतीकवादी युगात प्रत्येक मानवाला शारीरिक, मानसिक आणि भौतिक संतापाने घेरलेले आहे. दिवसेंदिवस भौतिक आणि विलासी वस्तूंचा उपयोग करून सुख आणि क्षणीक आनंदाची अनूभूती करित आहे तर दूसरीकडे मानसिक तनाव आणि विभिन्न व्याधींनी ग्रस्त आहे. त्याला चिकित्सेसोबतच मन आणि शरीराला स्वस्थ ठेवणाऱ्या योग क्रियेचा अभ्यास करण्याची आवश्यकता आहे. तो आसन आणि प्राणायामाचा अभ्यास करून लाभ प्राप्त करू शकतो.

भारतीय दर्शन आणि धर्म यामध्ये प्राणायामाचे विशेष स्थान आहे. प्रत्येक व्यक्तीमध्ये विद्यमान असणारी शक्ती प्राणिक शक्तीच्या रूपात कार्य करित असते. जी भौतीक जगात गती आणि क्रियेच्या रूपात तर मानसिक जगात विचाराच्या रूपाने प्रकट केल्या जाते. म्हणून प्राणायमाचा अर्थ प्राणिक उर्जेचे नियंत्रण असा होता. हे प्राणिक उर्जेचे नियंत्रण मनुष्याच्या स्नायुमध्ये प्रवाहीत होउन मांसपेशिचे संचालन करते. बाहय जगाचा अनुभव करणे तसेच आन्तरिक विचार करण्यासाठी कारणीभूत ठरते. प्राणायामाद्वारे या उर्जेवर नियंत्रण प्राप्त करणे हेच साधकाचे लक्ष्य असते. प्राणायाम शब्द दोन शब्दाने मिळून बनलेला आहे. प्राण आणि आयाम. प्राणायमाचा अर्थ शरीरात विद्यमान जीवन शक्ती आणि आयामचा अर्थ संयम. एकंदरीत प्राणायमाचा अर्थ आहे प्राण आणि संयम. अर्थात श्वास घेणे आणि सोडणे यावर नियंत्रण. वैज्ञानिक पध्दतीने श्वास प्रकियेवर मनुष्याचे नियंत्रण असा होतो. महर्षी पतंजलीच्या म्हणण्यानुसार आसन सिध्द झाल्यावर गतीवर अवरोध निर्माण करणे याला प्राणायाम म्हणतात. आसन सिध्द झाल्यावर बाहय वायू बाहेरून आत घेणे याला स्वांस म्हणतात तर पोटाच्या आत घेतलेला वायू बाहेर काढणे याला प्रश्वास म्हणात. या दोघांतील गतीचा अभाव किंवा विरोध याला प्राणायाम म्हणतात. प्राणायमाचा अभ्यास करणाऱ्या व्यक्तीचे मुख्य लक्ष्य प्रत्येक श्वासाची बचत करणे हा असून प्राणायाम करतांना श्वासाची गती खूप कमी होते. प्राणायाम करणाऱ्या व्यक्तीला स्वर विज्ञान माहित असणे गरजेचे आहे. प्राणायमाचे आठ प्रकार माणले जाते.— सूर्यभेदन प्राणायाम, उज्जारी प्राणायाम, सीत्कारी प्राणायाम, शीतली प्राणायाम, अस्त्रिका प्राणायाम, भ्रामरी प्राणायाम, मूर्छा प्राणायाम आणि केवल प्राणायाम. प्रत्येक प्रकारचा प्राणायाम हा विधी पूर्वक केला तर मनुष्याला निश्चितच लाभ होतो.

प्राणायमाचा सतत अभ्यास केल्याने चित्त एकाग्र होवू लागते त्यावेळी एखादया उचित विषयावर चित्त केंद्रित करणे आवश्यक असते.योग्याभ्यासी व्यक्तीचे चित्त साधारण मनुष्यासारखेच चंचल असते. यम, नियम, आसन, प्राणायाम आणि प्रत्याहार यांच्या नियमित अभ्यासाने मनाची चंचलता तसेच विषयांची प्रवृत्ती कमी होवून मन एकाग्र होते. ज्याप्रमाणे एखादया भांडयात पाणी टाकल्यानंतर पाणी त्या भांडयाचा आकार धारण करते त्याचप्रमाणे ज्या वस्तूला लक्ष्य बनवून चित्त एकाग्र केल्या जाते पुढे चित्त त्याचे रूप धारण करते. जेव्हा एकाग्रतेचा प्रवाह निरंतर चालत असते त्याला ध्यान अवस्था म्हणतात.

प्राणायमामुळे शरीरातील निम्न विसर्जन तंत्रावर प्रभाव पडतो. साधारणत: श्वास घेतल्यामुळे उदरातील मांसपेशी क्रमश: वर खाली होत असतात त्यामुळे आंतडे आणि गुर्दे यामध्ये सतत हालचाल आणि हल्की मालिश होत असते. प्राणायामातील पूरक, रेचक आणि कुंभक केल्याने ही मालिश आणखी स्पष्ट रूपाणे होवू लागते. यामुळे रक्त प्रवाहातील अडथळे दूर होतात. श्वसन यंत्रावरही प्राणायमाचा प्रभाव पडतो. श्वास क्रिया सुरळीत चालावी याकरिता स्वांसपयोगी मांसपेशी मजबूत असणे गरजेचे आहे. प्राणायमामध्ये छाती अधिकाधिक फुगवल्यामुळे आणि फुफुसाला अधिक फुगवल्याने फुफुसाला शक्ती मिळते आणि कार्बनडाय ऑक्साईड सारख्या दूषित वायूचे जास्त प्रमाणात विसर्जन होते. प्राणायाम केल्यामुळे रक्तातील ऑक्सीजनचे प्रमाण वाढत असते. जे अन्य व्यायामुळे वाढतांना दिसत नाही. प्राणायाम करतेवेळी मनुष्य खूप ऑक्सीजन ग्रहण करतो त्यामूळे श्वासपयोगी अंग समूहाचा चांगला व्यायाम होतो. सामान्य माणसाचा भ्रम आहे की प्राणायमामुळे ऑक्सीजन शरीराला जास्त मिळते. असे नसून प्राणायाम केल्यानंतर श्वास घेणारे अंग ऑक्सीजन पचविण्यासाठी समर्थ होत असतात. तसेच पाचन तंत्रावरही प्राणायमाचा चांगला प्रभाव पडतो. आहार पचविणाऱ्या तथा रस बनविणाऱ्या अंगावर प्राणायमाचा चांगला परिणाम होतो. अन्न आणि जल पचविण्याकरिता पेनक्रियास नामक ग्रंथी आणि यकृत मुख्य रूपाने कार्य

करते. प्राणायाम करतेवेळी उदर आणि वक्ष स्थलाच्या मधिल स्नायू ज्याला डायफ्राम म्हणतात आणि पोटातील मांसपेशी दोन्ही आळीपाळीने आकुंचन आणि प्रसरण पावतात ज्यामुळे अन्नपाचन करणाऱ्या अंगाची मालीश होते. रक्तसंचय हटविण्यासाठी प्राणायाम एक उत्तम साधन असून प्राणायमाच्या अभ्यासाने पाकोपयोगी अंग ठीक प्रकाराने कार्य करतात. तथा रक्तामध्ये आवश्यक पुष्टिकारक तत्व वाढवत असते. स्नायू तंत्र आणि ग्रंथीवरही प्राणायमाचा विशेष प्रभाव पडतो. रक्ताची उत्तमता आणि शरीरातील इतर स्नायू व ग्रंथींना होणारा उचित मात्रेतील रक्तपुरवठा यामुळे शरीर उत्तम राहते. प्राणायमामुळे विशेषत: शस्त्रिका प्राणायमामुळे रक्ताच्या गतीत वाढ होत जाते आणि रक्त ही उत्तम होत असते. शारीरिक शक्तीचे मूळ स्त्रोत मस्तिष्क असून मस्तिष्कानंतर दूसरा नंबर मेरूदंड आणि त्याच्याशी संबधीत स्नायूंचा येतो. प्राणायाम करतांना श्वास दीर्घ आंत घेतल्या जाते त्यामुळे मस्तिष्कामधून सर्व दूषित रक्त बाहेर निघून जाते व हृदयाला शुध्द रक्ताची प्राप्ती होते. मेरूदंड आणि त्याच्याशी संबधीत स्नायू मधिल रक्ताची गती साधारणत: मंद असते. प्राणायमामुळे रक्ताची गती तीव्र होत असते जे आपल्या शरीरासाठी लाभकारी ठरते. स्नायूवर प्रभाव टाकण्यासाठी भ्रस्त्रिका प्राणायाम श्रेष्ठ आहे.

आजच्या धकाधकीच्या युगात मनुष्यावरिल कामाचा ताण वाढलेला आहे. ताण वाढल्यामुळे त्याचे मानसिक आरोग्य बिघडत चाललेले आहे. कोरोणाच्या काळात तर ते आणखी बिघडत गेलेले दिसून आले. प्राणायमाचा अभ्यास केल्यामुळे मनुष्याच्या मानसिकतेवर सकारात्मक परिणाम होत असतो. मनुष्याच्या मनात सकारात्मक उर्जा निर्माण होवून त्याचे चित्त एकाग्र होत जाते आणि चित्त एकाग्र झाले तर तो इच्छित सफलता प्राप्त करू शकतो. आज स्पर्धेच्या युगात विद्यार्थ्याला यश प्राप्तीसाठी संघर्ष करावा लागतो. विद्यार्थी जीवण अतिशय महत्वपूर्ण असून याकाळात जर त्याला प्राणायाम करण्याची सवय लागली तर तो निश्चितच आपल्या लक्ष्यापर्यंत पोहचून यश प्राप्त करू शकतो. हिंदू धर्म शास्त्रात पंचमहाभूताचे महत्व सांगितलेले आहे. काम, क्रोध, मध, लोभ हे प्रत्येक मनुष्यात विराजमान आहे असे मानले जाते आणि हे सत्य ही आहे. दिवसेंदिवस मनुष्यातील सहनशिलता कमी होवून क्रोधाचे प्रमाण वाढत चाललेले आहे त्यामुळे समाजात हिंसाचाराचे प्रमाण वाढलेले आहे. वैज्ञानिक प्रगतीकडे वाटचाल करणाऱ्या जगात नैतिक मूल्याचे पतन होतांना दिसत आहे. हे पतन थांबवायचे असेल तर मनुष्याचे मानसिक स्वास्थ ठिक असने गरजेचे आहे. योग आणि प्राणायमाचा सदुपयोग करून मानसिक व शारीरिक स्वास्थ चांगले करणे शक्य आहे.

मूल्यमापन—योग सिध्दी मध्ये प्राणायमाला सर्वात महत्वपूर्ण अंग माणले जाते. आपल्या देशातील ऋषी, मुनी, साधूसंत यांनी सुध्दा श्वासाचे महत्व प्रतिपादन केलेले आहे. भारतात उगम पावलेली योग विज्ञानाची सरिता आता विश्वाच्या कानाकोपऱ्यात सर्वदूर पसरलेली आहे. संत कबीर म्हणतात "कहता हूं कहू जात हू। कहू बजाउ ढोल। स्वांसा खाली जात है। तिंहू लोक का मोल।" अर्थात संत कबीर म्हणतात की मी एक ढाले घेतो आणि लोकांना जागृत करून त्यांना सांगतो की तुमचा श्वास तुमच्यासाठी इतका महत्वाचा आहे की तुम्ही धरती, आकाश, आणि पाताळ या तिनही लोंकातील संपत्ती जरी तुम्ही दिली तरीही तुम्ही एक स्वांस खरेदी करू शकत नाही. कारण प्रत्येक स्वांस हा तुमच्यासाठी जीवन घेवून येत असतो. तो आला तरच तुमचे अस्तीत्व आहे म्हणून येणाऱ्या प्रत्येक स्वासांची मानवाने किंमत केली पाहिजे कारण तो अमूल्य आहे. प्राणायमाचा अभ्यास करून मनुष्य दोन स्वासांतील अंतर वाढवू शकते आणि आनंदही प्राप्त करू शकते. सध्याच्या काळात कोरोणा विषाणूने थैमान घातलेले आहे. कोरोणा विषाणू हा रूग्नाच्या श्वसन संस्थेवर हल्ला चढवितो तेव्हा स्वशन क्षमता सक्षम असली पाहिजे त्यासाठी प्राणायाम करणे अत्यंत गरजेचे आहे.

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सरदार पटेल महाविद्यालय, चंद्रपूर, महाराष्ट्र

सारांश :–
भारताच्या इतिहासाचा अभ्यास करतांना तो सर्वंकषतेवर होणे गरजेचे आहे. भारत स्वातंत्र्य चळवळीत पुरूषांच्या खांद्याला खांदा लावून महिलांनी सहभाग घेतलेला आहे. म्हणून त्यांच्या कार्याची दखल घेणे महत्वाचे आहे. महात्मा गांधीनी राष्ट्रीय चळवळीचे नेतृत्व स्वीकारल्यानंतर अहिंसात्मक मार्गाचा पुरस्कार केला. यावेळी त्यांनी ओळखले की स्वातंत्र्य चळवळीत स्त्रीयांचा सहभाग महत्वाचा आहे. गांधीजींच्या मते अहिंसात्मक संघर्ष कारण्यास घरे बाहेर पडल्याशिवाय राष्ट्रीय चळवळीला सामर्थ्य प्राप्त होणार नाही. जीवनाच्या प्रत्येक क्षेत्र पुरूषप्रमाणेच स्त्रीला अधिकार असले पाहिजे. गांधीजींच्या या आवाहनाला स्त्रीयांनी प्रचंड प्रतिसाद दिला होता. त्यामुळेच सामान्य कुटुंबातील महिलांप्रमाणे उच्चभ्रु घराणीतील तरुण मुलीही चळवळीत सहभागी झाल्या होत्या. डॉ. सुशीला नायर यांनीही महात्मा गांधी आणि कस्तुरबा गांधी सेवा करतांना तरुण वयातच भारताच्या स्वातंत्र्य चळवळीत सहभाग घेतला. १९३८ मध्ये प्रत्यक्ष त्या गांधीजींच्या सोबत असल्यामुळे स्वातंत्र्य चळवळीच्या त्या प्रत्यक्षदर्शी होत्या. स्वातंत्र्य चळवळीत सहभाग घेवून त्यांनी वैद्यकीय क्षेत्रात काम करतांना समाजसेवेचेही व्रत स्वीकारले होते. स्वातंत्र्यानंतरही त्यांनी वरच्या सरकार मध्ये महत्वाची पदे भूषवून लोकहिताची कामे केली. पण दुसऱ्याची सेवा करण्यात किती आनंद मिळतो याचे धडे त्यांनी गांधीजीकडून घेतले होते.

महत्वपूर्ण शब्द– असहकार, सविनय कायदेभंग, चलेजाव आंदोलन, जनचळवळ

प्रस्तावना :– महात्मा गांधीच्या विचारणी प्रभावित होवून अनेक देशभक्तांनी स्वातंत्र्याच्या यज्ञकुंडात आपल्या प्राणांची आहुती दिली. महात्मा गांधीला दीपस्तंभ मानलेल्या गांधीजींच्या भुरळ घालणाऱ्या व्यक्तीमत्वाने संपूर्ण चळवळीत प्रेरणा दिली. महात्मा गांधीनी भारतीय राष्ट्रीय कॉंग्रेसचे नेतृत्व स्वीकारल्यानंतरच स्वातंत्र्याची चळवळ खऱ्या अर्थाने जनचळवळ बनली आणि जनसामान्यांचा विशेषत: महिलांचा सहभाग वाढला.

डॉ. सुशीला नायर यांचा जन्म २६ डिसेंबर १९१४ ला कुंजा, जिल्हा गुजरात (पाकिस्तान) या गावात एका मध्यमवर्गीय कुटुंबात झाला त्यांनी एम.बी.बी.एस. आणि एम. डी. पी डिप्लोमा लेडी हार्डींग मेडीकल कॉलेज पंजाब विद्यापीठातून पूर्ण केली. तसेच पी.एच.डी जॉन हॉपकिन्स विद्यापीठ अमेरीका येथे पूर्ण केली. त्यानी लेडी हार्डींग मेडीकल कॉलेज मध्ये काही काळ सहाय्यक प्राध्यापक आणि रजिस्ट्रार म्हणूनही कार्य केले.[१] सुशिला नायरचे वडील बंधू प्यारेलाल गांधीजींचे दुसरे सचीव होते कारण पहिले सचीव महादेवभाई देसाई होते. प्यारेलाल महात्मा गांधीच्या विचारणी प्रभावित झाले होते म्हणून त्यांनी पंजाब विद्यापीठातून बी.ए. ची पदवी प्राप्त केल्यानंतर १९२० मध्ये गांधीजींनी सुरू केलेल्या असहकार आंदोलनात सहभाग घेतला व आपले पुढील शिक्षण थांबविले. गांधीजींनी सुरू केलेल्या सविनय कायदेभंग आंदोलनाच्यावेळी आपोजिशन ग्रुपचे ते सहभागी झाले होते. महात्मा गांधीनी एप्रिल १९३६ मध्ये वर्धा जवळील शेगाव हे खेडयात राहायला सुरवात केली. याचं गावाचे नाव बदलवून पुढे सेवाग्राम असे करण्यात आले. महात्मा गांधींना उच्च रक्तदाबाचा त्रास असल्यामुळे त्यांना आरोग्य सेवकाची गरज होती. १९३६ मध्ये पदवीचे शिक्षण पूर्ण करून डॉ. सुशीला नायरचे सेवाग्रामला आश्रममध्ये बंधू प्यारेलाल

[illegible] झाले ' आपटी आईच्या कडेवरून ती गांधीजींना भेटायला गेल्याचे तिला [illegible] असे करतांना ते तेथे असता आईने तिला बरोबर नेले होते तिला त्यावर [illegible] होती की त्यांनी प्यारेलालला घरी जायला सांगावे. विधवा आई आणि [illegible] किती काळजी घ्यावी. यावेळी गांधीजींनी प्यारेलाल यांना चार–पाच वर्ष राहण्याची परवानगी [illegible] होती परंतु त्यांच्याशी बोलतांना तिने आपणहून त्यांच्या कामात सहभागी होण्याचे कबूल केले व दोन–तीन वर्ष कस्तुरबा गांधीच्या सहवासात राहण्याची परवानगी मागितली ' याप्रसंगी [illegible] सुशिला नायर यांच्या आईला सुध्दा इथे आणावे म्हणजे पूर्ण कुटुंब एकत्र राहू शकेल असे सुचविले. कस्तुरबा गांधी नेहमी सुशीला नायर यांनी पुढील शिक्षणासाठी बाहेर जावे [illegible] प्रोत्साहित करीत राहिल्या.

महात्मा गांधी आणि कस्तुरबा गांधी यांच्या निकट सहवासात ती राहत असे. त्यांनी डॉक्टर [illegible] ओळखली जाई. वास्तविक ती काही फक्त गांधीचीच डॉक्टर नव्हती तर संपूर्ण आश्रमाची डॉक्टर होती. याच काळात सेवाग्राम मध्ये हैजा या रोगाची साथ सुरू झाली त्यावेळी [illegible] सुशिला यांना म्हटले की "सर्व गावाला हॉस्पीटल व प्रत्येक घराला वार्ड समजा [illegible]" महात्मा गांधीनी दिलेले हे पहिलेच कार्य होते. सुशिलाजींनी रात्रंदिवस [illegible] कस्तुरबा गांधीच्या प्रोत्साहनामुळे सुशिलाजींनी एम.बी.बी.एस. [illegible] दिल्ली लेडी हार्डींग मेडीकल कॉलेज पंजाब विद्यापीठातून पूर्ण केली आणि १९४२ पासून [illegible] त्या सेवाग्राम आश्रम मध्ये सेवा करू लागल्या. सुखासिन आयुष्याचा ध्यास सोडून [illegible] साधेपणाने गरिबांच्या सेवेचा मार्ग तिने निवडला होता. १९४४ मध्ये डॉ. सुशिला नायर यांनी सेवाग्राम येथे एक लहानशी डिसपेन्सरी सुरू केली. काही दिवसातच तिचे रूपांतर एका हॉस्पीटल मध्ये झाले. फक्त आश्रमातीलच नव्हेतर संपूर्ण गावातील लोक त्यांना [illegible] लागले.

असहकार चळवळीतील कार्य –ब्रिटीशांनी भारतातील स्वातंत्र्याची चळवळ दडपून टाकण्यासाठी रौलेट ॲक्ट आणला. या कायद्याच्या विरोधात संपूर्ण हिंदुस्थानात विरोध प्रदर्शन सुरू असतांना अमृतसर शहरात जालियनवाला बाग हत्याकांड घडून आले. इ.स. १९१९च्या मॉंटफोर्ड सुधारणा कायदा तसेच हंटर समितीच्या अहवालात जालियनवाला बाग हत्याकांडातील दोषी जनरल डायर यास [illegible] सोडण्यात आले या पार्श्वभूमीवर ब्रिटीशांना सहयोग न करण्याच्या धोरणाचा विचार करून महात्मा गांधीनी असहकार आंदोलनाची सुरवात केली. महात्मा गांधीनी सुरू केलेल्या असहकार चळवळीत हिंदी लोकांनी पदव्यांचा व स्थानिक स्वराज्य संस्थातील जागांचा त्याग करणे, सरकारी समारंभावर बहिष्कार टाकणे, विद्यार्थींनी शाळा, कॉलेज सोडणे, व राष्ट्रीय शाळा महाविद्यालये स्थापन करणे. व्यापाऱ्यांनी परकीय मालाचा व्यापार न करणे, हातमाग व खादीला प्रोत्साहन देणे, शेतकऱ्यांनी शेतसारा न भरणे, वकिलांनी वकिली सोडून या चळवळीत भाग घेणे, [illegible] कार्यावर भर देण्यात आला होता. हे संपूर्ण कार्यक्रम राबवतांना सर्व भारतीयांनी अहिंसक मार्गाचा अवलंब केला तर एका वर्षात स्वराज्य मिळवून देतो ही घोषणा महात्मा गांधीनी केली होती. राष्ट्रीय आंदोलन चालविण्यासाठी पैशाची गरज होतीच त्यासाठी १ कोटी रूपयांचे उद्दिष्ट ठेवून गांधीजींनी टिळक स्वराज्य फंड सुरू केला. त्यासाठी देशभरात गांधीजींनी सभा घेवून लोकांना मदतीचे आवाहन केले. सुशिला नायर यांनी बालवयातच रोहतक येथे सभेचे आयोजन केले. सभागृह लहंगा आणि पारंपरिक वेशभुषा केलेल्या महिलांनी दाटीवाटीने भरलेले होते. महिलांनी गांधीजींच्या आवाहनाला प्रतिसाद देत मोठया संख्येने दागदागीने व पैसे टिळक स्वराज्य फंडासाठी दिले ' परंतु ४ फेब्रुवारी १९२२ला उत्तरप्रदेशातील गोरखपूर जिल्हातील चौरीचौरा या ठिकाणी झालेल्या हिंसक घटनेमुळे महात्मा गांधीनी असहकाराची चळवळ मागे घेतली.

[illegible] आले होते. २२ फेब्रुवारी १९४४ ला आगाखान पॅलेस [illegible] कस्तुरबा गांधींचे निधन झाले.

[illegible] सर्वच आंदोलनात स्वदेशी वस्तूंच्या वापरावर भर दिला होता. [illegible] गांधींनी आपल्या [illegible] बहिष्कार केला होता त्यामुळे त्यांनी सीपला या औषध [illegible] त्यांनी विदेशी औषधांना सुद्धा बहिष्कार [illegible] ख्वाजा अब्दुल हमिद जे महात्मा गांधींना आपले गुरु मानायचे त्यांनी [illegible] संस्थापक [illegible] अत्यावश्यक औषधांची निर्मिती करण्यासाठी आवाहन केले. त्यावेळी सुशीलाजी [illegible] भारताला स्वातंत्र्य मिळण्यापूर्वी भारतात हिंदू–मुस्लीम दंगलीला नोआखली [illegible] पंजाब येथे सुरुवात झालेली होती. ही दंगल शमविण्यासाठी [illegible] मुस्लीम– शिख दंगलीला [illegible] टाकून नोआखली येथे गेले त्यावेळी सुशिला नायर त्यांच्या सोबत [illegible] आपले प्राण संकटात [illegible] दिल्लीत आलेल्या मुस्लिमांनी गांधीजींकडे निवेदन केले की त्यांचे खूप हाल होत आहेत. तुम्ही एकदा येऊन पहा. तेव्हा ही मंडळी पुराना किल्ला आणि जुन्या किल्ल्याच्या [illegible] राहत होती. त्यांना पहायला गांधीजी जाणार म्हटल्यावर हजार लोक चिडले [illegible] गांधीजी शांतपणे बाहेर आले. उभे राहिलेल्याबरोबर [illegible] गाडीतून [illegible] गाडीवर हल्ला केला [illegible] आपुलकीने त्यांच्याशी बोलू लागले यावेळी त्यांनी गाडीऐवजी पायी फिरण्याचा [illegible] सर्वच निर्वासित वस्त्यांची स्थिती करुणाजनक होती. बायका रस्त्यावरच बाळंत होत होत्या. जखमींवर इलाज होत नव्हते अन्न औषध निवाऱ्याची कमतरता होती. याप्रसंगी गांधीजींनी सुशिलाजींना विचारले "तू या लोकांना मदत करशील काय?" सोबतच्या सहकाऱ्यांनी [illegible] हे लोक वाईट आहेत तरुण मुलीला एकटे पाठवू नका. परंतु [illegible] गांधीजींचे शब्द [illegible] सुशिलाजींच्या मनाची तयारी झालेली असल्यामुळे त्यांनी कोणतीही भीती न बाळगता आपली वैद्यकीय साधने घेऊन मदतकार्य सुरू केले. ज्या सहकाऱ्यांनी [illegible] ते आता संरक्षक म्हणून कार्य करू लागले. छावणीतील नवजात बाळांना [illegible] ही सोबतची [illegible] होती. त्यांना वाचविले तरच लोकांचा विश्वास बसणार होता म्हणून सुशिलाजींनी आपला अनुभव पणाला लावून नवजात बाळांना वाचविले[९] फाळणीनंतर सगळीकडे [illegible] वातावरण तापले होते. त्यावेळी भवालपूरच्या नवाबांनी गांधीजींना पत्र लिहीले " हिंदू मुस्लीम प्रजाजन हे माझे दोन डोळे आहेत. हिंदू हा प्रदेश सोडून जाऊ इच्छित आहेत तुम्ही त्यांना [illegible] न जाण्याविषयी समजवा" पण त्याचवेळी शिखांनी कळवळून लिहल होत की तिथे [illegible] वातावरण मुळीच नाही. आम्ही इस्लाम कबूल केला तरच तिथे राहू शकतोय. त्यांनी त्यांच्या हलाखीचे अत्यंत भीतिदायक वर्णन केले होते. यामागील सत्य जाणून घेण्यासाठी गांधीजींनी डॉ. सुशीला नायरला म्हणाले "यामागे काय सत्य आहे हे तू तिथे जाऊन प्रत्यक्ष पाहून येऊन मला सांग". गांधीजींच्या सांगण्यानुसार सुशीलाजी आणि लेस्ली क्रॉस या क्वेकरपंथाच्या [illegible] बरोबर मुलतान जवळच्या भवालपूरला गेले. जायला, रहायला आणि परतायला एकेक दिवस असा तीन दिवसांचा कार्यक्रम ठरला होता. परंतु नवाब कराचीला गेले होते आणि ते दुसऱ्या दिवशी परतणार होते परंतु तीन दिवस उलटून गेले तरी ते परतले नव्हते. त्यामुळे दोघांनीही परतण्याचा निर्णय घेतला. तितक्यातच सुशिला नायर यांना गांधीजींच्या हत्येबद्दल माहिती मिळाली[१०] त्या खूप दुःखी आणि निराश झाल्या आणि आठवणींचा महापूर त्यांच्या मनात आला. त्यांना स्मरण झाले की दुसऱ्यांची सेवा केल्यामुळे किती आनंद मिळतो हे त्यांना गांधीजींमुळे कळले होते.[११] तात्काळ तेथील कमिशनरने गाडी करून त्यांना दिल्लीसाठी रवाना केले. गांधीजींच्या निधनाने त्यांच्या जीवणातील एका पर्वाचा अंत झालेला होता परंतु न खचता स्वातंत्र्यानंतरही त्यांनी नव्या सरकार मध्ये महत्वाची पदे भूषवून लोकहिताची कामे केली.

मूल्यमापन :– स्वातंत्र्य चळवळीशी सुशीलाजींचा बालपणापासूनच संबंध आलेला होता. ...
सुशीला नायर यांनी गांधीजींचे वागणे बोलणे जवळून पाहिले होते त्यांच्याशी विज्ञानावर ...
घातले होते. गांधीजींच्या अहिंसेच्या मार्ग आणि विचारसरणीवर त्यांचा गाढ विश्वास ...
त्यामुळेच त्या स्वातंत्र्य चळवळीत सहभागी झाल्या. गांधीजींमुळेच त्यांनी समाजसेवेचे ...
स्वीकारले म्हणूनच अविवाहीत राहून त्यांनी आयुष्यभर भारतीय जनतेची सेवा केली. ...
भारतीय स्वातंत्र्य चळवळीतील योगदान महत्वपूर्ण आहे.

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६) ट्राबुले डेविड एम, महात्मा गांधीज सत्याग्रह अँन्ड नॉन व्हायलेंट रजिस्टंस, कॉलेज ऑफ स्टिफन आइसलॅंड, १९९७ पेज नं ३२५

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सरदार पटेल महाविद्यालय, चंद्रपूर

सारांश–

आधुनिक उद्योगांची सुरुवात भारतात झाल्यानंतर कामगार चळवळीला सुरुवात झाली. १९२० ला ऑल इंडिया ट्रेड युनियन काँग्रेसची स्थापना झाल्यावर राष्ट्रीय स्तरावर कामगार [illegible] एकत्रित येवू लागले. त्यामध्ये रामभाऊ रुईकरही होते. स्वातंत्र्य चळवळीसोबतच रामभाऊ [illegible] पासून कामगार चळवळीत काम करू लागले. सुरुवातीच्या काळात त्यांचा संबंध [illegible] क्षेत्रातील प्रसिद्ध नेते भुईटोळकर टेंगडी व किसन फागुजी बन्सोड यांचेशी आला. [illegible] शहरातील प्रसिद्ध असलेल्या टाटांच्या एम्प्रेस मिल व मॉडेल मिल मध्ये त्यावेळी हजारो कामगार काम करीत होते. मिलमध्ये होणारे कामगारांचे आर्थिक शोषण रामभाऊंना पाहवत नव्हते [illegible] रामभाऊंनी कामगारांना न्याय मिळवून देण्यासाठी कामगार क्षेत्रात काम करण्याचा निर्णय घेतला. त्यांच्या राजकीय व कामगार चळवळीतील प्रवासाला एकाचवेळी सुरूवात झाली. [illegible] त्यांच्या कामगार क्षेत्रातील प्रभावी कार्यामुळेच त्यांना राजनांदगाव येथील मिल मध्ये सुरू असलेल्या संपाच्यावेळी मध्यस्थता करण्यासाठी १९२४ मध्ये बोलविण्यात आले व तेव्हापासून त्यांचा [illegible] बी.एन.सी. मिल राजनांदगाव येथील कामगारांशी येवू लागला. कामगारांच्या एकजुटीसाठी [illegible] मिल मजदूर संघ (लाल झेंडा) राजनांदगाव या संघटनेची स्थापना केली. इ.स. १९३७, १९[illegible], १९४८ या तिन्ही वर्षी झालेल्या संपात त्यांची भूमिका महत्वपूर्ण होती.

महत्वपूर्ण शब्द– औद्योगिकरण, सेन्ट्रल प्रोव्हिन्स, शॉवालिस कंपनी, एम्प्रेस मिल, मॉडेल मिल

प्रस्तावना – ब्रिटीशांच्या शासन काळात भारतात औद्योगिकरणाला सुरवात झाली. विशेषतः [illegible] मिल, ज्यूट मिल, लोह व पोलाद या क्षेत्रात. मध्यप्रांत व वऱ्हाड मध्ये कापसाचे उत्पादन मोठ्या प्रमाणात होत असल्यामुळे मध्यप्रांतात अनेक कापड गिरण्यांची सुरवात झाली. नागपूर येथे टाटा कंपनीने एम्प्रेस मिल व मॉडेल मिलची सुरवात केली. मध्यप्रांतात ज्या कापड गिरण्या होत्या त्यापैकी महत्वाची कापड गिरणी म्हणजे सेन्ट्रल प्रोव्हिन्स मिल राजनांदगाव.

सेन्ट्रल प्रोव्हिन्स मिलची स्थापना २८ जून १८९० मध्ये इंडियन कंपनी ॲक्ट १८८२ नुसार राजनांदगावचे महंत राजा बलरामदास यांनी केली. कंपनीचे रजिस्टर ऑफिस रायपूर मध्ये होते. या मिल करिता राजा बलरामदास यांनी जमीन दिली होती. १८९४ मध्ये बांधकाम पूर्ण झाल्यावर उत्पादनाला सुरवात झाली. मिल मध्ये धोती, चादर, सुती धुस्से, लठ्ठा, मारकीन कापडाचे उत्पादन होवू लागले. मिलमध्ये काम करण्याकरिता विदर्भातून कोष्टी आणि महार जातीच्या [illegible] कारागीरांना आणण्यात आले होते. नागपूर येथून आलेल्या कामगारांकरिता मिलच्या [illegible] बांधून वसविण्यात आले होते. सुरवातीला त्यांच्याकडून कोणताही किराया घेतला जात नव्हता [illegible] १९३८ मध्ये शॉवालिस कंपनीच्या व्यवस्थेनुसार चार आणे म्हणजेच पचविस पैसे किराया [illegible] जाई.[1]

इ.स. १८९४ ते १८९६ या कालावधीत मिलमधील उत्पादन व्यवस्थीत सुरू होते. [illegible] मिल मधील कापडाला भरपूर मागणी होती म्हणून मिल संचालकांनी उत्पादन वाढविण्यासाठी [illegible] कर्जाऊ रक्कम घेतली. परंतु अनुभवहीन संचालकांमुळे मिल तोटयात येवू लागली. [illegible] राजा बलरामदास यांनी मिल विकण्याचा निर्णय घेतला. [illegible] दबाव असल्यामुळे १८९७ मध्ये बलरामदास यांनी ही मिल अवघ्या पाच लाखात [illegible]

कलकत्ता स्थित कंपनीने सेंट्रल प्रॉविन्स मिलचे नाव बदलून 'दि बंगाल नागपूर कॉटन मिल लिमिटेड' असे ठेवले. कंपनीचे मुख्यालय कलकत्ता येथे होते. व्यवस्थापनामुळे व कुशल नेतृत्वामुळे मिलची प्रगती होऊ लागली. परंतु कामगारांच्या समस्यांकडे कंपनीने पूर्णपणे दुर्लक्ष केले. मिलमध्ये कामगारांना १२ ते १३ तास काम करावे लागत परंतु त्यानुसार वेतन दिल्या जात नव्हते. मिलमधील आवाजामुळे कामगार वर्गात बहिरेपणाचे प्रमाण वाढू लागले. मिल मधील दमट वातावरणामुळे रोगांचे प्रमाण वाढले. ही मिल राजनांदगाव संस्थानात होती व संस्थानावर कोर्ट ऑफ वॉर्डनुसार इंग्रजांचे शासन होते. ब्रिटीश शासनाचे कंपनीला संरक्षण असल्यामुळे इथल्या व्यवस्थापकांच्या हुकूमशाही पध्दतीने कारभार सुरु होता. त्यामुळे कामगार वर्गात प्रचंड असंतोष वाढला. अशा असंतुष्ट कामगारांचे नेतृत्व ठाकूर प्यारेलाल सिंग यांनी केले.

१.८ १९२० प्रथम कामगार आंदोलन –१९२० ला ठाकूर प्यारेलाल सिंग यांनी केलेल्या संपातील प्रमुख मागण्या पुढीलप्रमाणे होत्या. कामाचे तास ८ करण्यात यावे, काम करण्याच्या स्थितीत सुधारणा करण्यात यावी तसेच कामगारांचे वेतन वाढविण्यात यावे. ३७ दिवसांनी १९२० ला २००० मजुरांनी आंदोलनाला सुरुवात केली. प्रारंभापासूनच प्यारेलाल सिंग यांनी राजनांदगाव मजदूर संघाची स्थापना केली. शेवटी ३७ दिवसानंतर व्यवस्थापकांनी मागण्या मान्य केल्याने या संपाची यशस्वीरित्या सांगता झाली. परंतु बीहवाव दिवाण संस्थानच्या पोलीसीकरवी कंपनीच्या सांगण्यानुसार कामगार प्रतिनिधी राजूलाल, शिवलाल आणि प्यारेलाल सिंग यांनी राजनांदगाव संस्थान सोडावे असा आदेश दिला. शेवटी कामगारांच्या एकतेमुळे हा आदेश रद्द करण्यात आला.

१.९ १९२४ द्वितीय कामगार आंदोलन– प्रथम आंदोलनानंतर कामगारांना दिलेल्या आश्वासनाची पूर्ती झालेली नव्हती. उलट कामगारांवरील अत्याचारात वाढ झालेली होती. संपात सहभाग घेणारे मजूर वगळून बाहेरील मजुरांना कंपनीत प्राधान्य देऊन त्यांना कोणत्याही संपात सहभागी होणार नाही असे त्यांच्याकडून लिहून घेतले जाई. तर जुन्या मजुरांना पाच मिनिटेही उशीर झाला तर संघटन काढण्याची धमकी दिली जाई. शेवटी कंपनीच्या जाचाला कंटाळून १९२४ मध्ये संपाला सुरुवात झाली. ब्रिटीश सरकारने कामगारांवर दडपण आणण्यासाठी संपूर्ण राजनांदगाव संस्थानात धारा १४४ लागू केली. कामगारांची एकता तोडण्यासाठी साम, दाम, दंड, भेद नितीचा वापर सुरु झाला. तरीही कामगार मागे हटण्यासाठी तयार नव्हते. हा संप सात महिन्यापर्यंत सुरूच होता. संपाच्यावेळी गोळीबारही झाला त्यामध्ये जगू गोंड नामक व्यक्ती शहीद झाला तर काही कामगारांना जखमा झाल्या. या हत्याकांडाची कोणतीही निष्पक्ष तपासणी न करता प्यारेलाल सिंग यांच्यावर आरोप ठेवण्यात आले.[8]

संस्थानचे दिवाण मॅकगॉविन यांनी प्यारेलाल सिंग यांना पत्र दिले की तुम्ही यापुढे राजनांदगाव संस्थानात प्रवेश करू शकत नाही. हे पत्र मिळाल्यावर प्यारेलाल सिंग यांनी व्यवस्थापकाशी चर्चा करण्याचा प्रयत्न केला, परंतु त्यांनी चर्चेसाठी नकार दिला. शेवटी प्यारेलाल सिंह यांनी त्याचे तितकेच उत्तर देण्याचे ठरवले. ते म्हणाले "राजनांदगाव संस्थान असो वा नसो संप हा होणारच." त्यांनी प्रमाणधान ठेऊन राजनांदगाव रेल्वे स्टेशनचा आसरा घेतला. कारण हे रेल्वे स्टेशन राजनांदगाव संस्थानाच्या अधिकार क्षेत्रात येत नव्हते याचा पुरेपूर फायदा घेत त्यांनी स्टेशनवरच संपाची मशाल पेटवली.[9] परंतु स्टेशनवरून संपाचे संचालन करणे सोपे नव्हते म्हणून प्यारेलाल सिंग यांना वाटले की मजुरांची बाजू मांडण्यासाठी प्रभावी नेत्याची गरज आहे. त्यांनी रामभाऊ रुईकरांशी संपर्क साधला रामभाऊ लवकरच राजनांदगावला पोहचले. व्यवस्थापकांशी चर्चा करून त्यांनी हा संप मिटविला. येथूनच रामभाऊ आणि राजनांदगाव मिल मधील कामगारांचा संपर्क वाढ झाली.

इ.स. १९३७ तृतीय मजदूर आंदोलन– १९३४ मध्ये राजनांदगाव संस्थानातून [illegible] प्यारेलाल सिंग यांनी [illegible] शहरात [illegible] कामगारांनी [illegible] सुरू केले. [illegible] वर्ष झाली तरीही [illegible] राजनांदगाव [illegible] ठाकूर प्यारेलाल [illegible] राजनांदगावातील [illegible] [illegible] रामभाऊ रुईकर [illegible] आश्वासन देत [illegible] [illegible] करित होते. [illegible] कामगारांच्या मागण्या पूर्ण [illegible] [illegible] केल्यास [illegible] [illegible] १५ दिवसात मागण्या पूर्णपणे [illegible] सुरुवात केली. [illegible] [illegible] फेब्रुवारी १९३७ मध्ये ३००० मजुरांनी [illegible] केली. [illegible] विरोध ठाकूर प्यारेलाल सिंग [illegible] प्रबंधकाशी कामगारांच्या पगारात १० टक्के [illegible] चर्चा [illegible] होतू लागली. मिल [illegible] [illegible] बी.एन.सी मिल मधील [illegible] [illegible] परंतु प्यारेलाल सिंग यांनी [illegible] [illegible] प्यारेलाल सिंग [illegible] [illegible] नागपूर मिलच्या संघाला सहानुभूती म्हणून [illegible] दिला "[illegible] राजदूर [illegible] संपर्क साधण्याचा प्रयत्न सुरू होता" [illegible] आयोजन करण्यात आले त्यावेळी रामभाऊंनी [illegible] [illegible] मिल अधिकाऱ्यांनी प्यारेलाल सिंग [illegible] [illegible] [illegible] मध्यस्थता करण्यासाठी प्यारेलाल सिंग [illegible] [illegible] सुचविण्यास [illegible] [illegible] सुचविले की [illegible] येतु शकते नाही [illegible] की [illegible] व रामभाऊ रुईकर यांचे [illegible] सुचविले [illegible] राजनांदगावला पोहचले." रामभाऊंना पाहून कामगार वर्गात आनंदाचे वातावरण पसरले. [illegible] रुईकरांनी कामगारांच्या जाहीर सभेत भाषण केले. त्यानंतर कामगारांचे एक शिष्टमंडळ [illegible] [illegible] व्यवस्थापकांना भेटले. परंतु [illegible] यशस्वी झाल्या नाहीत. पुन्हा १० [illegible] [illegible] तडजोडीसाठी प्रयत्न झाले व [illegible] तडजोड मान्य झाली व संपाची घोषणा [illegible] [illegible] आली." त्यामुळेच कामगारांचा रामभाऊ रुईकरांवरचा विश्वास आणखी दृढ झाला. [illegible] रुईकर कामगारांसाठी धावून आले त्यांनी व्यवस्थापकाशी चर्चा केली व हा तीन महिन्यापासून [illegible] संप मागे घेण्यात आला. रामभाऊ रुईकरांनी बी. एन. सी. मिल मधील मजुरांसाठी [illegible] [illegible] [illegible] जाहिर केला त्यानुसार २६ मे १९३७ ला रुईकरांनी [illegible] [illegible] [illegible] मिल मजूर संघाचे कार्यालय सुरू केले. याच ठिकाणी संघाच्या "[illegible] [illegible]" स्थापना केली." त्यावेळी संपूर्ण शहर "लाल झेंडे की जय" आणि [illegible] [illegible] विजय असो" अशा घोषणांनी निनादून गेले. ही संघटना काँग्रेस समर्पित [illegible] मजदूर संघ डिसेंबर १९३८ मध्ये नोंदणीकृत केली. मिल मजदूर संघ (लाल झेंडा) [illegible] याच कार्यालयातून संघाचे संचालन करित असे. श्री. रुईकरांनी पुढेही राजनांदगाव येथील [illegible] [illegible] आपला संबंध कायम ठेवला.

इ.स. १९३८ चतुर्थ मजदूर आंदोलन– मे १९३७ मध्ये मिल मालक आणि प्रबंधकांमध्ये [illegible] [illegible] इ.स. १९३४ मध्ये ठरविलेला मजुरी दर सप्टेंबर १९३८ पासून [illegible] [illegible] आश्वासन देण्यात आले होते. परंतु याकडे कुणीही लक्ष दिले नाही. उलट [illegible] [illegible] [illegible] शुल्क यांनी ४०० मजुरांची छटणी केली. श्री. रुईकरांनी कामगारांच्या [illegible] सुची प्रबंधकाकडे पाठविली परंतु प्रबंधकांनी लक्ष दिले नाही. रुईकरांनी [illegible] [illegible] [illegible] [illegible] भडकत [illegible] होता. [illegible] प्रतिसाद मिळाला नाही. त्यामुळे कामगार वर्गात [illegible] [illegible] [illegible] [illegible] [illegible] त्यात मिलच्या व्यवस्थापकांनी कामगार [illegible] रामभाऊंचा [illegible] मिल संघटनेत नको होता. [illegible] अशा निर्बंध घातला." याचा सरळ अर्थ होता की [illegible] [illegible] कामगारांच्या सप्टेंबर महिन्यातील आठ दिवसाचा पगार कापला. व्यवस्थापकाची [illegible] [illegible] कामगार चिडले आणि त्यांनी [illegible] हरताळ पुकारला. कामगारांची एकजूट [illegible]

[illegible] लागून रुईकरांनीही या संपाला पाठिंबा दिला. मिलचे व्यवस्थापक [illegible] बोलणी करण्यास तयार नव्हते. तडजोडीसाठी त्यांचा हात पुढे [illegible] प्रकारे सर्व रुईकरांनी संस्थानाच्या दिवाणाला पत्र पाठवून मध्यस्थी [illegible] उपाय म्हणून आणि कामगारांच्या मागण्यांचा सहानुभूतिपूर्वक विचार करा असे [illegible] विनंती केली आणि आठ दिवसांच्या १९३८ पासून बेमुदत अन्न सत्याग्रह करण्याचा आपला निर्णय जाहीर केला. नाहीतर ११ आक्टोबर [illegible] मिलच्या व्यवस्थापकाशी [illegible] कोणतीही हालचाल केली नाही. त्यामुळे १९ ऑक्टोबर १९३८ पासून रुईकरांनी उपोषणास प्रारंभ केला. त्यावेळी [illegible] संस्थानचे दिवाण अध्यक्ष होते. नागपूर नगर काँग्रेस कमिटीचे अध्यक्ष श्री [illegible] सिंग [illegible] काँग्रेस कमिटीचे राजनांदगावच्या शासकांना व व्यवस्थापनाला तडजोड घडवून आणण्यासाठी विनंती केली [illegible] व्यवस्थापकांनी लक्ष दिले नाही.'' शेवटी २२ नोव्हेंबर १९३८ पासून मिल बंद करण्यात आली. [illegible] सुरू असलेल्या कामगार सभेच्यावेळी मिल व्यवस्थापकाने आपले गुंडही पाठविले होते. रुईकरांचे भाषण सुरू असताना गुंडांनी त्यांच्या अंगावर दगड फेकून मारले तरीही रुईकरांनी आपले भाषण सुरूच ठेवले. [illegible] आणि [illegible] प्रशासनाने लाठीचार्ज ही केला. राजनांदगावच्या [illegible] रामभाऊ रुईकर हातात तिरंगा घेवून [illegible] आले. त्यावेळी सर्व स्त्री–पुरुष कामगारांनी त्यांना उत्स्फूर्त प्रतिसाद देत घोषणा दिल्या. या सभेच्यावेळीही पोलिसांनी कामगारांवर लाठीचार्ज केला त्यामध्ये अनेक कामगार जखमी झाले. या घटनेचा निषेध करण्यासाठी राजनांदगाव संस्थानाचे दिवाण मॅकनाथिन यांना कामगारांनी घेराव केला त्यावेळी कामगारांवर झालेल्या लाठीचार्ज व मृत्यूसाठी उलट रामभाऊ रुईकरांनाच दोषी ठरविण्यात आले. या काळात राजनांदगाव संस्थानाने रुईकरांना संस्थानातून हुसकावून लावण्याचे ठरविले होते. त्याकाळचे कामगार आयुक्त सी. एम. त्रिवेदी आपल्या वरिष्ठांना लिहतात "प्रांतीय सरकारला याबाबत कोणतेही कर्तव्य नाही पण मला असे वाटते की रामभाऊ परत जाणार नाहीत. ब्रिटीश भारतातील १८६४च्या ब्रिटीश कायद्यानुसार ते रुईकरांना राजनांदगाव संस्थानातून काढू शकतात. परंतु त्या संस्थानात हा कायदा आहे की नाही हे मला माहीत नाही. याशिवाय त्या ठिकाणचे मुख्य अधिकारी मंडळ आदेश काढू शकतात, त्यावेळी रुईकरांना त्या आदेशाचे उल्लंघन करता येणार नाही." '' रुईकर आपल्या निर्णयावर ठाम होते व त्यांचे उपोषण सुरूच होते. शेवटी प्रांतीय ट्रेड युनियन काँग्रेसचे सचिव श्री आर. डब्ल्यु. फुले यांनी महात्मा गांधींचे लक्ष रुईकरांच्या उपोषणाकडे जावे म्हणून नागपूर रेल्वे स्टेशनवर महात्मा गांधी आले असताना त्यांच्याकडे एक पत्र देऊन ही माहिती दिली. "गांधीजींनीही तात्काळ रुईकरांना तार पाठवून विनंती केली की रुईकरांनी उपोषण बंद करावे.'' सुभाषचंद्र बोसांनाही आग्रह करून १६ नोव्हेंबर रोजी रुईकरांना उपोषण सोडावयास लावले. हे उपोषण एकूण १७ दिवस चालले. रुईकरांनी माघार घेतल्यामुळे ठाकूर प्यारेलाल सिंग यांना पुढाकार घ्यावा लागला. या संपात जवळपास ६०० कामगारांना कामावरून काढण्यात आले'' [illegible] काही दिवसात पुन्हा त्यांना कामावर घेण्यात आले. ही हरताळ जवळपास ११ महिने पर्यंत चालली त्यामुळे संपाला हिंसात्मक वळणही मिळाले होते. रुईकर डोंगरगड वरून राजनांदगाव [illegible] येवून आंदोलनाचे नेतृत्व करित होते.''

रुईकरांनी राजनांदगावच्या कामगारांना संघटीत करून कामगार चळवळीचा झेंडा [illegible] फडकविण्यात जेवढे श्रम घेतले त्यापेक्षा जास्त प्रयत्न रुईकरांनी राजनांदगावात काँग्रेसची संघटना उभारण्यासाठी घेतले. त्यांचे उपोषण संपल्यानंतर राजनांदगावपासून दहा [illegible] मैल दूर असलेल्या [illegible] या गावी राजनांदगाव काँग्रेसचे पहिले अधिवेशन घेण्याचे निश्चित करण्यात आले. २२ [illegible] १९३८ ला विधानसभेचे सदस्य व्ही. वाय. तामस्कर यांच्या अध्यक्षतेखाली अधिवेशन होणार

होते. रामभाऊंची पत्नी इंदिराबाई अधिकाराच्या [illegible] समितीच्या [illegible] होते [illegible] आता कामगार चळवळीपुरतेच मर्यादित न राहता त्यांच्या [illegible] राजनांदगाव संस्थान [illegible] होण्या म्हणून संस्थानाच्या अधिकाऱ्यांनी एक बंदी हुकूमनामे रामभाऊ व इंदिराबाई [illegible] संस्थानात प्रवेश करण्याची बंदी घातली. रामभाऊंनी हा बंदीहुकूम मोडण्याचा निर्णय [illegible] ४ डिसेंबर १९३८ ला इंदिराबाईंनी राजनांदगावात प्रवेश करण्याचा प्रयत्न केला [illegible] सोबत त्यांचा तीन वर्षांचा मुलगा [illegible] होता. संस्थान प्रशासनाने ताबडतोब इंदिराबाईंना [illegible] करून राजनांदगावच्या हद्दीबाहेर १४ मैल सोडण्यात आले. पुन्हा असाच प्रयत्न [illegible] त्या राजनांदगाव मिल मजूर सभेच्या सभापती [illegible] दिवाण [illegible] हा बंदी हुकूम मोडण्याचा [illegible] रामभाऊ व इंदिराबाईंनी केला तेव्हाही त्यांना राजनांदगावापासून ४० मैल दूर [illegible] घनदाट अरण्यात रात्री सोडण्यात आले. ती रात्र दोघांनीही जंगलातच काढली. [illegible] आपल्या कार्यापासून ढळणारे नाहीत. कामगार चळवळीत कार्य करीत असताना रूईकरांना [illegible] संकटांना तोंड द्यावे लागले. कामगारांच्या प्रेमापोटी त्यांनी आपले जीवन अर्पण [illegible] घातले. पण हे सर्व करीत असतांना रूईकरांच्या पत्नी इंदिराबाईंनी साथ त्यांना प्रत्येक [illegible] लाभली.

१९४८ चे मजदूर आंदोलन— रामभाऊंचा राजनांदगावच्या बंगाल नागपूर कॉटन मिल [illegible] संघटनेशी जवळचा संबंध असल्यामुळे राजनांदगाव येथील ठाकूर प्यारेलाल सिंह, [illegible] घाटोलीया, धनालाल पारख, पन्नालाल शर्मा, कस्तुरचंद जैन, कन्हैयालाल अग्रवाल हे सर्व [illegible] आंदोलन व श्रमिक आंदोलनाशी जुळलेले होते. येथील कामगारांसाठी रामभाऊ [illegible] मार्गदर्शकच होते. ब्रिटिशांच्या काळात राजनांदगाव संस्थान असल्यामुळे संस्थानातील [illegible] औद्योगिक व आर्थिक विकास विशेष झालेला नव्हता. कामगारांनी राजनांदगावच्या बी. एन. सी. मिल मध्ये १६ मार्च १९४८ ला एक दिवसाचा लाक्षणिक संप पुकारला होता. कामगार [illegible] मागण्या मान्य केल्याशिवाय संप मागे घेण्यास तयार नव्हते. २४ मार्च १९४८ ला राजनांदगाव [illegible] पोलीसांनी कामगारांवर गोळीबार केला. गोळीबारात रामदयाळ नावाच्या व्यक्ती शहीद झाला [illegible] मोतीपुर येथे झालेल्या गोळीबारात धनाराम देवांगन आणि जगतराम सतनामी शहीद झाले. रामभाऊंना गोळीबाराची माहिती कळताच ते राजनांदगावाला रवाना झाले. त्यांनी केलेल्या चौकशीत त्यांना कळले की पोलीसांनी मरणाऱ्या माणसाला पाणी सुध्दा पाजले नाही. [illegible] त्या मृत माणसाला शवगृहापर्यंत पोहचविले. तर जखमी झालेल्या कामगारांना पोलीसांनी [illegible] बुकया मारल्या. पोलिसांनी केलेल्या अत्याचाराविरोधात रामभाऊंनी शासनाकडे तक्रार केली [illegible] गोळीबाराच्या विरोधात ५ जून १९४८ ला प्रांतीक गिरणी कामगार फेडरेशनची सभा रामभाऊंच्या अध्यक्षतेखाली घेण्यात आली. सभेत ठराव पारित करण्यात आला की या गोळीबाराची [illegible] निष्पक्ष चौकशी एका हायकोर्ट न्यायाधिशाकडून करण्यात यावी. जर पंधरा दिवसाच्या [illegible] सरकारने चौकशी सुरू न केल्यास प्रांतीय संयुक्त मोर्चाने आपली एक पोटसमिती नेमून [illegible] गोळीबाराची चौकशी करून तिचा अहवाल इंग्रजी, मराठी व हिंदी भाषेतून प्रसिध्द करावा व [illegible] कामगार आणि जनतेसमोर ठेवावा. या सर्व कार्यवाहीसाठी रामभाऊ रूईकर, आर. के. हळदुलकर, शिवाजीराव पटवर्धन, पी. के. तारे, शिवराज यांची नियुक्ती करण्यात आली. याच संदर्भात [illegible] १९४८ रोजी एक शिष्टमंडळ ना. मजूरमंत्री यांची भेट घेण्यासाठी गेले. त्यामध्ये रामभाऊ [illegible] सुखदेव प्रसाद गुप्ता (राजनांदगाव), आर. के. हळदुलकर (छिंदवाडा), भगवंतराव [illegible] (नागपूर), भा. वि. रोलमार (नागपूर), शेख मस्ताना (नागपूर), गणपतराव डोंगरे व गणूजी [illegible] अंडी मनसर, गुमान सिंग व नानीराव आचार (छिंदवाडा) हे सहभागी होते. रामभाऊ [illegible] पातळीवरून समस्या सोडविण्याचा प्रयत्न करीत होते. पण त्यासोबतच गोळीबारात [illegible]

[illegible] कामगार कार्यकर्त्यांच्या [illegible] राजकारणात [illegible] [illegible] आर्थिक [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] रामभाऊ रुईकर व [illegible] [illegible] [illegible] आकार प्राप्त केला.[11]

[illegible] — डी.एन.बी. मिल राजनांदगाव येथील कामगारांच्या [illegible] [illegible] [illegible] [illegible] मिल [illegible] केला. मिल [illegible] [illegible] [illegible] [illegible] [illegible] रामभाऊ रुईकरांचे [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] येथील कामगार [illegible] [illegible] [illegible] रुईकरांच्या [illegible] [illegible] राजनांदगाव येथील कामगार [illegible] [illegible] [illegible] [illegible] [illegible] ऐतिहासिक [illegible] [illegible] [illegible]

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9) ठाकूर विद्याभूषण, राजनांदगाव जिला एक परिचय, [illegible] प्रकाशन, राजनांदगाव, पृष्ठ ११
10) [illegible] रुईकर, कामगार केसरी रामभाऊ रुईकर जीवन चरित्र, रुईकर स्मारक समिती प्रकाशन, नागपूर, १९६६ पृष्ठ १८
11) डॉ. [illegible] [illegible] [illegible], आधुनिक विदर्भाचा इतिहास, [illegible] प्रकाशन, नागपूर, २००३ पृष्ठ ६४
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19) [illegible] सिंग, राजनांदगाव जिले का राजनैतिक एवं सांस्कृतिक इतिहास, [illegible] प्रकाशन राजनांदगाव, २००४ पृष्ठ ७३
20) Madhya Pradesh State Archives, Labour Department, 1948, File No- 12-57, p-02
21) Madhya Pradesh State Archives, Labour Department, 1948, File No- 12-57, p-03

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A Parametric Study of Acoustical Properties of Salicylamide Drug at Different Temperature

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ABSTRACT

This research paper is to pin out the various molecular interactions of molecules in the alcoholic salicylamide drug at the different temperature. Evaluations of molecular interactions of alcoholic salicylamide drug at different temperature have been investigated under ultrasonic technique at 2MHz. Ultrasonic data of drug solutions has been estimated at various desired thermo-acoustical parameters. A significant existence of solute-solvent and solute-solute interactions present in the system. Hence it is evident that the ultrasonic velocity measurement in the given medium serves as a careful probe in characterizing the physico-chemical properties of the medium

This research paper has said the various types of possible molecular interaction in the drug solution. This investigation has been thoroughly analyzed and eventually interpreted at the possible molecular interactions such as structure making and structure breaking effect and also solute-solvent, ionic interaction, H-bonding effect in the alcoholic salicylamide drug solution. The results obtained from these studies can thus be helpful for pharmacological application of drugs.

Keywords : Ultrasonic velocity, Density and Acoustical parameters, Salicylamide drug, Alcohol

I. INTRODUCTION

In the pharmaceutical and chemical industries, the wide application of ultrasound to promote Chemical processes. The physical and chemical interaction of ultrasound with molecular species has been thoroughly studied (1,2) and is an important tool for promoting reactions used for synthetic and medicinal chemistry as well as for improving drug extraction processes (3-6). Ultrasound is being explored to solve pharmaceutical manufacturing and formulation issues (7) dispersion of solids, the deagglomeration of solids in liquid and the preparation of colloids. In addition, ultrasound has been used in the development of novel catalysts, nanomaterials, nanocrystals and nanoscale catalysts (8-10). Diagnostic imaging is the most widespread medical application of ultrasound.

The wide ultrasonic sense has been adequately employed in understanding the nature of molecular interactions in pure liquids and liquid mixtures. The ultrasonic characterizations are highly sensitive to molecular interactions and used to demonstrate qualitative nature and strength of molecular interaction in the drug solution [11-14]. Incorporating the pharmacokinetics and pharmacodynamics play vital role in medicine and drug chemistry to carry out the interferometry, isometric and refractometric measurements [15, 16]. This information deals with the transport properties of drugs and ion-solvent

interactions. Drug action is the ultimate consequence of physico-chemical interaction between drug and receptor. The results ultimately zero in on the dipole association, inter-molecular attraction between the solute and solvent, dielectric constant of the medium, polarizability and mutual compensation of dipoles. It also directs transmission stability, its activity and effect of drug [17-19]. Alcohols are strongly self-associating and polar behavior of attraction with any other such a group of compound. Alcohols and aromatic compounds exist as associated structures in liquid state. Thus interaction of drug with alcohols give interesting properties arising from charge-transfer, dipole-dipole, donor-acceptor and hydrogen bonding may be observed.

These research paper thermo-acoustic parameters of the mixture of salicylamide and butanol are examined at various temperature ranges i.e. 278.15K-293.15K. Explore the various interactions and their subsequent consequence on transport properties of salicylamide drug. The research of physicochemical activities of drug can be the great attention from academic as well as physiological intellect [20-23].

II. METHODS AND MATERIAL

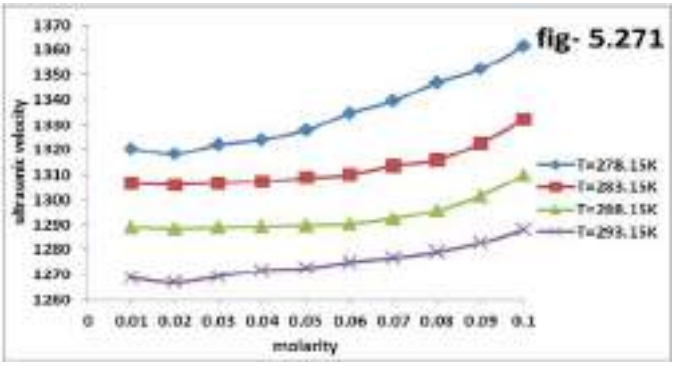
The solvents alcohols like butanol and analgesic drug salicylamidel were used AR grade (E-Merck chemicals, Germany) without further purification. The purity of chemicals has been verified out by comparing the ultrasonic data with standard literature value [24]. The measurement of ultrasonic parameter of the solution by using ultrasonic interferometer supplied by Vi-Micro system, Chennai (Model VCT: 71) having frequency at 2 MHz with an accuracy of 0.0001 m/s. The densities are measured using 10 ml specific gravity bottle. Specific gravity bottle having accuracy of ± 2 $X10^{-2}$ kg/m^3.Automatic temperature controller water bath supplied by Lab-Hosp Company Mumbai having an accuracy ±1K temperature. Viscosities were measured at particular temperature by using Oswald's viscometer; the calibration of viscometer by using doubled distilled water with literature value. The time rate of doubled distilled water and experimental mixture are measured with digital stop clock having accuracy of 0.01 sec (Model: RACER- 10W).Weights were measured with an electronic digital balance (Contech CA-34) having accuracy 0.0001gm. Such a set up make use of to determine the ultrasonic and thermo-acoustic evaluation in butanol and salicylamide at T=278.15K-293.15K at various molar range.

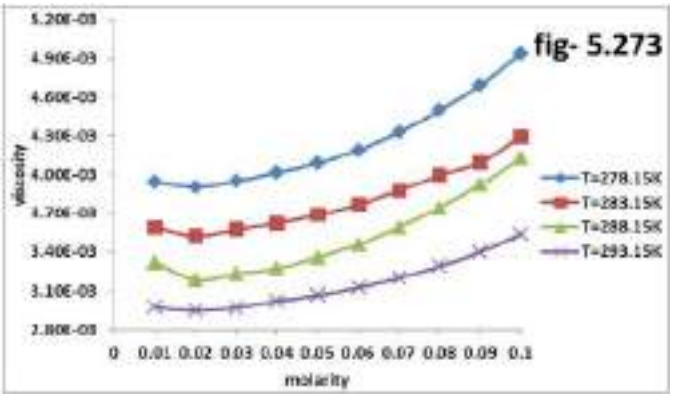
Ultrasonic and thermo-acoustic parameters are formulizing as follows:

Adiabatic Compressibility $(\beta) = 1 / U^2\rho$ ..... (1)
Specific Acoustic Impedance $(Z) = U\rho$ ..... (2)
Intermolecular Free Length $(L_f) = K_T \beta^{1/2}$ ..... (3)
Relaxation Time $(\tau) = (4/3)*\beta*\eta$ ..... (4)
Relative association $(Ra) = (\rho/\rho_0)(U_0/U)^{1/3}$ ..... (5)
Classical Absorption $(\alpha/f^2) = (8\pi^2\eta)/(3\ U\ \rho)$ ..... (6)
Internal Pressure $(P) = bRT\ (K\eta / U)^{1/2} x\ (\rho^{2/3}/M^{7/6}eff)$ (7)
Free Volume $(V_f) = (M_{eff}\ U / \eta\ K)^{3/2}$ ..... (8)
Molar volume $(Vm) = Meff/\rho$ ..... (9)
Molar Sound Velocity or Rao Constant $(R) = Meff/\rho\ (U)^{1/3}$ ..... (10)
Molar compressibility or Wada constant $(W) = V\ \beta^{1/7}$ ..... (11)
Isothermal Compressibility $(\beta i) = \gamma\ \beta$ ..... (12)
Surface Tension $(\sigma) = (6.3 \times 10^{-4})\ \rho U^{3/2}$ ..... (13)

Data interpretation by graphical tactic as follows

Following figures are various ultrasonic and thermo-acoustic parameters V/S molarity





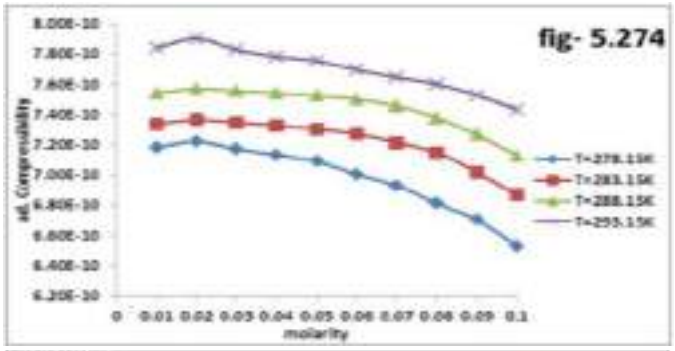


fig- 5.274
molarity
T=278.15K
T=283.15K
T=288.15K
T=293.15K

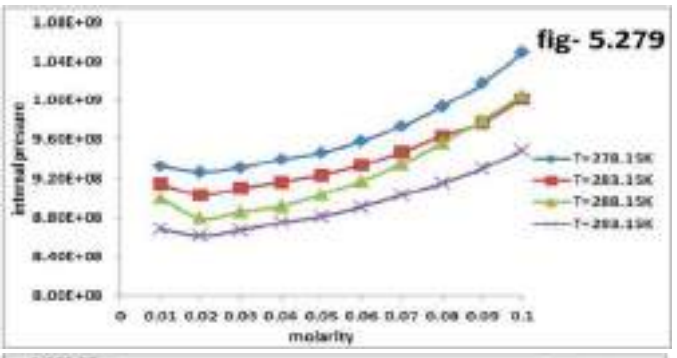


fig- 5.279
internal pressure
molarity
T=278.15K
T=283.15K
T=288.15K
T=293.15K

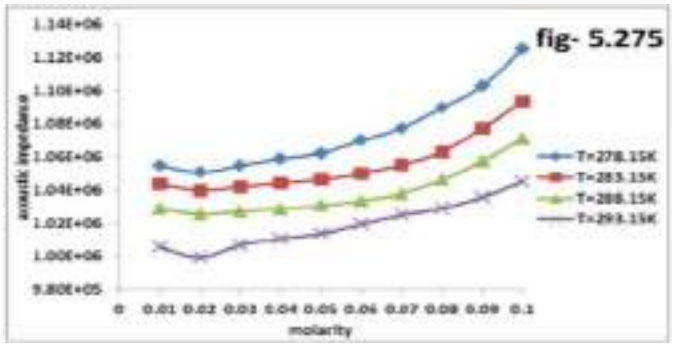


fig- 5.275
acoustic impedance
molarity
T=278.15K
T=283.15K
T=288.15K
T=293.15K

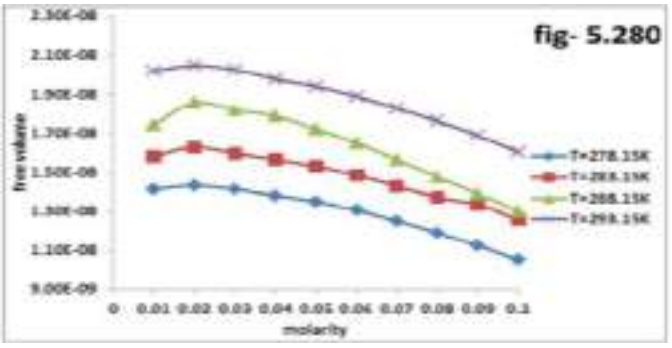


fig- 5.280
free volume
molarity
T=278.15K
T=283.15K
T=288.15K
T=293.15K

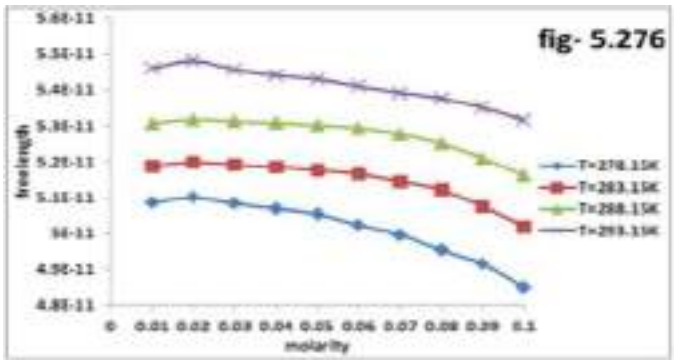


fig- 5.276
free length
molarity
T=278.15K
T=283.15K
T=288.15K
T=293.15K

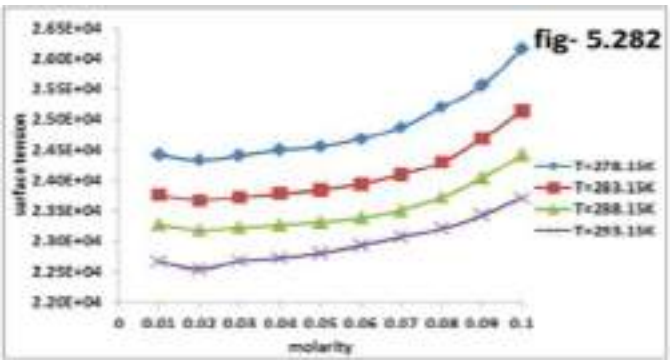


fig- 5.282
surface tension
molarity
T=278.15K
T=283.15K
T=288.15K
T=293.15K

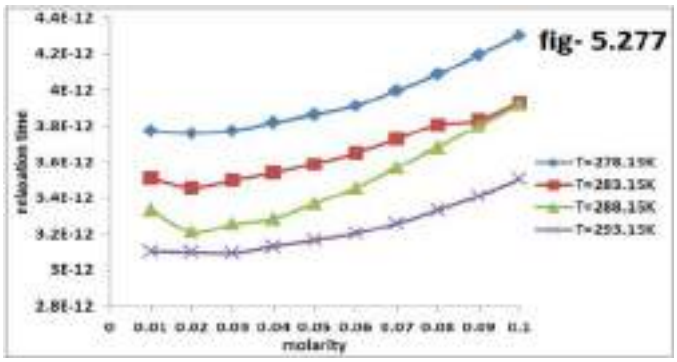


fig- 5.277
relaxation time
molarity
T=278.15K
T=283.15K
T=288.15K
T=293.15K

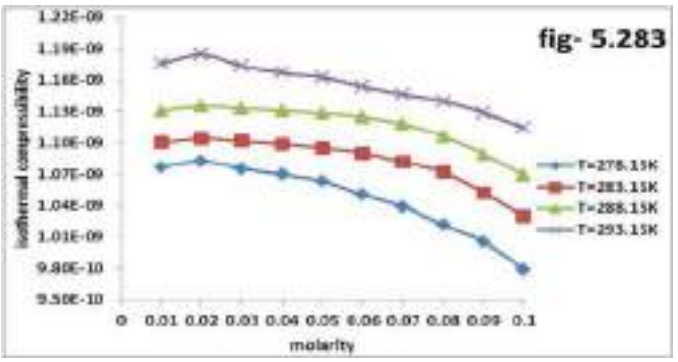


fig- 5.283
isothermal compressibility
molarity
T=278.15K
T=283.15K
T=288.15K
T=293.15K

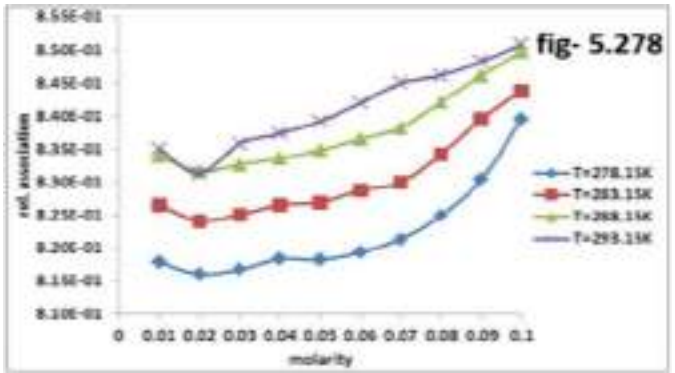


fig- 5.278
molarity
T=278.15K
T=283.15K
T=288.15K
T=293.15K

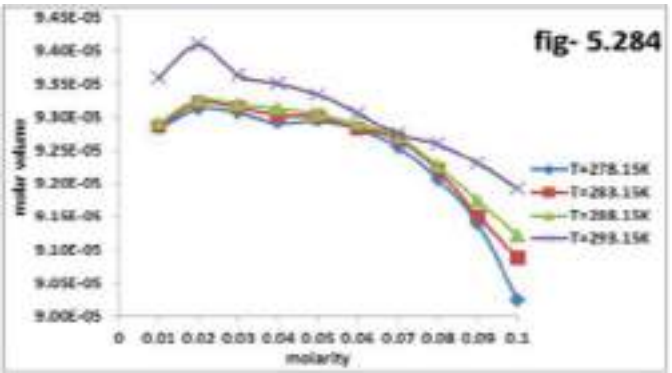
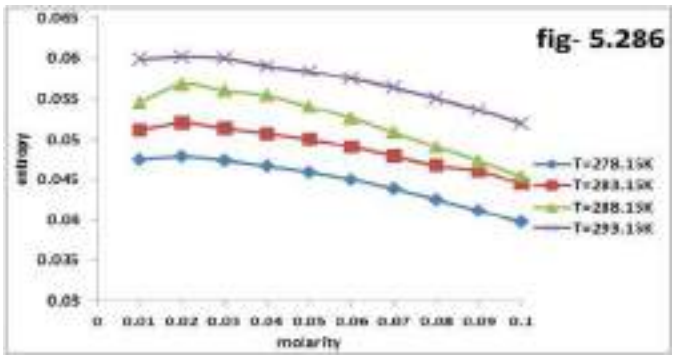
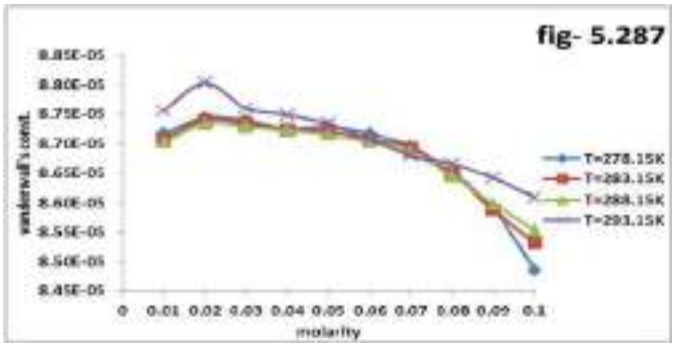


fig- 5.284
molar volume
molarity
T=278.15K
T=283.15K
T=288.15K
T=293.15K





III. RESULTS AND DISCUSSION

The outcome of experiments analyzed by Ultrasonic and allied parameters with different concentration of salicylamide with butanol at temperature T=278.15K-293.15K it has been revealed graphically. Nonlinear sense of ultrasonic velocity with increase in mole fraction of salicylamide gives the dipole-dipole interaction or hydrogen bonded complex structure between unlike molecules which leads to increase in sound velocity and decrease in compressibility. At low molarities, the number of hydrogen bonds formed may less and at high molarities it may more because of solute-solute interactions and it forms a tightly bounded system. Adiabatic compressibility is a wide measure of intermolecular association or dissociation or repulsion. Free length decreases as the mole concentration increases; these considerable interactions between solute and solvent molecules.

Ultrasonic velocity rises on decrease in free length and vice-versa. A sudden decrease in molecular free length shows a tightly packing molecules or strong interaction. Increase behavior of acoustic impedance with molarities may provide the strength of inter molecular interaction so it reveal on the basis of the interaction between solute and solvent molecules. The linear changes of Relative association observe the particular interaction exists in the solution and quite it is strong in nature. Internal pressure gives an outstanding examination of the solution phenomenon and evaluating various properties of the liquid state. The changes in the internal energy of liquid mixtures, it seems to undergo a very small isothermal change. So it is a measure of cohesive or binding forces between solute and solvent molecules. The internal pressure may provide essential information regarding the nature and strength of forces exist between the molecules. The variation of surface tension also supports the significant associative nature in the solution.

Loss of di-polar associating nature and difference in size and shape of the molecules, which provide to decrease in velocity and increase in compressibility. Increase in the compressibility value indicates the weakening of molecular interactions. The positive value of entropy indicates the reaction must be spontaneous process of flipping of molecule over each other. Increase in temperature of drug solution increases the disorder of the molecules; hence there is a reduction in molecular interaction and cohesive forces between the molecules. Effect of temperature produced destruction in hydrogen bonding between the molecules and hence weakens the molecular interaction. As the effect of this drug solution behaves dissociative nature

IV. CONCLUSION

The outcome of ultrasonic measurements reveals knowledge of a number of the thermophysical properties towards the strong intermolecular interaction provides the structure making property in the liquid mixture. The various kinds of intermolecular interactions are the micro analysis of the drug in terms of solute-solute, solute-solvent, ion-ion, dipole-dipole interactions which can directly signify the utility of the drug.

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Perspectives of Substituted Ferrites in Current Scenario

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ABSTRACT
During last few decades, there has been a growing degree of interest in ferrites. The magnetic, electrical, optical and other properties of ferrites gain attention due to their use in various applications such as medical diagnostics, rechargeable lithium batteries, high frequency media, solar energy devices and magnetic fluids. The high resistivity and low eddy currents makes ferrites the better choice over metals. The aim of this review paper consists of an overview on the ferrites, classification of ferrites, synthesis methods and its potential applications in different fields of technology as well as summarize the major researches in the field of Mn-Zn ferrites on one platform.

Keywords : Ferrites, Magnetic Fluids, Spinel, Retentivity, Nanoparticles

I. INTRODUCTION
Ferrites are chemical compounds obtained as powder or ceramic bodies with ferrimagnetic ordering due to the superexchange or interaction between the magnetic moments properties formed by iron oxides as their main component. Ferrites have the molecular formula of MFe2O4, where M stands for the divalent metals such as Fe2+ , Mn2+, Co2+, Ni2+, Cu2+, Mg2+, Zn2+ or Cd2+ . Like most other ceramics, ferrites are hard and brittle. They are also insulating or semiconducting metal oxides that exhibit high coercivity, high electrical resistance, low eddy current and dielectric loss with moderate permittivity . No other material has such a wide range of properties and therefore these materials are exploited for vast applications in various fields like transducers, activators, recording media, permanent magnets, phase shifters, electrode material for Lithium ion batteries, solid oxygen fuel cells and computer technology . The ferrite materials also exhibit dielectric properties and do not conduct electricity easily; therefore ferrites became an alternative for the metal magnets like iron and nickel . Ferrites are also magnetic dielectric materials that allow an electromagnetic wave to penetrate via it, thereby permitting an interaction between the wave and magnetization with in the medium . This makes them suitable for high frequencies application because an ac field does not induce undesirable eddy currents in an insulating material; even in microwave frequencies and they find very important applications in the field of microwave and optical communications . Therefore, due to the technological importance of ferrites increasing continuously as many discoveries required the processing of these materials is important to modify its properties as per the desired applications . Ferrites are structure sensitive materials and their properties critically depend on preparation method,

sintering condition, and amount of constituent metal oxides, grain size, porosity and the dopants or substituted elements. A. B. Gadkari, et al. reported that; ferrites are highly sensitive to preparation method, sintering condition, amount of constituent metal oxides, various additives include in dopants and impurities . These ferrite materials can be prepared by conventional synthesis methods such as; high-temperature solid-state reaction method, sol–gel method, co-precipitation, pulsed laser deposition, high-energy ball milling and hydrothermal synthesis methods.

II. METHODS AND MATERIAL

Types of ferrite materials

Ferrite materials can be classified depending on both crystal structure and magnetic properties. Depending on their crystal structural ferrites are classified in to three types: spinel ferrites, garnets, and hexagonal ferrites.

2.1 Spinel ferrites

Spinel ferrites are represented by the formula unit AB2O4. Most of the spinel ferrites form cubic spinel structure with oxygen anions in face centered cubic (fcc) positions and cations in the tetrahedral and octahedral coordinated interstitial lattice sites, forming the A and B sublattices . The spinel ferrites possess the general mineral spinel structure of MgAl2O4 which was first determined by Bragg and Nishikawa in 1915 . They are also called cubic ferrites with chemical formula of MFe2O4 where M is a divalent transitional metal ions such as Co2+, Mn2+, Zn2+, Fe2+, Mg2+, Ni2+, Cd2+, Cu2+ and etc. Depending upon the magnetic or non-magnetic nature and distribution of cations among A and B sublattices, spinel ferrites can exhibit properties of different type magnets, like: ferrimagnet, antiferromagnet and paramagnet. Among the broad classification of magnetic oxides, the spinel ferrites, due to their high magnetic permeability and low conduction losses find wide use in high frequency devices. S. Sugimoto et al. reported that spinel ferrites are the most widely used family of ferrites because of their high values of electrical resistivity and low eddy current losses make them ideal for their use at microwave frequencies. They are used in magnetic recording media, a microwave device, and magnetic resonance imaging. The spinel ferrites have been classified in to three types due to the distribution of cations on tetrahedral (A) and octahedral (B) sites. They are normal, inverse and partial inverse spinel ferrite.

2.1.1 Normal spinel ferrites

In normal spinel ferrites, all the divalent cations occupy tetrahedral site and trivalent cations occupy the octahedral sites. The general formula is: [M2+]T [M3+ 2]O O4 Where letter ‘O’ indicates octahedral site occupancy and the ‘T’ indicates tetrahedral site occupancy. Here, octahedral sites are occupied by only one kind of cations. In other words, in this structure, the non-magnetic ions occupy the A sites and consequently there is no AB interaction. The negative BB interaction now becomes dominant and the trivalent cations align themselves in an anti-parallel fashion; thereby producing zero net magnetization. Examples of normal spinal ferrites are ZnFe2O4 and CuFe2O4.

2.1.2 Inverse spinel ferrites

In inverse spinel ferrites, the trivalent cations occupy both the octahedral and tetrahedral sites and divalent cations occupy only octahedral sites. The general formula is; [M3+]T [M2+M 3+]O O4 In other words, in this case there are 8 M2+ ions that occupy 8 octahedral sites and the 16 Fe3+ ions are divided into 8 octahedral sites and 8 tetrahedral sites . NiFe2O4 and CoFe2O4 has an inverse spinel crystal structure.

2.1.3 Mixed spinel ferrites

In mixed spinel ferrites, the divalent and trivalent cations are randomly distributed among the tetrahedral and octahedral sites. It is intermediate

cation distribution between the normal spinel and inverse spinel. The cation distribution is given by the general formula: (M3+ δM 2+ 1-δ)[M3+ 2-δM 2+ δ] O4

where δ is the degree of inversion which depends on the synthesis techniques, calcination and sintering temperature with a value of zero for the normal and one for the inverse distribution . MnFe2O4 is an example of mixed spinel structure.

2.2 Garnets

Garnets have the general formula M3+Fe5O12 where M = La, Y, Sm, Eu, Gd, Tb etc. and have applications in microwave systems. They have complex crystal structure with the cell shape is cubic and the edge length is about 12.5Å . The coordination of the cations is considerably more complex than spinels, with 24 M3+ in dodecahedral sites, 24 Fe3+ ions in tetrahedral sites and 16 remaining Fe3+ in octahedral sites. Yoder and Keith reported that substitutions of cations can be made in ideal mineral garnet of Mn3Al2Si3O12. They produced and reported the first silicon free garnet Y3Al5O12 by substituting Y3+ Al3+ for Mn2+ Si4. Bertaut and Forret prepared Y3Fe5O12(YIG) in (1956) which is well-known garnet and measured their magnetic properties . In (1957) Geller and Gilleo also prepared and investigated silicon free garnet Gd3Fe5O12 which is also a ferromagnetic compound. Similar to spinels and hexagonal ferrites, a wide range of transition metal cations can substitute M3+ or Fe3+; especially rare earth ions may replace the ions on octahedral and dodecahedral sites. Each type of lattice site will accept other metal ions at dodecahedral sites, octahedral sites and at tetrahedral sites. Thus, in garnets, pentavalent ions such as V5+ and As5+ can occupy tetrahedral sites, while Ca2+ substitute ions on dodecahedral sites. They are important due to their applications in memory structure.

2.3 Hexagonal ferrites

Hexagonal ferrites are well established magnetic materials represented by the general Formula: M2+Fe12O19 where M = Ba, Sr, Ca, Pb, etc are important in permanent applications. They can be found in cost-effective hard magnets as well as in components for high frequency applications and they are widely used as permanent magnets and characterized by possessing a high coercivity. The hexagonal ferrite lattice is similar to the spinel structure, with the oxygen ions closely packed, but some layers include metal ions, which have practically the same ionic radii as the oxygen ions. This lattice has three different sites occupied by metals: tetrahedral, octahedral, and trigonal bi pyramid surrounded by five oxygen ions. Hexagonal ferrites have a variety of magnetic structures and properties that are determined by structure and particular composition which is identified by Went et al. (1952) & Jonker et al. (1956). Out of iron oxides, hexagonal ferrites are a broad subset which is of great practical importance as well as scientific interest. These systems are ferrimagnets as dominant interaction between magnetic ions and oxygen-mediated anti-ferromagnetic superexchange. They are widely used as permanent magnets and have high coercivity. Hexagonal ferrites have larger ions than that of garnet ferrites and are formed by the replacement of oxygen ions. Most of these larger ions are barium, strontium or lead.

2.4 Classification of ferrites on the basis of magnetic property

Depending on the magnetic properties, ferrites are often classified as hard and soft ferrites. This classification is based on their ability to be magnetized or demagnetized not their ability to withstand penetration or abrasion.

2.4.1 Hard ferrites

Hard ferrites are characterized by a large value of retentivity and coercivity after magnetization that means; hard ferrites are difficult to magnetize or demagnetize as soft ferrites easily which is an essential characteristic of a permanent magnets, so they find applications as permanent magnets in radios; e.g., strontium and barium ferrite. Their maximum

magnetic field is about 0.35 T and magnetic field strength is about 30 to 160 kA/m. Hard ferrites are ferromagnetic materials that are typically oxides of mixed transition metals that containing the iron.

For example, MnFe2O4 and Mg-Zn ferrite are described as Mn1- xZnxFe2O4 . They are usually insulating in nature and like most other ceramics, they are hard and brittle. These hard ferrites are used in applications such as magnetic components in microelectronics. The most commonly used hard ferrite is Cobalt ferrite, CoFe2O4 (CoO·Fe2O3), it is used in magnetic recording applications such as audio-/video-tape and high-density digital recording disks. Most hard ferrite particles used in synthesizing magnetic fluids exhibit a spinel structure. This structure consists of a cubic closed packed case of oxygen ions with the metallic ions occupying the tetrahedral A and octahedral B sites . Magnetically hard ferrites have these advantages and particular properties: economical raw materials, very good resistance against corrosion and chemicals and easy to magnetize.

2.4.2 Soft ferrites

Ferrites which are magnetically soft are often described as soft ferrites. They are characterized by a small value of coercivity so they cause low hysteresis loss at high frequency owing to which they are widely used in electromagnetic cores of transformers, switching circuits in computers and radio field inductors. Examples of soft ferrites are manganese-zinc ferrite, nickel ferrite, and lithium ferrite. Soft ferrites are those that can be easily magnetized or demagnetized. This shows that soft magnetic materials have low coercive field and high magnetization that is required in many applications. Due to the low coercivity of soft ferrites, their magnetization can switch direction without much energy requirement or heat generation. For this reason; soft ferrites find wide applications in electronic industries or in cores of modern electronic components such as recording heads, filters, switching power supply transformers, amplifiers, etc.

2.5 Ferrites synthesis methods

There are varieties of available synthesis methods, which can be successfully used to synthesize ferrite materials. The most commonly used synthesis methods are discussed below.

2.5.1 Solid state reaction synthesis

The physical, chemical and electrochemical properties of materials depend to a great extent on the synthesis methods. Several synthesis methods have been developed for the preparation of materials. Some of them are solid state synthesis, co-precipitation, sol-gel process, hydrothermal method and etc. Solid state reaction synthesis method is one of the common methods employed for preparing powder materials from oxides, carbonates, hydroxides, nitrates, sulfates, acetates, oxalates, and other metal salts. This technique involves heating mixtures of two or more solids to form a solid phase product. In this synthesis method, solvents are not used. Since, solids do not react with each other at room temperature, solid state synthesis needs much higher temperatures and longer heating time than other techniques. Solid state reaction differs from solution reaction, since in solution all ions and molecules are available for reaction. However, this is not the case in a solid state reaction. Here, the reaction takes place only at that point where the reactions are in intimate contact with each other. Once the product layer is formed at the interface between the reactants, further progress of the reaction depends upon the diffusion of one or both reactants through this product layer. This depends on various factors such as the size of the diffusion ions, the reaction temperature, and also the presence of defects and the history of the sample.

2.5.2 Sol-gel synthesis

Sol-gel processing is a wet chemistry technique, which can be used to synthesize solid electrolyte ferrite materials and powders as well as nanoparticles by a process preparation of a sol, gelation and aging of

it and removal of the liquid . A sol is a stable colloidal suspension of solid particles or molecular precursors in a liquid solvent. The colloidal particles are agglomerates and form polymer chains creating a polymer gel, a three dimensional continuous network including a liquid phase. The most widely used precursors for the sol-gel preparation are metal alkoxides, metal chlorides, nitrates and acetates which undergo hydrolysis and poly-condensation reactions. The sol-gel process works by following mechanism. Firstly, formation of stable solutions of the alkoxide or solvated metal precursor. Then process of gelation resulting from the formation of an oxide or alcohol bridged network by a poly-condensation or polyesterification reaction resulting in a dramatic increase in the viscosity of the solution. Within the next step is the process of gel aging during which the gel transforms into a solid mass. The next stage includes drying of the gel, when water and other volatile liquids are removed from the gel network. Dehydration is the fifth phase, where the gel is stabilized against rehydration. Calcining the monolith at temperature up to 800°C is normally required in order to achieve the final product. The sol-gel method has many advantages. The mixing of precursors taking place in a very short period of time and homogeneous gel can be obtained. During the sol-gel method, the chemical reactions occur more readily, with a much lower reaction temperature, which is advantageous in comparison to for instance solid-state reaction synthesis. Along with the advantages, the disadvantages also exist. For example, the precursors used for the synthesis could be expensive and in the case of organic precursors these could be toxic. One of the major disadvantages that the sol-gel process itself takes long processing times or several steps are involved.

2.6 Applications of ferrites

In the past decade MnZn have attracted a large amount of attention in academia due to its advantageous features that make MnZn ferrites suitable to be used in many applications of daily life. . Due to useful magnetic, electrical and optical properties of ferrite nanoparticles, researchers are taking interest in the synthesis of ferrite nanoparticles and making their use in a lot of applications that include medical field, information technology, antenna, microwave absorbing materials, biosensors and many electronic applications.

MnZn ferrites have a broad area of applications due to high saturation magnetization , high initial permeability , low power loss. The application area of MnZn ferrites include power applications, microwave devices, magnetic fluid , radar absorbing system, high frequency applications , bio-medical , water purification etc. Use of MnZn ferrites in the field of power application attracted great attention in the research areas. From last many years the MnZn ferrites are synthesized to be used in power applications for making current convertors, power inductors with magnetic cores , electronic transformer cores , high frequency applications , electronics and communication.

2.6.1 Microwave devices

Ferrite nanoparticles have low electrical conductivity and low dielectric losses , so they can be used in microwave devices. MnZn ferrites are most suitable for their use in the microwave devices because of high permittivity, high resistivity, high stability, high value of saturation magnetization, high curie temperature with low eddy current and low magnetic losses. Due to the use of ferrite nanomaterials, electronic devices can be mechanically hard, chemically stable and permit the materials to operate properly at a wide frequency range. There are a lot of advantages of the use of MnZn ferrites in the microwave devices. There is a decrease in the emission of unwanted EM waves from the device and also it absorbs the incoming EM waves that may harm the microwave device. MnZn ferrites are used in microwave systems because of their low loss and high saturation magnetization. Wang et al. synthesized MnZn ferrite nanoparticles

and the result showed that because of high reflection loss and broad absorbing band in low frequency (10 MHz to 1 GHz) these ferrites can be used in electromagnetic microwave absorbing field.

2.6.2 Radar absorbing devices

The radiations emitting from radar results in the increase in electromagnetic radiation pollution in the environment. These radiations reduce the efficiency and performance of electronic instruments and thus decrease their lifetime and safety. As MnZn ferrite belongs to the class of soft ferrites having high electrochemical stability, high permeability, high saturation magnetization and low power losses, it is used in many electronic applications. Ferrite nanoparticles can be used in the radar absorbing devices due to their high value of Curie temperature and temperature stability. Also the ferrite nanoparticles are environmentally safe that make their use easier in the radar absorbing devices. The application of MnZn ferrites in radar absorbing system is also attracting the researchers. Praveena et al. synthesized Ni0.4Zn0.2Mn0.4Fe2O4nano ferrites for radar absorbing. The high value of Curie temperature indicated homogeneity and temperature stability. The EPR spectra showed reduction in the peak width and increase in relaxation with increase in sintering temperature. These all results showed that the ferrite nanoparticles can be used for radar absorbing from few MHz to 2 GHz and also these materials are environmentally safe.

2.6.3 Image based diagnostics

A one-pot thermal decomposition method was used to synthesize a series of Zn2+ doped nanoparticles of (ZnxMn1-x)Fe2O4 and (ZnxFe1-x)Fe2O4 (x = 0, 0.1, 0.2, 0.3, 0.4, and 0.8). By carefully controlling Zn2+ doping level, nanoparticles of size 15 nm with single crystallinity and size monodispersity (s<5%) and having high magnetization value (175 emu/g) were obtained. The nanoparticles provided the large MRI contrast effects (r2 = 860 mm–1s–1) with an eight to fourteen fold increase in MRI contrast and a fourfold enhancement in hyperthermic effects compared to conventional iron oxide nanoparticles. This enhancement was significant for clinical purposes as the nanoparticle probe dosage level can be progressively lowered when using probes that have improved contrast enhancement effects. For (ZnxMn1-x)Fe2O4 nanoparticles, Zn2+ ions mainly occupy tetrahedral sites of the spinel matrix which was confirmed by using extended X-ray absorption fine structure (EXAFS) analysis to examine the Zn and Fe K-edges. To detect small sized pathogenic targets precisely at an early stage, MRI contrast agents are often used to highlight those specific areas of interest. Due to high imaging contrast effects, magnetic nanoparticles can increase the difference between pathogenic targets and normal tissues via MRI. One of the most appropriate ways to increase the MR contrast effects is the optimization of saturation magnetization (Ms) that is directly related to the relaxivity coefficient (r2). The relaxivity coefficient (r2) is determined by a slope of R2 against nanoparticle concentration and often used as an indicator for contrast effects. The relaxivity coefficient (r2) of contrast agents can be tuned and further enhanced by engineering magnetic parameters.

2.6.4 Electronic devices

MnZn ferrite nanoparticles are used in making many electronic devices due to their enhanced electrical properties such as high value of resistivity, low ac conductivity, low power losses etc. Dobak et al. studied miniaturization of components due to low loss MnZn ferrites. Also, Sun et al. studied effect of ZrO2 addition on the microstructure and various properties of MnZn ferrites and found that the optimal values of initial permeability (2322), saturation magnetization (522 mT) and power loss (386 kW/m3) make it suitable for switch mode power supply applications. Due to suitable electrical and magnetic properties of the Sc3+ doped Mn–Zn ferrites, these were useful for modern technological application as well as for low and high frequency application. MnZn ferrites are also

used to construct power inductors , wireless power transfer applications and for making inductive components.

2.6.5 Telecommunication and others

One of the major use of MnZn ferrites is in telecommunication and high frequency applications. MnZn ferrites have applications in the field of bio–medical and hyperthermia. Hurtado et al. synthesized MnZn ferrite along with activated carbon composite for use in bio–medical applications. MnZn ferrites can be used to make ferrofluid due to high value of saturation magnetization. Arulmurugan et al. synthesized Co–Zn and Mn–Zn ferrite nanoparticles and found that because of low Curie temperature and high value of thermomagnetic coefficient, these ferrites can be used for preparing temperature sensitive ferrofluid. Praveena et al. synthesized Mn–Zn ferrite nanoparticles for high frequency applications. The ferrites had low power loss in frequency range 10Hz-1MHz. The constructed transformer with the ferrite material high efficiency and low surface temperature rise at frequency 1 MHz making it suitable for operating at high frequencies.

2.6.6 MnZn ferrites for onging COVID-19 pandemics

As nanomaterials are making a global impact on healthcare and socioeconomic development so are the viruses during pandemics. Nanoparticles of MnZn have unique physical and chemical properties that have associated benefits in development of potential therapeutic drugs, nanomaterial based environment friendly antiviral sprays, drug delivery and to develop anti-viral surface coatings in home appliances. This is attributed to the fact that the choice of synthesis method provides size and charge tunability properties to the MnZn ferrites. The size tunablity ensures that large amount of drug can be delivered into anatomically privileged sites of the virus while charge tunability would facilitate entry of drug in to charged parts of the virus . In addition, biosensors for the early detection of viral strains such the COVID 19 can also be developed with MnZn ferrites. For instance MnZn ferrites can readily be used to develop Giant magneto-resistance based sensors which have previously been used for virus detection.

III.CONCLUSION

The synthesis of MnZn particles has increased in the last ten years and most progress can be seen in the year 2016. Due to the fascinating properties of MnZn ferrites among the class of soft ferrites like high value of saturation magnetization, low value of coercivity, high initial permeability, narrow size distribution of the ferrite particles, low remenant magnetization, the researchers are taking interest in the synthesis of these ferrites.The co-precipitation and sol-gel method are the best for getting the fine crystallite size among all synthesis techniques. The XRD pattern of the MnZn ferrites has characteristic peaks showing the cubic spinel phase having Fd3m phase group. The shape of the prepared ferrite is nearly spherical but some distortion may be observed after doping. FTIR spectra confirmed the spinel phase of the ferrite nanoparticles having tetrahedral and octahedral sites.The value of saturation magnetization is highest when we synthesize the MnZn ferrites with proper amount of nickel doping by using sol–gel auto combustion method. Also, for getting the low value of coercivity sol–gel method is preferred. Generally, MnZn ferrites have a lot of applications including biomedical field, electronic devices, for making radar absorbing materials, for making ferrofluids etc. For enhancing the applications and advantageous properties of MnZn ferrite nanoparticles, further studies are required.The electrical and magnetic properties of MnZn ferrites can be enhanced by doping other metals such as cobalt, zinc, magnesium to make them suitable for use in agricultural and electrical applications. In the context of use of nanoparticles in the pandemic outbreak, such as in the recent COVID-19, MnZn soft ferrites can play a significant role in the development

of high contrast imaging dyes for viral strains in body fluids. Perhaps MnZn can also serve as a candidate nanomaterial for developing nanomaterial based medicines and therapeutics.

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A Volumetric and Acoustical Study to Explore Interactions between Saline Salts and Fertilizer in view to Control the Salinity of Soil

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Abstract: The salinity of soil has great effects on nutrients availability to plants or crops and on the ability of plant roots to absorb nutrients. Because of low productivity problems in the salt affected soils, fertilizers are applied to counteract the conditions which limit the plant absorption of nutrients. Thus the present work is aimed to understand the structural/molecular changes of solute (fertilizer) in solutions (saline salts) which results various solute-solvent, solvent-solvent and ion-solvent interactions in order find any way to control the salinity problem. These interactions depend on the nature of solvent, size and structure of ion. For this purpose Ammonium Sulfate (AS) is being used which contain the 10.6% of nitrogen. The numerous volumetric and acoustical properties depend upon the temperature, concentration and composition were calculated on the basis of measured experimental data of density and sound velocity of Ammonium Sulfate (AS) molecules and different saline salts. The effect of different volumetric and acoustical parameters with change in concentration and temperature were studied and the results were explored in terms of solute-solvent, solvent-solvent interactions and structure making or breaking effects are of great importance in understanding the extent and nature of solutions.

Index Terms: **Acoustical properties, Density, Fertilizer, Intermolecular interaction, Sound velocity.**

I. INTRODUCTION

Plant faces different environment stresses like high temperature, cold, draught, salinity, UV and other biotic stress. However among these stresses, salinity is considered the most limiting factor for productivity of crops. In agriculture all salts contains some amount of soluble salts. Among these many salts act as a source of essential nutrients for the healthy growth of plants. However when the quantity/concentration of the salts (like: Na^+, Ca^{++}, Mg^{++}, SO_4^{--}, Cl^-, HCO_3^-, K^+, CO_3^{--}) soils exceeds a particular value, then this (Salinity) affects growth rate and it results in plants with smaller leaves, shorter length and sometimes fewer leaves by reducing growth rate. Salinity changes the roots structure by lowering their length and mass, therefore roots may become thinner or thicker. (Shannon et al., 1999)

The salinity of soil has great effects on nutrients availability to plants or crops and on the ability of plant roots to absorb nutrients. Because of low productivity problems in the salt affected soils, fertilizers are applied to counteract the conditions which limit the plant absorption of nutrients. (Gowaliker et al., 2009) During literature survey it has been revealed that, a decrease in the ability of the plant to absorb NH_4 generally take place in saline soils containing excess amount of Na, Mg or Ca. Therefor application of NH_4 fertilizer not only correct the deficiencies but also decrease the adverse effect of Na, Mg and Ca on the plants. As numerous thermodynamic and acoustical properties like acoustic impedance, specific heat ratio, isothermal and isentropic compressibility etc. depend upon the temperature, concentration, composition and therefore are of great importance in understanding the extent and nature of solutions. Therefore the present work aimed to understand the structural (molecular) changes of solute (fertilizer) in solutions (saline salts) which explore various solute-solvent, solvent-solvent and ion-solvent interactions in order find any way to control the salinity problem. These interactions depend on the nature of solvent, size and structure of ion.

II. EXPERIMENTAL PROCEDURE

A. Material

AR grade chemicals (mass fraction purity 99.8%) as Ammonium Sulfate (CAS no.: 7783-20-2), Sodium Chloride (CAS no.: 7647-14-5) and Magnesium Chloride (CAS no.: 7786-30-3), were obtained from Himedia Lab. Pvt. Ltd., Mumbai. All chemicals were used without any further purification. The concentrations (0.02-0.2 mol-kg^{-1}) of Ammonium Sulfate in 0.5M aqueous saline salts were changed by weight. All the glassware's was washed with double distilled water as well as with acetone and dried before use.

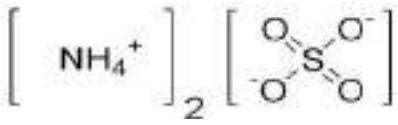

Fig*:* Structure of Ammonium Sulfate

B. Method

A digital ultrasonic velocity interferometer was used for measuring the ultrasonic velocity operating at frequency 2 MHz supplied from Vi Microsystems Pvt. Ltd., Chennai (Model VCT:71) with an overall accuracy 0.0001m/s. The source of ultrasonic waves was a quartz crystal excited by a radio frequency oscillator. The cell was filled with the desired solution and water at constant temperature was circulated in the outer jacket. The cell was allowed to equilibrate for 30min. prior to making the measurements.

The densities of the solutions were determined accurately using 10ml specific gravity bottle having accuracy ±2*10^{-2} kg/m^3 and digital electronic balance (Contech CA-34) having accuracy ±0.0001gm. An average of triple measurements was taken into account for better accuracy. The experimental temperature was maintained constant by circulating water with the help of an automatic thermostatic water bath supplied by Lab-Hosp. Company Mumbai having an accuracy ±1K temperature.

Table I: Density and Ultrasonic velocity of water at 288.15K temperature.

Current Work Data		Literature Data	
U. Vel. (U)	Density (ρ)	U. Vel. (U)	Density (ρ)
m/sec	kg/m^3	m/sec	kg/m^3
1466.032	999.103	1466.25	999.1

Table II: Abbreviations used.

M	Molal Concentration in mol./kg
CAS	Chemical Abstract Service
MHz	Mega Hertz
U_∞	Infinite Value of Ultrasonic Velocity

III. DEFINING RELATIONS

A For the derivation of several acoustical and thermo-dynamical parameters the following defining relations reported in the literature are used:

- Adiabatic Compressibility **$(\beta) = 1/(U^2\rho)$**
- Relative Change in Adiabatic Compressibility **$(\Delta\beta/\beta) = \{\beta-\beta_0\}/\beta$**
- Intermolecular Free Length **$(L_f) = K(\beta)^{1/2}$**
  Where, K be the Jacobson temperature dependent constant.
- Acoustic Impedance **$(Z) = U\rho$**
- Relative Association **$(R_A) = (\rho/\rho_0)(U_0/U)^{1/3}$**
- Isothermal Compressibility **(k_{T1})**
  $= 1.33*10^{-8}/(6.4*10^{-4}U^{3/2}\rho)^{3/2}$
- Isothermal Compressibility **(k_{T2})**
  $= 17.1*10^{-4}/(T^{4/9}U^2\rho^{1/3})$
- Specific Heat Ratio $(\gamma) = \{\frac{17.1}{T^{4/9}*\rho^{1/3}}\}$
- Relaxation Strength **$(r) = 1- (\frac{U}{U\infty})^2$**
- Non-Linearity Parameter **$(B/A)-1 = \{2+[\frac{0.98*10^4}{U}]\}$**
- Non-Linearity Parameter **$(B/A)-2 = \{-0.5+[\frac{1.2*10^4}{U}]\}$**

Isothermal Compressibility values have been computed using the McGowan's (McGowan's, 1969) Expression, using the arbitrary constant in the denominator of McGowan's expression by a temperature term. Pandey et al. (Pandey et al., 1994) suggested a relation for the evaluation of isothermal compressibility. Furthermore, Non-linearity parameter (B/A) values have been computed using the Hartmann-Balizer (Hartmann, 1979) and Ballou (Ballou et al. 1966) expression.

IV. RESULT AND DISCUSSION

A. Ultrasonic Velocity

In the present work ultrasonic velocity of pure water has been measured at 288.15K temperature and the observed data tabulated in the *Table I*. Comparison of observed data with literature data reported for water indicated that our results are in assent with the literature data.(Greenspan and Tschiegg, 1957) The ultrasonic velocity (U) of fertilizer: Ammonium Sulfate of varying concentrations (0.02-0.2 mol/kg) in 0.5M solution of both the saline salts solvents: NaCl and $MgCl_2$ measured at 288.15K temperature. The observed data of ultrasonic velocity increases with increase in concentration is shown in *Fig. 1*. Temperature and concentration affects the ultrasonic wave passing through solution. The increase in sound speed is accredited to the cohesion brought about by the ionic hydration and the construction of hydrogen bond between the fertilizer-water as well as fertilizer-saline salts. During the compression cycle of the ultrasonic wave, hydrogen atom are pushed closed

ensuring in a partially irreversible breaking of hydrogen bonds due to the absorption of energy. The fertilizer molecule form more compact structure with saline salt molecules. This functions as a material medium for sound waves. (Kumar, 2012)

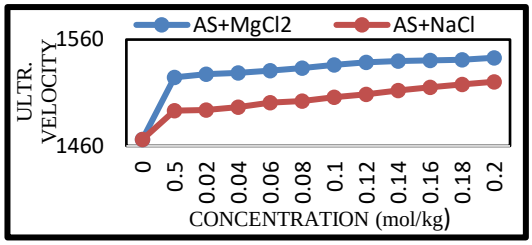

Fig. 1. Ultrasonic versus concentration at 288.15K temperature.

Table III: The values of Ultrasonic Velocity, Density and Adiabatic Compressibility, as a function of concentration of System (Ammonium Sulfate + 0.5M aq. Solution of ($NaCl/MgCl_2$) at temperature 288.15K.

Conc. (mol-kg^{-1})	T=288.15K					
	U (m/s)		ρ (Kg/m^3)		β*10^{-10} (m^{2}N^{-1})	
	NaCl	$MgCl_2$	NaCl	$MgCl_2$	NaCl	$MgCl_2$
0.00	1466.032	1466.032	0999.100	0999.100	4.66	4.66
0.5M	1493.123	1524.418	1019.700	1037.350	4.40	4.15
0.02	1493.82	1527.372	1020.020	1043.238	4.39	4.11
0.04	1496.658	1528.557	1020.869	1044.752	4.37	4.10
0.06	1500.649	1530.932	1021.234	1045.601	4.35	4.08
0.08	1502.366	1533.112	1022.056	1046.665	4.33	4.06
0.10	1505.812	1536.304	1022.894	1047.105	4.31	4.05
0.12	1508.695	1538.704	1023.444	1048.681	4.29	4.03
0.14	1512.171	1539.907	1024.395	1049.233	4.27	4.02
0.16	1515.079	1540.509	1024.998	1050.962	4.25	4.01
0.18	1517.999	1541.072	1025.894	1051.781	4.23	4.00
0.2	1520.343	1542.922	1026.583	1052.814	4.21	3.99

B. Density

Density of pure water has been measured at 288.15K temperature and the observed data tabulated in the *Table I*. After Comparison of observed data with literature data reported for water indicated that our results are shows well agreement with the literature data. (Chauhan and Kumar, 2014; Naseem and Jamal, 2013) As density is a measure of compactness in matter within the substance and is closely related to packing of materials in the system and hence different material possess different densities. By increasing pressure on material or substance one can increase the density while increase in temperature results in decrease in density of material or substance. The density (ρ) of both the systems (as shown in *Fig. 2*), increases with increase in concentration due to improve in compactness or structure of solvent by the addition of solute molecules. This indicates association occurs between solute and solvent molecules. (Malasane, 2013) The increase in density results increase in the molar volume indicating the association in the components of the constituent molecules and confirms the structural rearrangement.

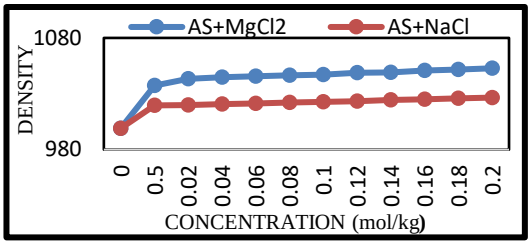

Fig. 2. Density versus concentration at 288.15K temperature.

C. Adiabatic Compressibility

Physico-chemical properties of liquid can be understood by adiabatic compressibility (β) as the hydrogen bonding between the unlike components in the solutions decreases with the compressibility. In the present case it is found that the adiabatic compressibility decreases with increase in concentration. Because, as water is polar solvent and when salts and fertilizer mixed, the well intermolecular interaction occurred, resulting in close packing of molecules. The decrease values of adiabatic compressibility shown in *Fig. 3* Indicate the strong association of fertilize and saline salts molecules. The compressibility of the solvent is higher than that of solution and decreases with increase in concentration of the solution. (Endo, 1973)

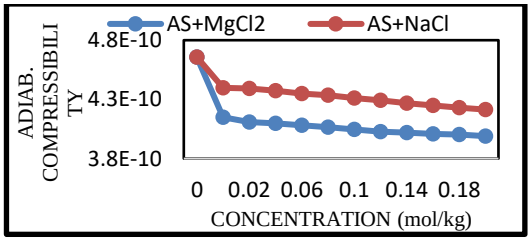

Fig. 3. Adiabatic compressibility versus concentration at 288.15K temperature.

Table IV: The values of and Relative change in Adiabatic Compressibility, Intermolecular Free Length and Acoustic Impedance as a function of concentration of System (Ammonium Sulfate + 0.5M aq. Solution of ($NaCl/MgCl_2$) at temperature 288.15K.

Conc. (mol-kg^{-1})	T=288.15K					
	Δβ/β		L_f *10^{-11} (m)		Z	
	NaCl	$MgCl_2$	NaCl	$MgCl_2$	NaCl	$MgCl_2$
0.00	-0.0043	-0.0043	4.36	4.36	1464713	1464713
0.5M	-0.0065	-0.0065	4.24	4.11	1522538	1581355
0.02	-0.0087	-0.0087	4.23	4.09	1523726	1593412
0.04	-0.0109	-0.0109	4.22	4.09	1527891	1596963
0.06	-0.0130	-0.0130	4.21	4.08	1532513	1600744
0.08	-0.0130	-0.0130	4.20	4.07	1535502	1604655
0.10	-0.0153	-0.0153	4.19	4.06	1540286	1608671
0.12	-0.0175	-0.0175	4.18	4.05	1544065	1613609
0.14	-0.0197	-0.0197	4.17	4.05	1549060	1615721
0.16	-0.0219	-0.0219	4.16	4.04	1552953	1619017
0.18	-0.1009	-0.1633	4.15	4.04	1557306	1620869
0.20	-0.1051	-0.1672	4.15	4.03	1560758	1624410

D. Relative Change in Adiabatic Compressibility

After calculating and plotting the graph of relative change in adiabatic compressibility against concentration as shown in *Fig. 4* it is found that the negative values of 'Δβ/β' is due to the solute-solvent interaction. Such an increase in 'Δβ/β' with increase in concentration may be attributed to an increase in the cohesive forces in solution. (Sumanthi and Varalakshmi, 2010) The negatively increase in 'Δβ/β' values confirms the negatively increase of bulk modulus values with concentration indicates that the hydrogen bonding between the unlike components in the solution increases. (Iqbal and Venrall, 1989)

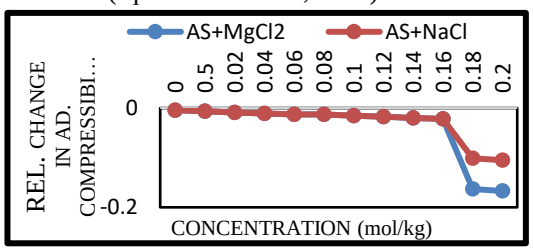

Fig. 4. Relative change in adiabatic compressibility versus concentration at 288.15K temperature.

E. Intermolecular Free Length

Intermolecular free length (L_f) is one of the important parameter in determining the nature as well as strength of interaction between the components of solution. It is the average distance between the surfaces of two neighboring molecules, which is called intermolecular free length. (Thirumaran and Inbum, 2011) intermolecular free length is the major factor in determining the existence of inter or intra molecular interactions among the solute and solvent molecules due to which structural rearrangement is affected. In the current work, using the sound velocity and density data the intermolecular free length calculated with the help of Jacobson's temperature dependent constant. Variation of free length is shown in *Fig. 5*. It is observed that the free length decreases with increase in concentration of fertilizer in saline solution, shows a significant interaction among the fertilizer and electrolyte solution. Among both the saline salts (NaCl and $MgCl_2$) intermolecular free length values are found low in water, while in the case of electrolyte solutions, it is found low $MgCl_2$ indicating strong intermolecular interaction of fertilizer with $MgCl_2$. The observed order of variation of intermolecular free length (L_f) in water as well as in salt solution is: $NaCl>MgCl_2>H_2O$

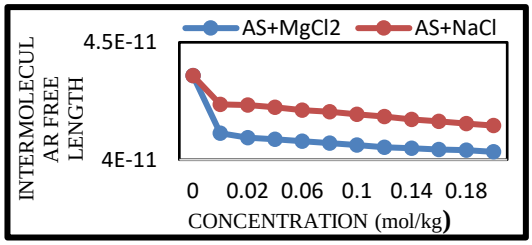

Fig. 5. Intermolecular free length versus concentration at 288.15K temperature.

F. Acoustic Impedance

The values of acoustic impedance for fertilizer: Ammonium Sulfate of different weight fraction viz. 0.02-0.2mol/kg in 0.5M solution of aqueous saline salt solutions of NaCl and $MgCl_2$ were calculated and tabulated in *Table IV* respectively. It is observed that the acoustic impedance (Z) values of Ammonium Sulfate fertilizer increases with increase in concentration of fertilizer in the both 0.5M aqueous electrolyte solutions and the values centered around 1Rayal as shown in *Fig. 6*. The increase in impedance values supports to the effective solute-solvent interactions completed through hydrogen bonding.(Nithiyanathan and Palanippan, 2012) The increase in the values of acoustic impedance with increase in weight fraction of fertilizer in both electrolyte solutions means the distance between the molecules in the mixture decreases and thereby increasing the potential energy of the interaction between the molecules which leads to observed increase in the value of ultrasonic velocity and decrease in the vales of intermolecular free length. The order of variation of acoustic impedance (Z) in water as well as in salt solution is:

$MgCl_2>NaCl>H2O$

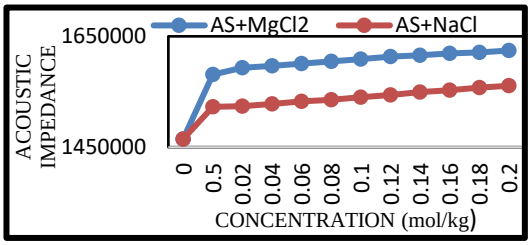

Fig. 6. Acoustic Impedance versus concentration at 288.15K temperature.

G. Relative Association

Relative association (R_A) is depend upon two factors: (1) The breaking of solvent structure on addition of solute to it and (2) the salvation of solutes that are simultaneously present. As shown in *Fig. 7*, the increase of 'R_A' with concentration suggests that close association of component of molecules and there exist intermolecular interactions.(Idrees et al., 2003; Mehra and Vats, 2010) Hence, observed order of increasing relative association of Ammonium Sulfate fertilizer in water as well as in both (NaCl and $MgCl_2$) electrolyte solution is: $H_2O<NaCl<MgCl_2$

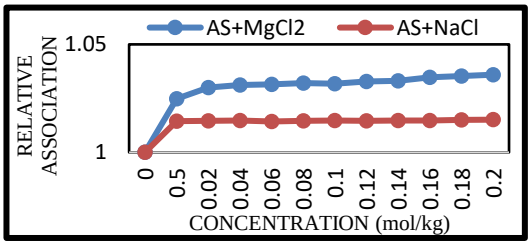

Fig. 7. Relative association versus concentration at 288.15K temperature.

Table V: The values of Relative Association and Isothermal Compressibility (kT_1) & (kT_2) as a function of concentration of System (Ammonium Sulfate + 0.5M aq. Solution of ($NaCl/MgCl_2$) at temperature 288.15K.

Conc. (mol-kg^{-1})	T=288.15K					
	R_A		(kT_1 *10^{-11}) (m^{2}N^{-1})		(kT_2 *10^{-11}) (m^{2}N^{-1})	
	NaCl	$MgCl_2$	NaCl	$MgCl_2$	NaCl	$MgCl_2$
0.00	1	1	6.19	6.19	6.42	6.42
0.5M	1.01441	1.02486	5.76	5.35	6.15	5.87
0.02	1.01457	1.03001	5.75	5.29	6.14	5.83
0.04	1.01477	1.03124	5.72	5.27	6.12	5.82
0.06	1.01423	1.03154	5.68	5.24	6.08	5.80
0.08	1.01466	1.03210	5.66	5.22	6.07	5.78
0.10	1.01472	1.03182	5.62	5.19	6.04	5.76
0.12	1.01462	1.03283	5.59	5.16	6.02	5.74
0.14	1.01478	1.03311	5.56	5.15	5.99	5.73
0.16	1.01473	1.03468	5.53	5.13	5.96	5.72
0.18	1.01496	1.03536	5.50	5.12	5.94	5.71
0.20	1.01512	1.03596	5.47	5.1	5.92	5.7

H. Isothermal Compressibility

The overall trends in the isothermal compressibility (k_{T1} and k_{T2}) are as shown in *Fig. 8* and *Fig. 9*. It has been found to be decreasing with increase in concentration of Ammonium Sulfate fertilizer in water as well as in aqueous solution of NaCl and $MgCl_2$ of 0.5M. The decrease in 'k_T' values with increase in concentration of fertilizer seems to be the result of corresponding decrease in free volume. (Millero, 1969) As the weight fraction of fertilizer increases in the electrolyte solutions, the large proportion of the water molecules are electro-stricted and hence the amount of bulk water decreases causing the compressibility to decrease.

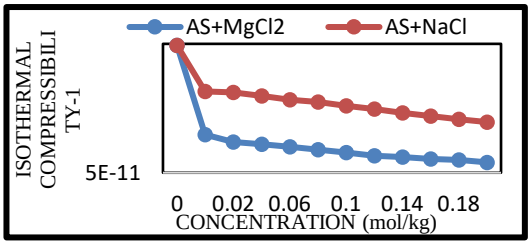

Fig. 8. Isothermal compressibility-1 versus concentration at 288.15K temperature.

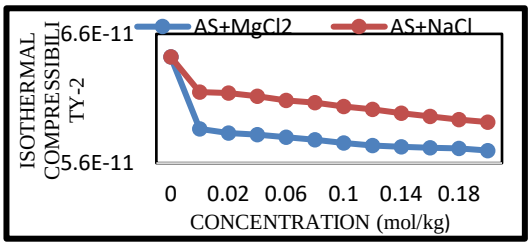

Fig. 9. Isothermal compressibility-2 versus concentration at 288.15K temperature.

I. Heat Capacity Ratio

Fig. 10 shows the variation of specific heat ratio of varying weight fraction (0.02M-0.2M) of fertilizer: AS in water and 0.5M aqueous solution of NaCl and $MgCl_2$ solution at 288.15K temperature. The heat capacity ratio (γ) is constantly decreasing, which throw light on the fact that specific heat at constant volume is decreasing constantly with increasing concentration.

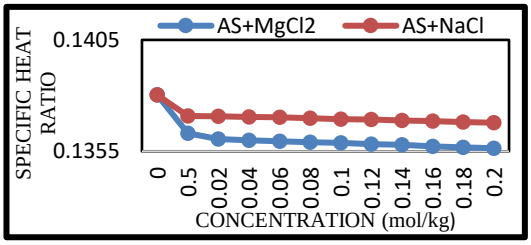

Fig. 10. Specific heat ratio versus concentration at 288.15K temperature.

Table VI: The values of Heat Capacity Ratio and Relaxation Strength as a function of concentration of System (Ammonium Sulfate + 0.5M aq. Solution of ($NaCl/MgCl_2$) at temperature 288.15K.

Conc. (mol-kg^{-1})	T=288.15K			
	γ (K$^{4/9}$)$^{-1}$(kg$^{1/3}$m^{-1})$^{-1}$		r	
	NaCl	$MgCl_2$	NaCl	$MgCl_2$
0.00	0.138027	0.138027	0.160449	0.160449
0.5M	0.137091	0.136309	0.129134	0.092246
0.02	0.137077	0.136052	0.128321	0.088725
0.04	0.137038	0.135986	0.125006	0.087310
0.06	0.137022	0.135949	0.120333	0.084472
0.08	0.136985	0.135903	0.118319	0.081862
0.10	0.136947	0.135884	0.114270	0.078035
0.12	0.136923	0.135816	0.110875	0.075152
0.14	0.136881	0.135792	0.106773	0.073706
0.16	0.136854	0.135718	0.103334	0.072981
0.18	0.136814	0.135683	0.099875	0.072304
0.20	0.1367837	0.135638	0.097093	0.070075

J. Relaxation Strength

Relaxation strength is totally depends on the factor [1- $\frac{U}{U\infty}$]. Here 'U' be the ultrasonic velocity of solution and 'U_∞' is constant, has value 1600 m/sec. the decrease in values of relaxation strength with increase in concentration indicates solute- solvent interaction in the system (shown in *Fig. 11*). Which suggest the greater association between fertilizer and saline salts. (Baluja and Karia, 2000)

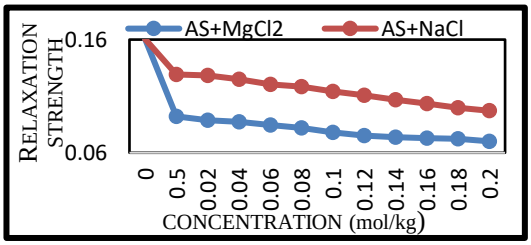

Fig. 11. Relaxation strength versus concentration at 288.15K temperature.

K. Non-linear Parameter

Non-linear parameter (B/A) obtain by Hartmann-Balizer and Ballou is related to the internal pressure, hardness, intermolecular potential, molecular structure and molecular interaction of liquid. *Fig. 12* and *Fig. 13* shows the non-linearity parameter for both the systems as a function of concentration at 288.15K temperature.(Joshi et al., 2017) The decreasing trends of both these parameters exhibits the interaction between the components of solute and solvent is stronger at higher concentration while mixing. Hence the accuracy of both the methods limits the usefulness of direct application of these methods to fluid mixture investigation. (Pandey et al., 2006; Sharma, 1983)

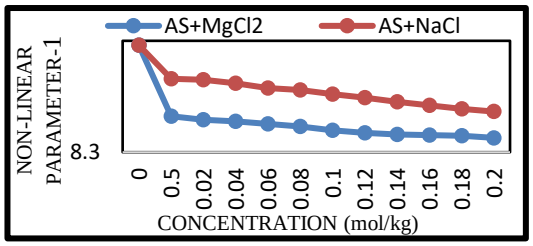

Fig. 12. Non-linearity parameter-1 versus concentration at 288.15K temperature.

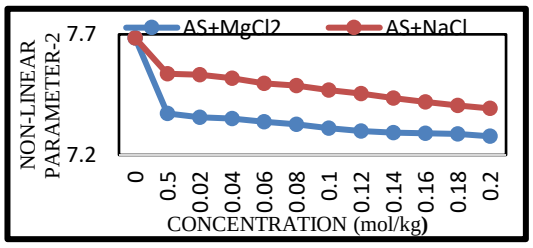

Fig. 13. Non-linearity parameter-2 versus concentration at 288.15K temperature.

Table VII: The values of Non-Linearity Parameter $(B/A)_1$ and $(B/A)_2$ as a function of concentration of System (Ammonium Sulfate + 0.5M aq. Solution of ($NaCl/MgCl_2$) at temperature 288.15K.

Conc. (mol-kg^{-1})	T=288.15K			
	$(B/A)_1$ (m^{-1}s)		$(B/A)_2$ (m^{-1}s)	
	NaCl	$MgCl_2$	NaCl	$MgCl_2$
0.00	8.684711	8.684711	7.68536	7.68536
0.5M	8.563424	8.428683	7.536846	7.371857
0.02	8.560362	8.41625	7.533096	7.356632
0.04	8.547922	8.411275	7.517864	7.350541
0.06	8.530508	8.401329	7.49654	7.338363
0.08	8.523044	8.392227	7.487401	7.327217
0.10	8.508117	8.378946	7.469122	7.310954
0.12	8.49568	8.368996	7.453894	7.298771
0.14	8.480749	8.364021	7.43561	7.292678
0.16	8.46831	8.361534	7.420379	7.289633
0.18	8.455867	8.359212	7.405144	7.28679
0.2	8.445914	8.351585	7.392956	7.277451

CONCLUSION

The various volumetric and acoustical parameters determined by using the measured values of density and ultrasonic velocity of Ammonium Sulfate solutions in both electrolyte solution (NaCl and $MgCl_2$). All parameters used to investigate the intermolecular interactions between the Ammonium Sulfate fertilizer molecules and saline salts. Values of intermolecular free length calculated from adiabatic compressibility data, which is positive and decrease with increasing weight fraction of fertilizer. Furthermore, acoustic impedance of fertilizer in both saline salts becomes positive and centered around unity with increasing weight fraction of fertilizer indicating solute-solute interaction is replaced by solute-solvent interaction. In the light of above observations and discussions, it may be further concluded that: the concentration, nature of solute, nature of solvent and its position plays an important role in determining the interactions occurring in the solution. Also from the rest acoustical and volumetric parameters it is concluded that H-bonding interaction is strong at higher concentration. Moreover, the values of density, relative association and compressibility for Ammonium Sulfate fertilizer are found to be maximum with $MgCl_2$ coz it has weak interaction with water molecules among the electrolyte solution and ergo can bind with fertilizer molecules more effectively.

CONFLICTS OF INTEREST

The authors declare no conflict of interest in the present research work.

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Ultrasonic characterization on fertilizer solutions in view to sustainable agriculture

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ABSTRACT

The volumetric and sound parameters are very helpful tools to predict the different kinds of intermolecular interactions and their strengths associated with them. It is revealed that the soil salinity problem incessantly spreads due to continuous changes in climate, excessive use of groundwater, and bulk use of low-quality water for irrigation. Excessive soil salinity reduces the many agricultural crop production, which is particularly sensitive throughout the development and growth of the plant. The effect of salinity could be controlled or counteracted by the application of suitable fertilizers into the saline soils. In this manuscript, numerous acoustic as well as thermodynamic parameters of ammonium sulphate (AS) fertilizer of different weight fractions at 293.15 K temperature have been studied. The results obtained, from calculated different acoustic and volumetric parameters expose the existence of strong interactions in the system taken for investigation, this depends on the ilk of molecules. The fertilizer: ammonium sulphate shows, maximum molecular interactions at higher concentrations in all the solvents (Water, Sodium Chloride, and Magnesium Chloride), and this can again castoff in view as a remedy for soil salinity using interactions among saline salts and fertilizers.

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1. Introduction

Physico-chemical properties of the liquid system can be studied through ultrasonic methods [1–4] due to its capability of characterizing the physicochemical behavior of liquid [5–7]. Since ultrasonic velocity depends on material density and elasticity, ultrasonic velocity, along with density and viscosity data helps us to study the weak interaction between ions, dipoles, hydrogen bonding, multipolar and dispersive forces [8,9]. The speed and efficiency of transmission of the ultrasound are sensitive to the nature of the bond and the masses of the molecules present in the system. Molecular association and dissociation existing in the liquid solutions can also be investigated through ultrasonic techniques (see Fig. 1).

Nowadays ultrasonic study of proteins in an aqueous electrolytic medium has gained much importance in assessing the nature of molecular interaction present in the mixture. During the last two to three decades, many researchers made use of the ultrasonic, viscometric and volumetric studies on a variety of pure liquids and their binary and ternary mixtures, liquid crystals, polymers, electrolytic solutions, drugs and evolved a wide range of thermodynamic data [9–12]. There is no thermo-acoustical and physicochemical study to examine the interactions between fertilizer and soil salts. During the literature survey, it is found that plant faces difficulty to uptake the macronutrients (such as Potassium and Nitrogen), when the soils contain excess quantity of Na, Mg, or Ca. Thus the application of these fertilizers in the saline soils acts in two ways: (1) Corrects the deficiencies, and (2) Drop the antagonistic effects of the Na, Cl, or SO_4 on the plants [13].

Knowledge about different thermo-acoustical properties by the proper explanation of their physicochemical behaviour provides a vision about the molecular interactions occurred in the solutions and could help to pick out a suitable and specific fertilizer for salty soil under ambient circumstances of temperature and concentration. Therefore, the present work is pointed to reconnoitre the molecular interactions between macronutrients fertilizers, water, and saline salts using electrolytic (NaCl and $MgCl_2$) solutions by ultrasonic and volumetric approaches.

In the present study, Ammonium Sulphate fertilizer has been cast-off. The numerous thermo-acoustic and volumetric parame-

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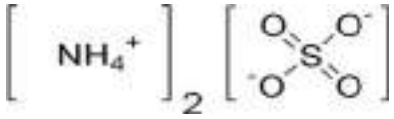

Fig. 1. Molecular structure of ammonium sulphate.

ters like adiabatic compressibility (β), intermolecular free length (L_f), internal pressure (π_i), acoustic impedance (Z), relaxation strength (r), surface tension (σ), isothermal compressibility (k_T), Non-linearity parameter (B/A), etc. provide useful information about the existence of intermolecular interactions amid the molecules of solute and solvent [14].

2. Experimental details

2.1. Materials

The following listed AR grade chemicals of mass fraction purity ≫ 99.7% were purchased and used without any further refinement.

- Ammonium Sulphate (Molecular weight: 132.14 g-mol^{-1} and CAS no.: 7783-20-2).
- Sodium Chloride (Molecular weight: 58.44 g-mol^{-1} and CAS no.: 7647–14-5).
- Magnesium Chloride (Molecular weight: 203.31 g-mol^{-1} and CAS no.: 7786–30-3).

The mole fractions of fertilizer were varied over an entire range (0.02–0.2 mol-kg^{-1}) in 0.5 mol-kg^{-1} solutions of electrolytic salts to have the experimental liquids (mixture) of different compositions. All the glassware was rinsed off with freshly double distilled water and acetone and dried well afore use to minimize unnecessary errors.

2.2. Method

The ultrasonic (sound) velocity measurement has been carried out by using a digital ultrasonic velocity interferometer operated at 2 MHz frequency with 0.0001 m-s^{-1} accuracy. Densities of the doubled distilled water and experimental liquids were determined using a 10 ml capacity specific gravity density bottle with ±2 * 10^{-2} kg-m^{-3} correctness and highly precise digital electronic weighing balance having accuracy ±0.0001g. An electronically operated automatic thermostatic water bath with ±1 K exactitude, used to make the temperature of the experimental solutions constant.

2.3. Theory

The following list, acoustic and volumetric parameters were determined from the observed data of ultrasonic (sound) velocity (U) and density (ρ) using the standard formulae taken from the literature:

- The values of speed of sound (U) and the density (ρ) of the medium helps in calculating the adiabatic compressibility using the equation of Newton Laplace [10]: $(\beta) = \frac{1}{\rho U^2}$ ...1
- Relative Change in Adiabatic Compressibility can be calculated by the relation: $(\Delta\beta/\beta) = \frac{\beta-\beta_0}{\beta}$ ...2
- Acoustic Impedance [15] depends on density and velocity by the equation given as (Z) = Uρ ...3
- The Intermolecular Free Length can be calculated from the relation,$(L_f) = K(\beta)^{1/2}$ ...4
- Where K stands for Jacobson's temperature-dependent constant. Whose value at any temperature (T) can be determined by (93.875 + 0.345 T) × 10^{-8}.
- Relative Association $(R_A) = \frac{\rho}{\rho_0}\left(\frac{U_0}{U}\right)^{1/3}$ ...5
- Surface Tension (σ) = {(6.3 * 10^{-4})ρU$^{3/2}$} ...6
- Hartmann-Balizar [16] has shown theoretically that the intermolecular potential energy is the dominant factor in determining sound speed, and its derivative in liquids. The expression proposed by Hartmann-Balizar is as follows: $(B/A)_1 = \{2 + [\frac{0.98*10^4}{U}]\}$ ...7
- According to the empirical rule of Ballou [17], there is a relationship between B/A of liquid and reciprocal of sound velocity as follows: $(B/A)_2 = \{-0.5 + [\frac{1.2*10^4}{U}]\}$ ...8
- Relaxation Strength [18] directly correlates with adiabatic compressibility. It can be calculated by the formula (r) = $1 - (\frac{U}{U_\infty})^2$ ...9
- Where U is the ultrasonic (sound) velocity of solvent or solution and U_∞ has the constant value of 1600 m/s.
- Specific Heat Ratio $(\gamma) = \{\frac{17.1}{T^{4/9}{}_*\rho^{1/3}}\}$ ...10
- The expression for McGowan's [19] Isothermal Compressibility is: $(k_{T1}) = 1.33 * 10^{-8}/(6.4 * 10^{-4}\ U^{3/2}\rho)^{3/2}$ ...11
- Pandey and coworkers [20] also proposed the formula for calculating the thermodynamic property such as Isothermal Compressibility (k_T) at a certain temperature (T) is: (k_{T2}) = {17.1 * 10^{-4}/(T$^{4/9}$U^{2}ρ$^{1/3}$) ...12
- From the calculated values of isothermal compressibility, isobaric thermal expansion coefficient and temperature, Internal Pressure of the liquid mixture can be obtained as: $(\pi_i) = \{\frac{T*\alpha}{k_T}\}$ ...13

3. Result and discussion

The tabulated data in Table 1, shows the good agreement between the observed and literature values of ultrasonic (sound) velocity and density of freshly used doubled distilled water measured at 293.15 K temperature [21]. The ultrasonic (sound) velocity (U) and density (ρ) of ammonium sulphate fertilizer of erratic weight fraction (0.02–0.2 mol-kg^{-1}) in water as well as in saline salt solutions of 0.5 mol-kg^{-1} concentration measured at a constant 293.15 K temperature. It is observed that the values of density and ultrasonic (sound) velocity increases with an increase in the weight fraction of solute in all the three solvents (H_2O, NaCl, and $MgCl_2$) are listed in Table 2. The increase in density and ultrasonic (sound) velocity is because of strong molecular interaction accredited to the enhancement in cohesive forces. Due to these cohesive forces, the molecules of fertilizer form a more compact structure with salt molecules as compared to water molecules [22].

In the present study, it is found that the adiabatic compressibility (β) and intermolecular free length (L_f) of ammonium sulphate fertilizer in all the three different solvents (H_2O, NaCl, and $MgCl_2$) decreases with the addition of solute (ammonium sulphate). This decrease in the values of adiabatic compressibility ratifies the close stuffing of molecules. Because, the water behaves as a polar solvent and when the solute (ammonium sulphate) is added to it, then intermolecular interaction occurred. The decreasing values of

Table 1
Ultrasonic velocity and density of freshly double distilled water at a temperature of 293.15 K.

Obtained data		Literature (Survey) data	
U. Velocity (U) m-s^{-1}	Density (ρ) kg-m^{-3}	U. Velocity (U) m-s^{-1}	Density (ρ) kg-m^{-3}
1481.496	0998.200	1482.940	998.202

Table 2
The calculated data of Ultrasonic (sound) Velocity, Density, and Adiabatic Compressibility for the systems: (1) Ammonium Sulphate + Water and (2) Ammonium Sulphate + 0.5 M concentration of aqueous Solution of NaCl/ $MgCl_2$ at 293.15 temperature.

CONC. (M) (mol/kg)	ULTRASONIC (SOUND) VELOCITY (m/sec)			DENSITY (Kg/m^3)			A. COMPRESSIBILITY * 10^{-10} (m^2N^{-1})		
	H_2O	NaCl	$MgCl_2$	H_2O	NaCl	$MgCl_2$	H_2O	NaCl	$MgCl_2$
0.00	1481.496	1481.496	1481.496	0998.200	0998.200	0998.200	4.56	4.56	4.56
0.02	1482.854	1507.720	1537.935	1000.864	1018.657	1041.605	4.54	4.32	4.06
0.04	1486.226	1510.043	1540.344	1002.298	1019.411	1043.038	4.52	4.30	4.04
0.06	1489.614	1513.540	1542.156	1003.847	1020.115	1043.744	4.49	4.28	4.03
0.08	1491.882	1515.294	1545.186	1004.973	1020.961	1044.594	4.47	4.27	4.01
0.10	1494.726	1518.228	1547.010	1005.999	1021.674	1046.334	4.45	4.25	3.99
0.12	1497.009	1520.583	1550.058	1007.152	1022.367	1047.030	4.43	4.23	3.98
0.14	1500.022	1522.945	1552.506	1008.552	1023.203	1047.869	4.41	4.21	3.96
0.16	1502.172	1525.909	1554.347	1009.878	1023.937	1048.606	4.39	4.19	3.95
0.18	1505.055	1528.288	1556.192	1010.960	1024.773	1050.469	4.37	4.18	3.93
0.20	1507.370	1531.870	1558.042	1011.830	1025.446	1051.349	4.35	4.16	3.92

adiabatic compressibility and intermolecular free length are tabulated in Tables 2 and 3 respectively. Both the parameters point out the strong association between fertilizer-saline salts molecules instead of fertilizer-water. The compressibility of the solvent is higher than that of the solution and decreases with an increase in the concentration of the solution.

After calculating the values of relative change in adiabatic compressibility by using the adiabatic compressibility values laid out in Table 3. It is found that the values are negative over the entire range of concentrations and confirm the good interface between the solute–solvent. This behavior $\Delta\beta/\beta$ parameter may be credited to an increase in the cohesive forces in solution by hydrogen bonding [23].

It is observed that the acoustic impedance (Z) and relative association (R_A) values increase with the increase in weight fraction of fertilizer (AS) in water and both salts solutions. The calculated values of both parameters are set out in Tables 3 and 4. The increase in impedance values is due to the decrease in intermolecular free length, making fewer gaps between the molecules. This supports the significant solute–solvent interactions in the binary and ternary experimental liquids [24–26].

The surface tension of liquid and liquid mixture is an important parameter for many biological and industrial processes. The addition of solute increases the surface tension of solution accompanied by variation in mean free length. The increasing trend of surface tension (σ) is listed in Table 4. It is found that the surface tension values are higher than the factor 3. This is usually accredited to hydrogen bonding with dipolar interactions [27]. The nonlinearity parameter is a measure of the nonlinearity of the equation of state of fluid and plays a noteworthy role in acoustics, biology, agriculture, and medicine. Non-linear parameter (B/A) calculated with the help of Hartmann-Balizer and Ballou relations are represented in Figs. 2 and 3. It is observed that the values of non-linearity parameters for ammonium sulfate fertilizer in the case of Hartmann and Ballou are a good asset. This indicates that the clustering of molecules is more and hence less spacing [28].

The decrease in values of relaxation strength (r) and specific heat ratio (γ) with the rise in weight fraction of ammonium sulphate fertilizer is due to the formation of the complex by solvent molecules around the fertilize molecules and indicates fertilizer-salt interaction in the system (listed in Table 5). Which throws light on the fact that there exists a better association between fertilizer-salts-water [29,30].

Isothermal compressibility means the extent to which a fluid can be compressed without raising the temperature of the fluid. The overall trends in the isothermal compressibility (k_T) are as shown in Figs. 4 and 5. It has been found that the calculated values of isothermal compressibility's by using both the relations to be decreased while concentration increases. The outcomes of 'k_T' values of ammonium sulfate in all three solvents seem to be the result of a corresponding decrease in free volume and average kinetic energy of the constituent solute–solvent molecules in the saline salts solution [31].

In the present system, the internal pressure (π_i) increases with an increase in the concentration of fertilizer at 293.15 K temperature as set out in Table 6. This behavior of the solution indicates the intermolecular space decreases with the addition of fertilizer in salt solutions and increases the interaction between the molecules in the system [32,33].

Table 3
The calculated data of Relative Change in Adiabatic Compressibility, Acoustic Impedance, and Intermolecular Free Length for the systems: (1) Ammonium Sulphate + Water and (2) Ammonium Sulphate + 0.5 M concentration of aqueous Solution of NaCl/ MgCl at 293.15 temperature.

CONC. (M) (mol/kg)	RELATIVE CHANGE IN ADIABATIC COMPRESSIBILITY			ACOUSTIC IMPEDANCE (kgm^2s^{-1})			INTERMOLECULAR FREE LENGTH $*10^{-11}$ (m)		
	H_2O	NaCl	$MgCl_2$	H_2O	NaCl	$MgCl_2$	H_2O	NaCl	$MgCl_2$
0.00	0.00000	0.00000	0.00000	1,478,829	1,478,829	1,478,829	4.35	4.35	4.35
0.02	−0.00451	−0.05694	−0.12450	1,484,135	1,535,850	1,601,921	4.34	4.24	4.11
0.04	−0.01053	−0.06099	−0.12995	1,489,641	1,539,355	1,607,167	4.33	4.23	4.10
0.06	−0.01671	−0.06664	−0.13301	1,495,344	1,543,985	1,609,617	4.32	4.22	4.09
0.08	−0.02095	−0.07000	−0.13839	1,499,301	1,547,056	1,614,092	4.31	4.21	4.08
0.10	−0.02589	−0.07490	−0.14298	1,503,693	1,551,135	1,618,689	4.30	4.20	4.07
0.12	−0.03021	−0.07897	−0.14825	1,507,716	1,554,595	1,622,957	4.29	4.19	4.06
0.14	−0.03382	−0.08321	−0.15280	1,512,850	1,558,282	1,626,823	4.28	4.18	4.06
0.16	−0.04013	−0.08821	−0.15635	1,517,010	1,562,435	1,629,897	4.27	4.17	4.05
0.18	−0.04525	−0.09250	−0.16116	1,521,550	1,566,148	1,634,731	4.26	4.17	4.04
0.20	−0.04937	−0.09834	−0.16489	1,525,202	1,570,849	1,638,046	4.25	4.15	4.03

Table 4
The calculated data of Relative Association, Surface Tension, and Non-Linearity Parameter-1 for the systems: (1) Ammonium Sulphate + Water and (2) Ammonium Sulphate + 0.5 M concentration of aqueous Solution of NaCl/ MgCl at 293.15 temperature.

CONC. (M) (mol/kg)	RELATIVE ASSOCIATION			SURFACE TENSION (Nm^{-1})			NON-LINEARITY PARAMETER-1 ($m^{-1}s$)		
	H_2O	NaCl	$MgCl_2$	H_2O	NaCl	$MgCl_2$	H_2O	NaCl	$MgCl_2$
0.00	1	1	1	35859.9	35859.9	35859.9	8.614935	8.614935	8.614935
0.02	1.002363	1.014543	1.030560	36005.0	37570.7	39577.7	8.608877	8.499880	8.372181
0.04	1.003039	1.014773	1.031779	36179.7	37685.5	39738.4	8.593883	8.489881	8.362215
0.06	1.003827	1.014691	1.031733	36359.6	37842.6	39822.4	8.578886	8.474886	8.354740
0.08	1.004443	1.015140	1.031897	36483.5	37939.8	39972.3	8.568884	8.467391	8.342279
0.10	1.004831	1.015195	1.033210	36625.2	38076.6	40109.8	8.556386	8.454893	8.334799
0.12	1.005471	1.015359	1.033219	36751.3	38191.2	40255.2	8.546387	8.444896	8.322344
0.14	1.006193	1.015663	1.033503	36857.4	38311.5	40382.9	8.533238	8.434900	8.312375
0.16	1.007036	1.015733	1.033821	37041.5	38450.9	40483.2	8.523887	8.422401	8.304899
0.18	1.007471	1.016035	1.035248	37188.0	38572.3	40627.3	8.511390	8.412404	8.297424
0.20	1.007821	1.015908	1.035706	37305.9	38733.4	40733.9	8.501390	8.397409	8.289946

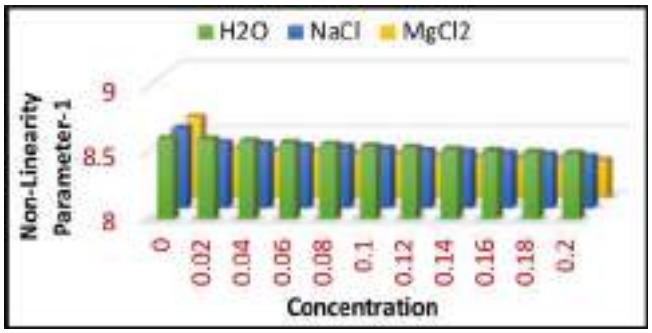

Fig. 2. Variation of non-linearity parameter by Hartmann-Balizer with concentration.

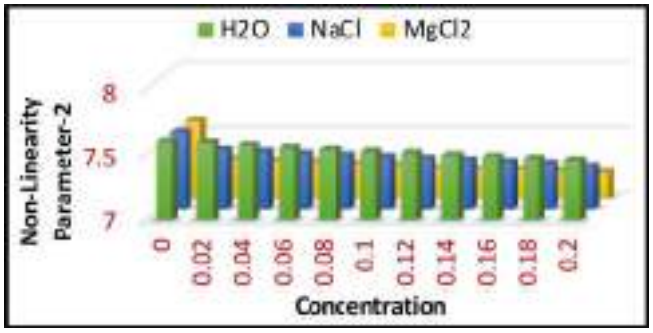

Fig. 3. Variation of non-linearity parameter by Ballou with concentration.

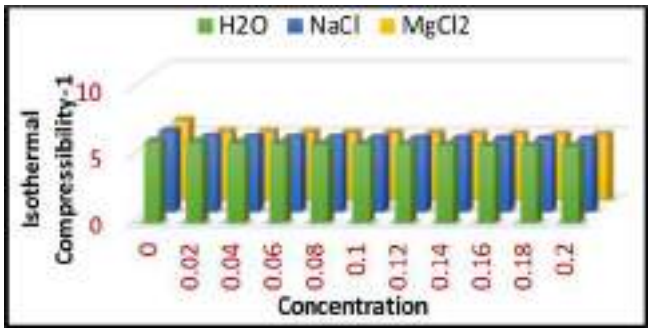

Fig. 4. Variation of isothermal compressibility by McGowan's with concentration.

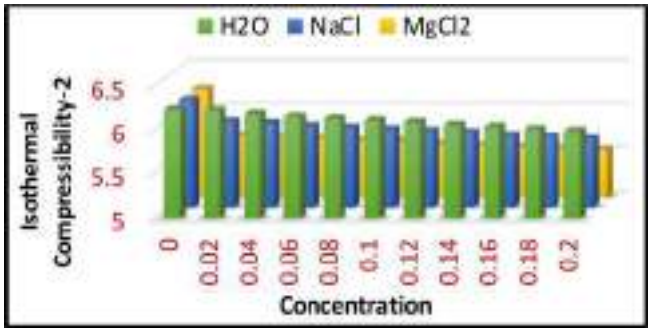

Fig. 5. Variation of isothermal compressibility by Pandey et al. with concentration.

Table 5
The calculated data of Non-Linearity Parameter-2, Relaxation Strength, and Specific Heat Ratio for the systems: (1) Ammonium Sulphate + Water and (2) Ammonium Sulphate + 0.5 M concentration of aqueous Solution of NaCl/ MgCl at 293.15 temperature.

CONC. (M) (mol/kg)	NON-LINEARITY PARAMETER-2 ($m^{-1}s$)			RELAXATION STRENGTH			SPECIFIC HEAT RATIO $(K^{4/9})^{-1}(kg^{1/3}m^{-1})^{-1}$		
	H_2O	NaCl	$MgCl_2$	H_2O	NaCl	$MgCl_2$	H_2O	NaCl	$MgCl_2$
0.00	7.599921	7.599920	7.599920	0.142644	0.142644	0.142644	0.137016	0.137016	0.137016
0.02	7.592503	7.459037	7.302671	0.141072	0.112023	0.076077	0.136895	0.136093	0.135086
0.04	7.574142	7.446793	7.290468	0.137161	0.109285	0.073180	0.136829	0.136059	0.135009
0.06	7.555778	7.428432	7.281314	0.133223	0.105155	0.070998	0.136759	0.136028	0.134994
0.08	7.543532	7.419255	7.266055	0.130581	0.103080	0.067344	0.136708	0.135991	0.134957
0.10	7.528227	7.403951	7.256897	0.127263	0.099603	0.065140	0.136661	0.135959	0.134882
0.12	7.515984	7.391709	7.241646	0.124595	0.096807	0.061453	0.136609	0.135928	0.134852
0.14	7.499883	7.379469	7.229439	0.121949	0.093999	0.058486	0.136546	0.135891	0.134816
0.16	7.488433	7.364164	7.220284	0.118547	0.090469	0.056252	0.136486	0.135859	0.134785
0.18	7.473131	7.351923	7.211131	0.115160	0.087631	0.054010	0.136437	0.135822	0.134705
0.20	7.460886	7.333562	7.201975	0.112436	0.083349	0.051760	0.136398	0.135792	0.134667

Table 6
The calculated data of Isothermal Compressibility-1, Isothermal Compressibility-2, and Internal Pressure for the systems: (1) Ammonium Sulphate + Water and (2) Ammonium Sulphate + 0.5 M concentration of aqueous Solution of NaCl/ MgCl at 293.15 temperature.

CONC. (M) (mol/kg)	ISOTHERMAL COMPRESSIBILITY-1 * 10^{-11} (m^2 N^{-1})			ISOTHERMAL COMPRESSIBILITY-2 * 10^{-11} (m^2 N^{-1})			INTERNAL PRESSURE * 10^9 (N m^{-2})		
	H_2O	NaCl	$MgCl_2$	H_2O	NaCl	$MgCl_2$	H_2O	NaCl	$MgCl_2$
0.00	6.05	6.05	6.05	6.24	6.24	6.24	5.06	5.06	5.06
0.02	6.01	5.64	5.22	6.23	5.99	5.71	5.09	5.37	5.74
0.04	5.97	5.61	5.19	6.19	5.97	5.69	5.12	5.39	5.77
0.06	5.92	5.58	5.17	6.16	5.94	5.68	5.15	5.42	5.79
0.08	5.89	5.56	5.14	6.14	5.92	5.65	5.18	5.44	5.81
0.10	5.86	5.53	5.11	6.12	5.90	5.64	5.20	5.46	5.84
0.12	5.83	5.50	5.09	6.10	5.88	5.61	5.22	5.48	5.87
0.14	5.79	5.48	5.06	6.07	5.86	5.59	5.25	5.50	5.89
0.16	5.76	5.45	5.04	6.05	5.83	5.58	5.27	5.53	5.91
0.18	5.73	5.42	5.02	6.02	5.82	5.56	5.30	5.55	5.93
0.20	5.70	5.39	5.00	6.00	5.79	5.55	5.32	5.58	5.95

4. Conclusion

Values of surface tension (σ) for all the solutions become positive. This indicates the systems acquire number of hydrogen bonding and dipole–dipole type interactions form in the solutions. The remaining volumetric and sound properties illustrate that, maximum interactions developed by the ammonium sulphate fertilizer with $MgCl_2$ solutions. The entire scenario concluded that the molecules of ammonium sulphate fertilizer can easily bind with salt molecules and make the passage for water, which is then uptake by the plants.

The order followed by the parameters of ammonium sulphate (AS) fertilizer in H_2O, NaCl and $MgCl_2$ solutions is: $(AS + H_2O + MgCl_2) > (AS + H_2O + NaCl) > (AS + H_2O)$

CRediT authorship contribution statement

Paritosh L. Mishra: Conceptualization, Methodology, Investigation. **Ajay B. Lad:** . **Urvashi P. Manik:**.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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INTERMOLECULAR INTERACTION OF TRIPLE SUPER PHOSPHATE FERTILIZER IN AQUEOUS SOIL SALT SOLUTIONS : AN ULTRASONIC STUDY

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ABSTRACT

The ultrasonic parameters and characterization helps to forecast and understand the behavior of intermolecular interaction, strength as well as the ilk of the liquid mixture present in the system. In view of above facts, the ultrasonic velocity (U) and density (?) measurements studies on fertilizer name as Triple Super Phosphate having number of concentrations varying from 0.002-0.02 mol-kg^{-1} in 0.2 mol kg^{-1} aqueous soil salt solution at 293.15K temperature were undertaken during the month of March 2021 at physical science laboratory, Sardar Patel Mahavidyalaya, Chandrapur, Maharashtra. The various thermo-acoustical parameters were calculated: Adiabatic Compressibility (β), Acoustic Impedance (Z), Intermolecular Free Length (L_f), Specific Heat Ratio (γ), Non-Linear Parameter (B/A), Isothermal Compressibility (k_T), Pseudo-Grüneisen Parameter (Γ) and Internal Pressure (π_i). In the light of all the observations and discussions, it may be interpreted that: the concentration, nature of solute, nature of solvent and its position plays an important role in determining the interactions occurring in the solution. From the acoustical and volumetric parameters it is concluded that H-bonding interaction was strong at higher concentration. The thermo-acoustic and volumetric parameters exhibited the strength of molecular interaction. It is observed that the order of interaction was : Na_2SO_4>NaCl>H_2O

This kind of information can be useful in the manufacturing of more effective fertilizer by increasing their activity according to soil salinity treatment and in other application by changing the ilk of its molecule. Hence the study expose the structural sense of the experimental liquid mixture and results have been described in the light of intermolecular interaction exist in between the fertilizer-water-saline salt solutions.

(Keywords : Fertilizer, pseudo-grüneisen parameter, internal pressure, triple super phosphate, intermolecular interaction)

INTRODUCTION

Nowadays, ultrasonic field have bearded the status of an important inquest to study the properties of science, industries, metallurgy, medicine and also in agriculture (Mishra *et al.,* 2020). The ultrasonic velocity has been measured in order to understand the ilk of molecular interactions in pure, binary and ternary mixtures (Praharaj *et al.,*2012). Acoustical parameters were calculated from the experimentally determine values of speed of sound and density of the experimental liquid mixture. Such studies as a function of concentration and temperature are useful in gaining insight into the structure and bonding between the associated molecules.

Knowledge of thermo-acoustic properties is of great importance in studying and understanding the various physico-chemical behavior and molecular interactions between various essential molecules in a living organism as well as in plants. Although, chemical fertilizers are playing a crucial role to feed crops with nutrients they need to grow and be harvested for nutritious food posing a greater thread to sustainable agriculture (Fayera *et al.,* 2021). During the last two decades the ultrasonic study has been carried out to investigate hydration of fertilizers (Khatun *et al*., 2018).

Fertilizers are the main constituents of Nitrogen, Potassium and Phosphorous nutrients and are quite useful for understanding the thermodynamic and physico-chemical behavior of nutrients in solution.(Rathika *et al.,*2014). As triple super phosphate fertilizer is highly concentrated phosphorous fertilizer having 46% of di-phosphorous pentoxide (P_2O_5). It accelerate the growth of the root of the young plants and increases the resistance of the plants to freezing and drought. Thus, we report in this manuscript, the effect of TSP fertilizer on saline salt solution, which offers a way to counteract the salinity problem in agriculture.

MATERIALS AND METHODS

The liquid mixture of various weight fraction (*viz.,* 0.002-0.02 mol.kg^{-1}) of triple super phosphate in water and

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in 0.2 mol.kg^{-1} aqueous solution of sodium chloride and sodium sulfate were prepared by taking AR grade chemicals of 99.8% purity. The ultrasonic velocity measurement carried out at a constant 293.15K temperature with the help of thermostatic water bath having an accuracy ±1K at a fixed 2MHz frequency digital ultrasonic velocity interferometer with an overall accuracy 0.0001 ms^{-1}.

The densities of the solutions were determined accurately using 10 ml specific gravity density bottle having accuracy ±2*10^{-2} kg.m^{-3}. All the weighings were done with the help of digital electronic balance having accuracy 0.0001g.

Defining relations

For the derivation of several acoustical and thermo-dynamical parameters the following defining relations reported in the literature are used:

- Adiabatic Compressibility (â) = 1/(U^{2}ñ)
- Acoustic Impedance (Z) =Uñ
- Intermolecular Free Length (L_f) = K(â)$^{1/2}$
- Specific Heat Ratio (ã) = $\{\frac{17.1}{T^{4/9}\rho^{1/3}}\}$
- Non-Linearity Parameter (B/A)=$\{2+[\frac{0.98*10^4}{U}]\}$
- Isothermal Compressibility (k_T) = $\{1.33*10^{-8}/(6.4*10^{-4}U^{3/2}ñ)^{3/2}\}$
- Pseudo-Grunseien Parameter (r) = $\{\frac{\gamma-1}{\alpha*T}\}$
- Internal Pressure ($ð_i$)= $\{\frac{T*\alpha}{k_T}\}$

RESULTS AND DISCUSSION

The ultrasonic velocity and density of fertilizer: triple super phosphate of varying concentration in water and 0.2 mol.kg^{-1} aqueous solution of sodium chloride and sodium sulfate increased with the increase in concentration, shown in Fig. 1 and Fig. 2 respectively. The increase in sound speed and density is accredited to the cohesion brought about by the ionic hydration and the construction of hydrogen bond between the fertilizer-water-saline salt. The fertilizer molecule form more compact structure with soil salt molecules which clearly showed the strong intermolecular interaction between the fertilizer and saline salts molecules due to the increase in the cohesive force. This functions as a material medium for sound waves. The similar results was obtained by Kumar (2012), who reported the ultrasound velocity increased with the increasing concentration of electrolyte at all temperatures.

It is observed from Fig. 3 that the adiabatic compressibility for both the salt solutions showed decreasing order with the increase in weight fraction of fertilizer in the salts solutions. This decreased in adiabatic compressibility indicating strong intermolecular interactions between the fertilizer and saline salts as compared to saline salts and water. The similar trends occurred by the Thirumaran *et al*. (2011). They revealed that the decreased intermolecular free length after mixing the components, confirms the association of molecules.

Acoustic impedance has a direct relation with elastic property of the solution. Fig. 4, represents the behavior of triple super phosphate fertilizer in aqueous saline salt solutions at 293.15K temperature at a frequency of 2MHz. The acoustic impedance versus weight fraction of TSP fertilizer graph showed the increasing trend for both the salt solutions and confirms the molecular interaction present in the solution. Tadalkar *etal*. (2011) also observed that the acoustic impedance increased with the increase in concentration and confirms the molecular interaction between fructose with magnesium chloride was stronger than sodium chloride solutions. It is observed that the order of acoustic impedance for current work was : Na_2SO_4>NaCl>H_2O.

Intermolecular free length is the distance between the surfaces of two neighboring molecules. Thus, it specifies the interaction plays between the constituent molecules. The regular decrease in the value of intermolecular free length with the increase in weight fraction of TSP fertilizer are tabulated in Table 1 and represented graphically in Fig.5. The graph clearly showed the strong packing between the components of fertilizer with saline salt solutions. Mishra and Manik (2015) found the similar behavior of experimental liquid in their work, as the concentration of solute i.e. 2-Phenylaniline in Toluene solvent increased, the values of free length exhibit decreasing trend. The observed order of variation of intermolecular free length (Lf) in water as well as in salt solution is: Na_2SO_4<NaCl<H_2O

The non-linearity parameter plays a significant role in acoustic, from underwater acoustic to medicine and fertilizer. From the Table 2 it is observed that the value of non-linearity parameter showed a decreasing order while increasing the concentration of solute in both the solvents and confirms the increasing trend of internal pressure as shown in Fig. 10.

The overall trend in the isothermal compressibility (kT) shown in Fig. 8 has been found decreased with the increase in weight fraction of fertilizer: TSP in both the saline salt solutions. The decrease in kT values supports to the effective TSP fertilizer interaction with saline salts solutions. The decrease in kT values with continuous increase in fertilizer concentration in weight fraction seems to be the result of corresponding decrease in free volume and hence confirms the decrease of free length. Similar results were obtained by the Basharat (2012) in his work. He found that the ternary systems (amino acid + salt + water) in aqueous 0.5m K_2SO_4 solution decreased with the addition of solute. The resultant order of isothermal compressibility is: Na_2SO_4<NaCl<H_2O

The Pseudo-Grünseien parameter (r) measures the degree of molecular or ionic association. The calculated values of r have been listed in Table 2 and a graph is plotted

Table 1. The values of Ultrasonic Velocity, Density, Adiabatic Compressibility, Acoustic Impedance and Intermolecular Free Length as a function of concentration of System (Triple Super Phosphate + 0.2M aq. Solution of ($NaCl/Na_2SO_4$) at temperature 293.15K

Conc.	T=293.15K									
(mol-kg^{-1})	U (m/s)		(Kg/m^3)		â*10^{-10}(m^{2}N^{-1})		Z (kgm^{2}s^{-1})		L_f*10^{-11} (m)	
	NaCl	Na_2SO_4	NaCl	Na_2SO_4	NaCl	Na_2SO_4	NaCl	Na_2SO_4	NaCl	Na_2SO_4
0.00	1481.496	1481.496	998.200	998.200	4.56	4.56	1478829	1478829	4.36	4.36
0.2M	1494.976	1512.712	1006.435	1026.985	4.45	4.26	1504596	1553533	4.30	4.21
0.002	1497.247	1515.616	1010.186	1024.810	4.42	4.25	1512498	1553219	4.29	4.20
0.004	1498.385	1516.781	1010.591	1025.800	4.41	4.24	1514253	1555914	4.28	4.20
0.006	1499.525	1517.948	1011.448	1026.761	4.40	4.23	1516692	1558568	4.28	4.19
0.008	1500.666	1518.525	1012.068	1027.713	4.39	4.22	1518776	1560603	4.27	4.19
0.010	1501.810	1519.701	1012.696	1028.635	4.38	4.21	1520877	1563210	4.27	4.19
0.012	1502.955	1520.286	1013.301	1029.550	4.37	4.20	1522946	1565210	4.26	4.18
0.014	1504.101	1521.458	1014.100	1030.447	4.36	4.19	1525309	1567771	4.26	4.18
0.016	1505.250	1522.632	1014.532	1031.341	4.35	4.18	1527124	1570351	4.25	4.17
0.018	1506.401	1524.396	1015.412	1032.235	4.34	4.17	1529618	1573527	4.25	4.17
0.020	1507.553	1525.585	1016.368	1033.118	4.33	4.16	1532229	1576097	4.24	4.16

Table 2. The values of Specific Heat Ratio, Non-Linear Parameter, Isothermal Compressibility, Pseudo-Gruneiesen Parameter and Internal Pressure as a function of concentration of System (Triple Super Phosphate + 0.2M aq. Solution of ($NaCl/ Na_2SO_4$) at temperature 293.15K

Conc.(mol-kg^{-1})	T=293.15K									
	γ (K$^{4/9}$)$^{-1}$(kg$^{1/3}$m^{-1})$^{-1}$		(B/A) (m^{-1}s)		kT*10^{-11} (m^{2}N^{-1})		γ		π_i*10^9	
	NaCl	Na_2SO_4	NaCl	Na_2SO_4	NaCl	Na_2SO_4	NaCl	Na_2SO_4	NaCl	Na_2SO_4
0.00	0.137016	0.137016	8.61493517	8.614935	6.05	6.05	-3.12742	-3.12742	5.06	5.06
0.2M	0.136642	0.135724	8.55528918	8.478431	5.85	5.53	-3.14486	-3.17075	5.21	5.47
0.002	0.136472	0.135820	8.54534623	8.466018	5.8	5.52	-3.14854	-3.17325	5.25	5.47
0.004	0.136454	0.135776	8.54037514	8.461051	5.79	5.51	-3.14992	-3.17483	5.26	5.49
0.006	0.136416	0.135734	8.53540288	8.456084	5.77	5.49	-3.15144	-3.1764	5.27	5.50
0.008	0.136388	0.135692	8.53043382	8.453633	5.76	5.48	-3.15289	-3.17733	5.28	5.51
0.010	0.136359	0.135652	8.52545928	8.448637	5.74	5.46	-3.15434	-3.17890	5.29	5.53
0.012	0.136332	0.135611	8.52048797	8.446156	5.73	5.45	-3.15578	-3.17982	5.30	5.54
0.014	0.136297	0.135572	8.51551990	8.441190	5.71	5.43	-3.15729	-3.18138	5.32	5.55
0.016	0.136277	0.135533	8.51054642	8.436224	5.70	5.42	-3.15868	-3.18294	5.33	5.56
0.018	0.136238	0.135494	8.50557189	8.428776	5.68	5.39	-3.23322	-3.18514	5.34	5.58
0.020	0.136195	0.135455	8.50060064	8.423765	5.66	5.38	-3.16178	-3.18671	5.36	5.60

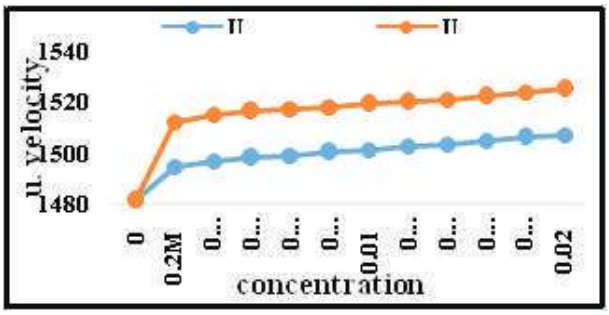

Fig. 1. Ultrasonic velocit versus concentration at 293.15K temperature.

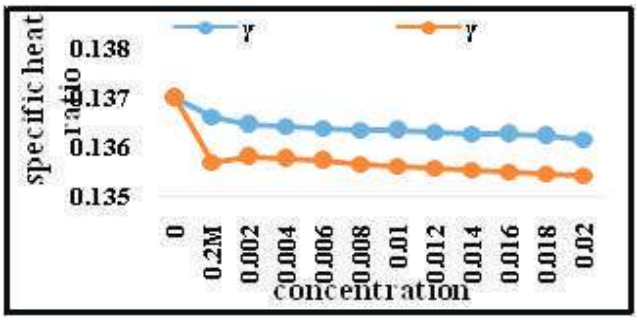

Fig. 6. Specific Heat Ratio versus concentration at 293.15K temperature.

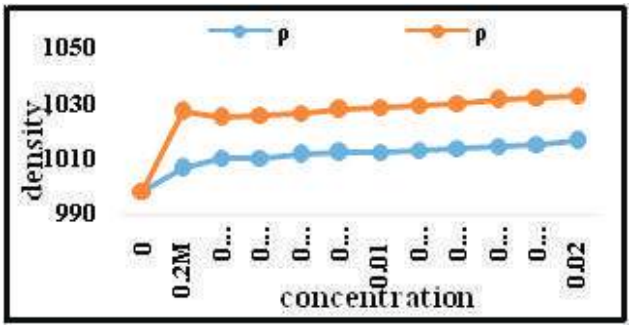

Fig. 2. Density versus concentration at 293.15K temperature.

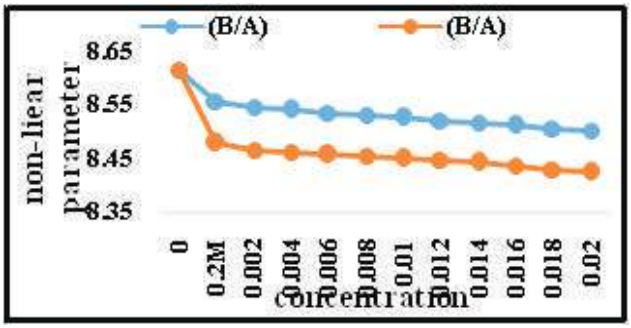

Fig. 7. Non-Linear Parameter versus concentration at 293.15K temperature.

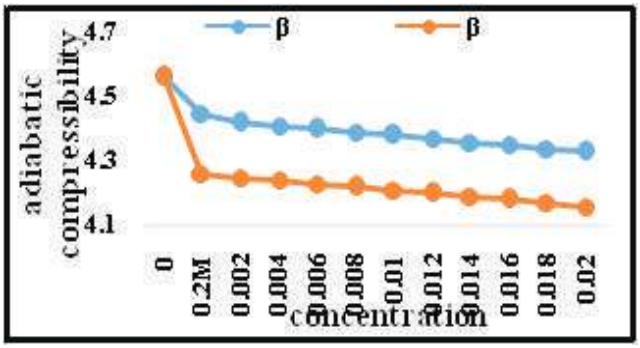

Fig. 3. Adiabatic compressibility versus concentration at 293.15K temperature.

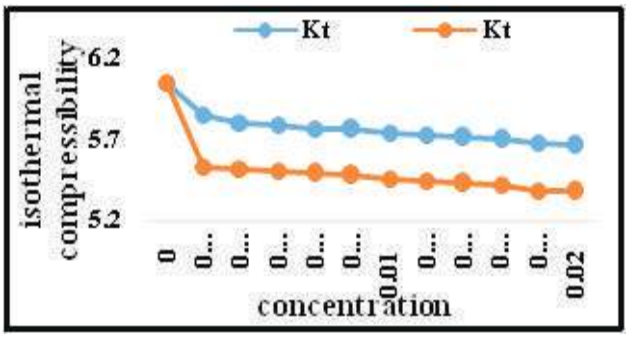

Fig. 8. Isothermal Compressibility versus concentration at 293.15K temperature.

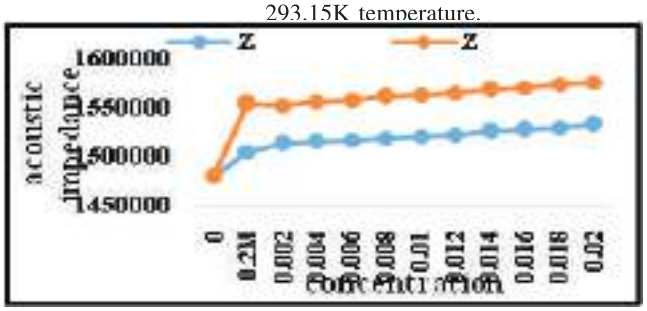

Fig. 4. Acoustic impedance versus concentration at 293.15K temperature.

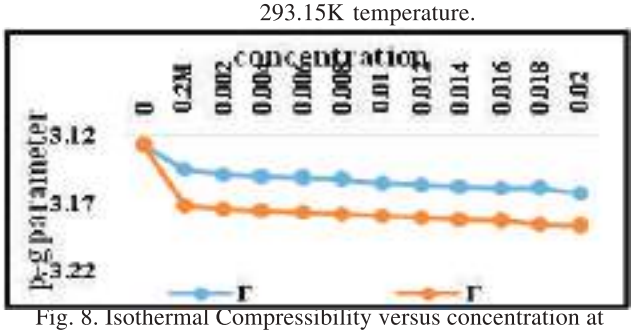

Fig. 8. Isothermal Compressibility versus concentration at 293.15K temperature.

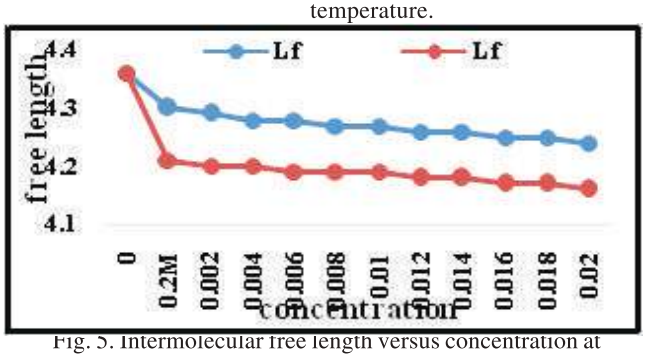

Fig. 5. Intermolecular free length versus concentration at 293.15K temperature.

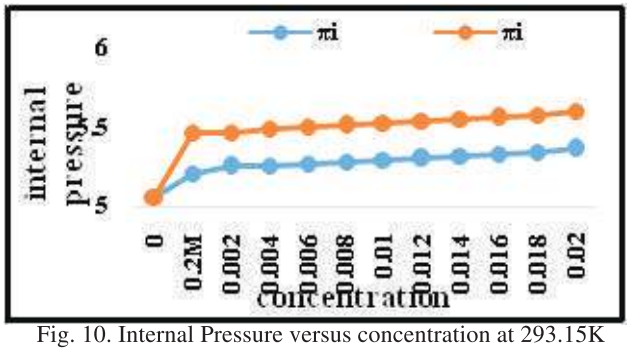

Fig. 10. Internal Pressure versus concentration at 293.15K temperature.

against the fertilizer concentration at a constant 293.15K temperature (Fig. 9). It is observed that the Pseudo-Grünseien parameter values were negative and showed an increasing trend of variation with the addition of fertilizer in the saline salt solvent. The negative values suggests the probable formation of intermolecular complex in the system and strong intermolecular interaction. Pandey *et al*. (2006) also reported this kind of results in their research work and exposed the behavior of liquid and kind of interaction exist in that liquid.

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Interaction of Sodium Sulphate with Saccharide (Sucrose) Solution: A Thermo-Acoustical Approach

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ABSTRACT

Measurement ultrasonic velocity (U) and density (ρ) of different compositions (0.001-0.1mol/kg) of the sodium sulphate has been carried out by usingdigital ultrasonic interferometer operated at 2 MHz. in the solution of (0.2 and 0.5 mol/kg) of aqueous sucrose as function of temperature. The different acoustical and volumetrical parameters have been calculated from the data of ultrasonic velocity and density. This kind of information data provides the information requirely the different properties (like mechanical, thermal and elastic) of the liquid system in view from number of aspect.

KEYWORDS: Acoustical parameters, density, distilled water, ultrasonic velocity and sodium sulphate.

INTRODUCTION

To study the liquid state the ultrasonic velocity measurements provides a tool. The molecular interaction in pure liquid and its various composition and mixture with other liquid are study with help of ultrasonic characterization.[1] As ultrasonic speed along with density make available for use wealth of information regarding nature and strength of molecular interaction exit in the liquid and liquid mixture. The evidence delivers about kind of interaction prevailing in the liquid mixture which computed in utilizing density and ultrasonic speed data numerous mechanical, thermal and elastic parameters such as bulk modulus, internal pressure, surface tension, thermal conductivity, isothermal compressibility.[2] Ultrasonic sound refers to instantaneous sound pressure with a high frequency than human audible sound frequency (20 Hz to 20 KHz). Different acoustical parameter which calculating from thevalues determined by the ultrasonic velocity and density. [3] More application gives in distinguish thermodynamic and physiochemical behavior of liquid mixture by non-destructive techniques resourceful or all around.[4]

Sodium sulphate is the inorganic compound with formula Na_2SO_4. All form are white solid that are highly soluble in water. Its molecular weightis 142.04 g/mol sodium sulphate in the anhydrous. [5] For the mixture, Sucrose is a disaccharide and is a sugar composed of glucose andfructose of sucrose $C_{12}H_{22}O_{11}$ and its molecular weight 342.30g/mol. It is also soluble in water just used to Na_2SO_4. Sucrose is extracted and refined from either sugarcane or sugar bat for human consumption. Thus, the interaction of these two compound plays a vital role in human body and helps the pharmaceutical industries, to make some more effective drugs related to their (Sucrose + Na_2SO_4) application.

MATERIAL AND METHOD

In the present work, we have used analytical reagent (AR) grade with 99% purity of Sucrose {[CAS No- 57-50-14] [molecular wt. – 342.3 g/mol]} used as solute, Sodium Sulphate with 99% purity of {[CAS No-7757-82-6][molecular wt-142.04 g/mol]} and fresh distilled water having [molecular wt. 18.01528 g/mol with density – 1000 kg/m^3] used as a pure universal solvent and this work was done at different temperatures (i.e.283.15K, 288.15K, 293.15K and 298.15K) and different concentrations.

1. This experiment was carried out at different temperatures which were maintained constant by a digital water bath.
2. The measurement of weight was done by using a digital weighing machine having an accuracy of ±0.1mg.
3. Ultrasonic velocity was measured with the help of digital ultrasonic velocity interferometer with a 2MHz frequency having an accuracy of 0.1%.
4. The density of this solution was accurately determined by using a 10ml specific gravity density bottle.
5. Using the measured data, other acoustical parameters have been calculated usingcstandard relation.

DEFINING RELATION

1. **Surface Tension (σ):** Surface tension [6] is the tendency of liquid surface at rest to shrink intothe minimum surface area possible.
   $\sigma = (6.3*10^{-4})dC^{3/2}$
2. **Internal Pressure (πi):** Internal Pressure [7] is a significant parameter which is used to understand structure and nature of intermolecular interaction in the liquid molecules.
   $\Pi i = \{ T*\alpha/kT\}$
3. **Isothermal Compressibility (k_T):** Isothermal compressibility is used to determined the compressible properties of water supply.
   a. 'Mc' Gowan Method [8] $k_{T1} = 1.33*10^{-8}/(6.4*10^{-4}C^{3/2}d)^{3/2}$
   b. Pandey et al. Method [9] $k_{T2}= 17.1*10^4/(T^{4/9}C^2d^{1/3})$
4. **Bulk Modulus (k):** Bulk modulus[10] is the reciprocal of adiabatic compressibility, it is used tomeasure the ability of substance.
   $k = 1/\beta$
5. **Thermal Conductivity (k):** Thermal conductivity [11] is refer to the ability of material or substanceto conduct or transfer heat.
   $k = \{ 3.0*(dNA/M)^{2/3}k_BC\}$

RESULT AND DISCUSSION

The obtained variation of experimentally determined values of ultrasonic velocity, density and other calculated parameter of sodium sulphate at different temperature and concentration as shown in fig.1-8.

Ultrasonic velocity is most important parameter that gives information concerning the nature of molecular interaction and is affected by concentration and temperature. The ultrasonic velocity of the system with increases with the increasing temperature as well as concentration. Shown in fig.1. This represent the association in the molecule of solute and solvent, due to dipole-dipole, ion-dipole interaction.[12] As shown in fig.2 density of aqueous sucrose has been measured at different temperature. By increasing pressure on material can increase the density while increasing temperature result in decrease in density of material. The density(ρ) of sodium sulphate in aqueous sucrose solution increases with increase in concentration due to elaboration in compactness or structure of solvent by the addition of solute molecules in the solution. This shows association occur between solute and solvent molecule. The increase in density result increase in molar volume indicates the association in the components of the constituents molecules and contracts the structural rearrangement.[13]

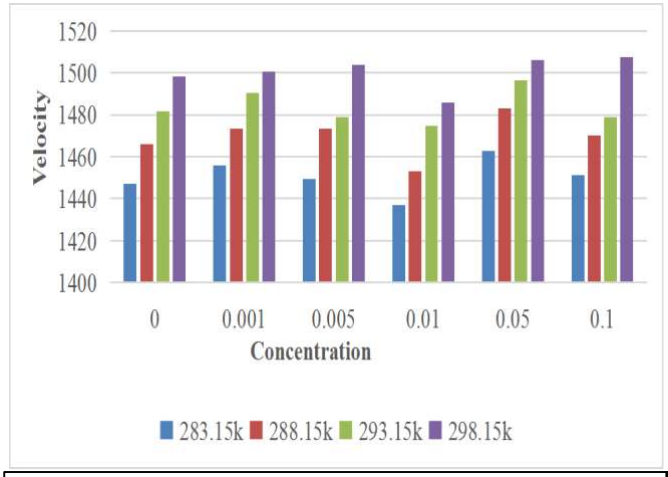

Fig.1 Variation of ultrasonic velocity with concentration and temperature

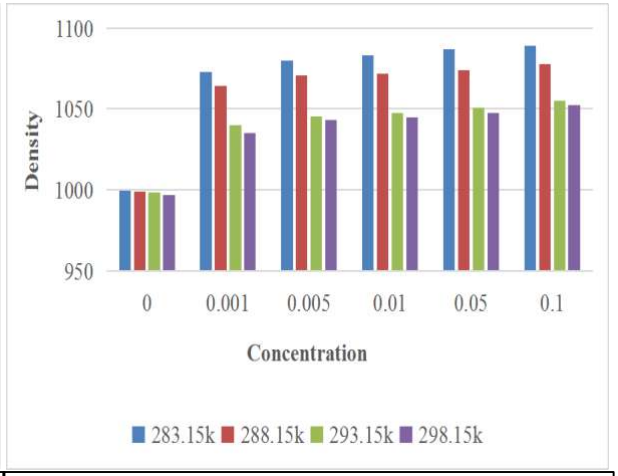

Fig.2 Variation of density with concentration and temperature

Surface tension is used to study the surface composition of aqueous solution of the mixture. Addition of solute increases the surface tension of solution. The increasing trend ofsurface tension is graphically represented in fig.3 with different concentration but at 0.01 concentration, the surface tension is slightly decreases. The solute confirms migration of constituent molecules and strong interaction in the system. From fig.4, in the present system the internal pressure (πi) increases in concentration at various temperatures. This behavior of the solution indicates intermolecular space decreases with addition sodium sulphate in sucrose solutions and interaction increases which supports the association among the constituent molecules of the solute and solvent.[13]

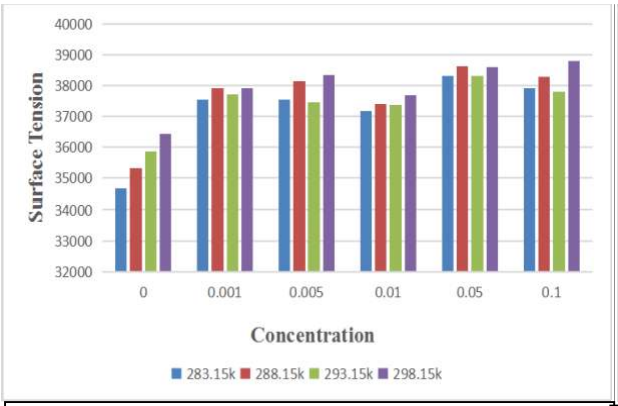

Fig.3 Variation of Surface tension with concentration and temperature

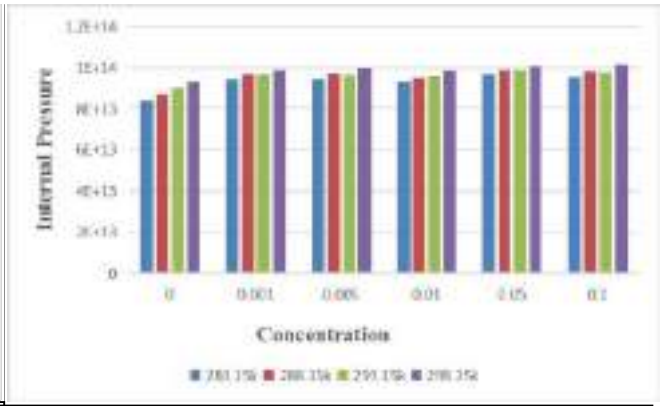

Fig.4 Variation of Internal Pressure with concentration and temperature

The bulk modulus of sodium sulphate in aqueous sucrose solution increases with increase in concentration and temperature as shown in fig.5 which observed that the hydrogen bonding between the unlike components in the solution increases.[14] By observing graph ofthermal conductivity as shown in fig.6 of water is increases with increase in temperature. As compare to the concentration it is observed that the thermal conductivity slightly increases with concentration and temperature. It is clear that the energy is flow when the molecules are close to each other. This means in the given system intermolecular interaction takes place.[15]

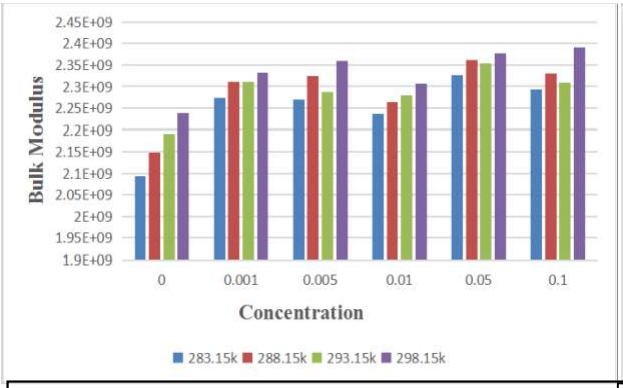

Fig.5 Variation of Bulk modulus with concentration and temperature

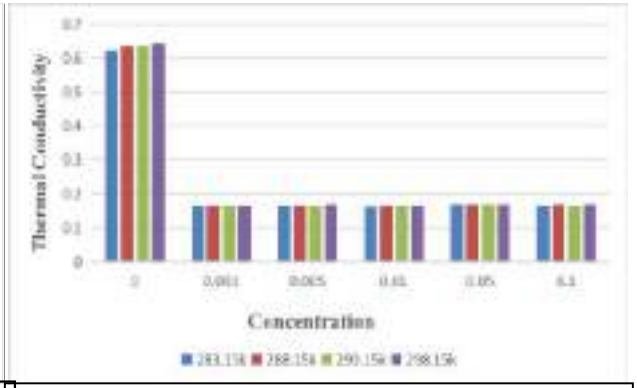

Fig.6 Variation of Thermal conductivity with concentration and temperature

The isothermal compressibility are as shown in fig.8. The isothermal compressibility has been found to be decreasing with increase in concentration seems to be the result of corresponding decreases in average kinetic energy and free volume of the constituent solute- solvent molecules in the aqueous sucrose solution.[7]

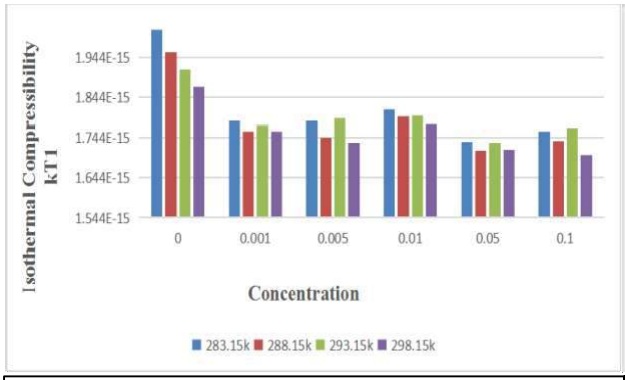

Fig.7. Variation of Isothermal compressibility k_{T1} with concentration and temperature

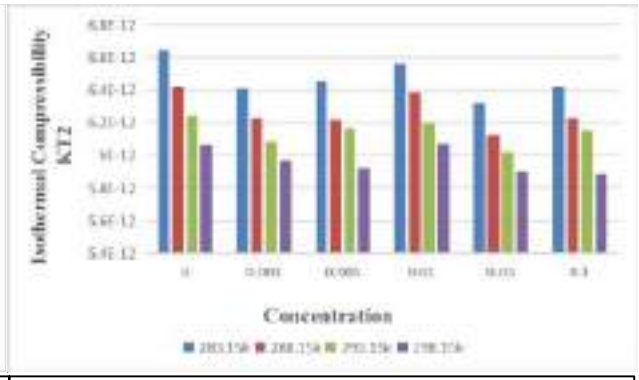

Fig.8. Variation of Isothermal compressibility k_{T2} with concentration and temperature

CONCLUSION

In present work, the solution/mixture of sodium sulphate + water + sucrose (0.2 mol/kg) different property like mechanical, thermal and elastic parameter were calculated from measured data of density and ultrasonic velocity as a function of temperature and concentration. The mechanical property (surface tension and internal pressure) of sodium sulphate confirms that migration of constituent molecules and interaction increases which supports the association among the constituent molecules of the solute and solvent. Elastic property indicates that the hydrogen bonding between the unlike components in the solution increases. Thermal property is concluded that the energy is flow when the molecules are close to each other. This means in the given system intermolecular interaction take place.

Thus, the interaction of these solute and solvent (sodium sulphate and sucrose) plays a vital role in human body and helps the pharmaceutical industries, to make some more effective drugs related to their (Sucrose + Na_2SO_4) application.

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Ultrasonic Studies on Molecular Interaction of Fertilizer in Aqueous Saline Soil Salt Solutions at Different Temperatures

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Full Length Research Article

Ultrasonic Studies on Molecular Interaction of Fertilizer in Aqueous Saline Soil Salt Solutions at Different Temperatures

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A B S T R A C T

In this paper an attempt is made to understand the structural (molecular) alterations of fertilizer in saline soil salts which results various solute-solvent, solvent-solvent and ion-solvent interactions in order find a way to control the problem of soil salinity. These interactions depend on the nature of solvent, size and structure of ion. For this purpose, Potassium Sulfate (PS) fertilizer is being used which contain the 43% of K concentration. The ultrasonic parameters and characterization help to forecast and understand the behavior of intermolecular interaction, strength as well as the nature of the liquid mixture exist in this system. In view of above facts, the density (ρ) and speed of sound (U) measurements studies on fertilizer: Potassium Sulfate of number of concentrations varying from 0.02-0.2 mol-kg^{-1} in 0.5M solution of saline soil salt solutions and the results were explored in terms of solute-solvent, solvent-solvent interactions. These are of great importance in understanding the extent and nature of solutions as well as to counteract the problem of soil salinity.

***Key words*:** Acoustical properties, Density, Fertilizer, Intermolecular interaction, Soil salinity

The consistent climate change due to the global warming, excessive application of groundwater and increasing successive use of low-quality water in irrigation with intensive farming and poor drainage generates the soil salinity problem. Now a days this soil salinization becomes a major factor contributing to the loss of productivity of cultivated soils. It was estimated that about 20% (45 million ha) of irrigated land, producing one-third of the world's food, is salt-affected.[1]The salinity of soil has great effects on nutrients availability to plants or crops and on the ability of plant roots to absorb nutrients. Because of low productivity problems in the salt affected soils, fertilizers are applied to counteract the conditions which limit the plant absorption of nutrients [2].

During literature survey it has been revealed that, a decrease in the ability of the plant to absorb potassium generally take place in saline soils containing excess amount of Na, Mg or Ca. Therefor application of potassium fertilizer not only correct the deficiencies but also decrease the adverse effect of Na, Mg and Ca on the plants. Various thermo-acoustic parameters like: adiabatic compressibility, change in adiabatic compressibility, intermolecular free length, and acoustic impedance were calculated. It was occurred that there is certain degree of variation exist in these parameters with change in concentration and temperature. Therefore, the present work aimed to understand the structural (molecular) changes of Potassium Sulfate fertilizer in saline soil salt solutions like: Sodium Chloride and Magnesium Chloride, which explore various solute-solvent, solvent-solvent and ion-solvent interactions in order find a way to control the salinity problem.

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Experimental details

A. Materials

AR grade chemicals (mass fraction purity 99.8%) as Potassium Sulfate (CAS no.: 7778-80-5), Sodium Chloride (CAS no.: 7647-14-5) and Magnesium Chloride (CAS no.: 7786-30-3), were obtained from Himedia Lab. Pvt. Ltd., Mumbai. All chemicals were used as supplied. The concentrations (0.02-0.2 mol-kg^{-1}) of Potassium Sulfate in 0.5M aqueous saline salts were changed by weight. All the glassware's was washed with double distilled water as well as with acetone and dried before use.

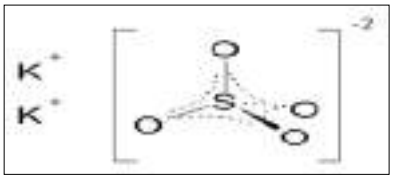

Fig 1 Structure of potassium sulfate

B. Method

A digital ultrasonic velocity interferometer was used for measuring the ultrasonic velocity operating at frequency 2 MHz supplied from Vi Microsystems Pvt. Ltd., Chennai (Model VCT:71) with an overall accuracy 0.0001m/s.

The densities of the solutions were determined using 10ml specific gravity bottle having accuracy $\pm 2*10^{-2}$ kg/m^3 and digital electronic balance (Contech CA-34) having accuracy ±0.0001gm. An average of triple measurements was taken into account for better accuracy. The experimental temperature was maintained constant by circulating water with the help of an automatic thermostatic water bath supplied by Lab-Hosp. Company Mumbai having an accuracy ±1K temperature.

Table 1 Density and ultrasonic velocity of water at 293.15K and 298.15K temperature

Current work data		Literature data	
U. Vel. (U) m/sec	Density (ρ) kg/m^3	U. Vel. (U) m/sec	Density (ρ) kg/m^3
293.15K			
1481.496	998.200	1482.63	998.202
298.15K			
1498.101	997.051	1497.06	997.025

Defining relations

For the derivation of several acoustical and thermo-dynamical parameters the following defining relations reported in the literature are used:

$$\text{Specific Heat Ratio } (\gamma) = \left\{ \frac{17.1}{T^{4/9} + p^{1/3}} \right\}$$

$$\text{Isothermal Compressibility } (k_T) = \{1.33*10^{-8}/(6.4*10^{-4}U^{3/2}\rho)^{3/2}\}$$

$$\text{Intermolecular Free Length } (L_f) = K(\beta)^{1/2}$$

Where; K be the Jacobson temperature dependent constant

$$\text{Pseudo-Grunseien Parameter } (r) = \left\{ \frac{\gamma - 1}{\alpha + T} \right\}$$

$$\text{Internal Pressure } (\pi_i) = \left\{ \frac{T + \alpha}{k_T} \right\}$$

$$\text{Apparent Molar Volume } (V_\phi) = \left\{ \frac{M}{p} - \frac{1000\,(p - p_0)}{Mpp_0} \right\}$$

$$\text{Solubility Parameter } (\delta) = \sqrt{\pi_i}$$

$$\text{Acoustic Impedance } (Z) = U\rho$$

RESULTS AND DISCUSSION

A. Density

Density of pure water has been measured at 293.15K and 298.15K temperatures and the observed data tabulated in the (Table 2). After Comparison of observed data with literature data reported for water indicated that our results are shows well agreement with the literature data. [3-4] The density (ρ) of both the systems, increases with increase in concentration and temperature due to improve in compactness or structure of solvent by the addition of solute molecules. This indicates association occurs between solute and solvent molecules. [5] The increase in density of fertilizer solutions in both saline salts solutions with rise in concentration results increase in the molar volume indicating the association in the components of the constituent molecules and confirms the structural rearrangement. Furthermore, density values of system decrease with rise in temperature shows decrease in intermolecular forces due to increasing thermal energy of the system.

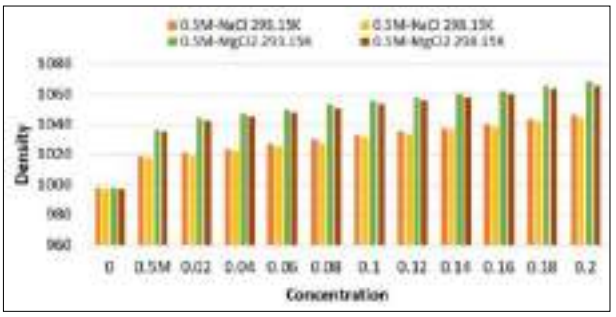

Fig 1 Density versus concentration at 293.15K and 298.15K temperature

Table 2 Density of potassium sulfate + (0.5M) aq. NaCl/$MgCl_2$. at 293.15K and 298.15K temperatures

Conc. (M) mol-kg^{-1}	Density			
	0.5M-NaCl		0.5M-$MgCl_2$	
	293.15K	298.15K	293.15K	298.15K
0.00	998.20	0997.00	998.20	0997.00
0.5M	1018.54	1017.11	1035.82	1034.51
0.02	1021.13	1019.71	1044.31	1042.39
0.04	1023.70	1022.42	1046.91	1045.01
0.06	1026.67	1025.13	1049.41	1047.62
0.08	1029.64	1027.45	1053.12	1050.25
0.10	1032.22	1030.87	1054.85	1052.93
0.12	1035.00	1033.30	1057.62	1055.49
0.14	1037.12	1036.12	1060.88	1058.00
0.16	1040.52	1038.10	1062.24	1060.43
0.18	1043.50	1041.45	1065.61	1063.71
0.20	1046.08	1044.17	1068.27	1065.93

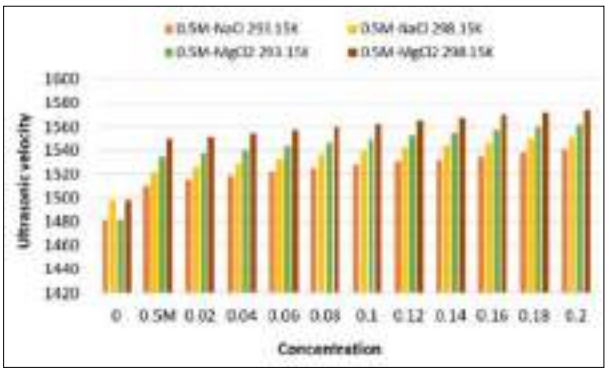

Fig 2 Ultrasonic velocity versus concentration at 293.15K and 298.15K temperature

B. Ultrasonic velocity

In the present work ultrasonic velocity of pure water has been measured at 293.15K and 298.15K temperatures and the observed data tabulated in the (Table 1). Comparison of observed data with literature data reported for water indicated that our results are in assent with the literature data [6]. The ultrasonic velocity (U) of Potassium Sulfate fertilizer of changeable concentrations (0.02-0.2 mol/kg) in 0.5M solution of both the saline salts solvents: Sodium Chloride and Magnesium Chloride measured at 293.15K and 298.15K temperatures. The observed data of

ultrasonic velocity increases with increase in concentration as well as in temperature is tabulated in (Table 3). Temperature and concentration affect the ultrasonic wave passing through solution. The increase in sound speed is accredited to the cohesion brought about by the ionic hydration and the construction of hydrogen bond between the fertilizer-water as well as fertilizer-saline salt solutions [7].

Table 3 Ultrasonic velocity of potassium sulfate + (0.5M) aq. NaCl/$MgCl_2$. at 293.15K and 298.15K temperatures

Conc. (M) mol-kg^{-1}	U. Velocity			
	0.5M-NaCl		0.5M-$MgCl_2$	
	293.15K	298.15K	293.15K	298.15K
0.00	1481.496	1498.101	1481.496	1498.101
0.5M	1509.908	1521.054	1534.759	1550.048
0.02	1515.046	1526.192	1537.765	1551.883
0.04	1517.916	1529.062	1540.178	1554.952
0.06	1521.375	1532.521	1543.205	1557.415
0.08	1525.431	1536.577	1546.244	1559.887
0.10	1528.342	1539.488	1549.295	1562.366
0.12	1530.679	1541.825	1552.973	1565.476
0.14	1532.436	1543.582	1555.435	1567.349
0.16	1534.786	1545.932	1557.286	1569.852
0.18	1538.324	1549.471	1559.761	1571.735
0.20	1540.692	1551.838	1561.623	1573.621

C. Specific Heat Ratio:

Data inserted in (Fig 3) shows the variation of specific heat ratio at different concentration and at various temperatures viz. 293.15 and 298.15K respectively. The heat capacity ratio (γ) is constantly decreasing with the increment of concentration and temperature, which throw light on the fact that specific heat at constant volume is decreasing constantly with increasing concentration and temperature also.

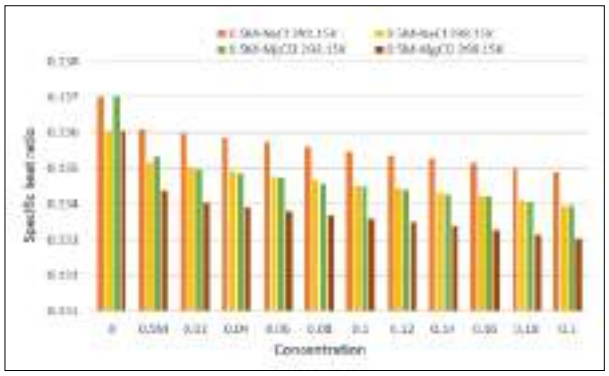

Fig 3 Specific heat ratio versus concentration at 293.15K and 298.15K temperature

Table 4 Specific heat ratio of potassium sulfate + (0.5M) aq. NaCl/$MgCl_2$. at 293.15K and 298.15K temperatures

Conc. (M) mol-kg^{-1}	Specific heat ratio			
	0.5M-NaCl		0.5M-$MgCl_2$	
	293.15K	298.15K	293.15K	298.15K
0.00	0.136098	0.135142	0.135337	0.134380
0.5M	0.135983	0.135028	0.134969	0.134041
0.02	0.135869	0.134908	0.134858	0.133929
0.04	0.135738	0.134789	0.134751	0.133817
0.06	0.135607	0.134687	0.134592	0.133706
0.08	0.135494	0.134538	0.134518	0.133592
0.10	0.135373	0.134433	0.134401	0.133484
0.12	0.135281	0.134312	0.134263	0.133378
0.14	0.135134	0.134225	0.134206	0.133278
0.16	0.135004	0.134081	0.134064	0.133139
0.18	0.134893	0.133965	0.133953	0.133047
0.20	0.137016	0.136045	0.137016	0.136045

D. Isothermal Compressibility:

Isothermal Compressibility values have been computed using the suggested Mc Gowan's [8] relation. The overall trends in the isothermal compressibility (k_T) are as shown in (Fig 4). It has been found to be decreasing with increase in concentration and temperature. The decrease in 'k_T' values with increase in concentration seems to be the result of corresponding decrease in free volume [9]. The decrease in free volume with rise in concentration clears the clustering of molecules and hence suggest the increase in interaction.

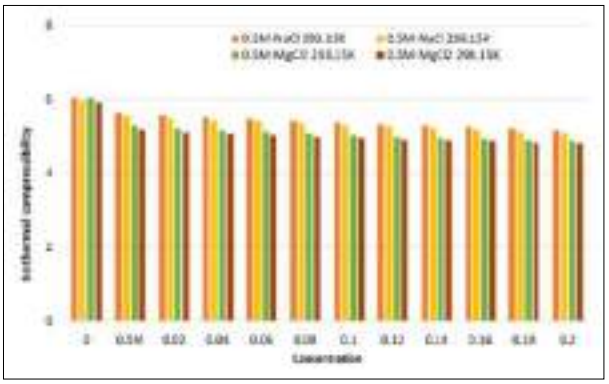

Fig 4 Isothermal Compressibility versus concentration at 293.15K and 298.15K temperature

Table 5 Isothermal compressibility of potassium sulfate + (0.5M) aq. NaCl/$MgCl_2$. at 293.15K and 298.15K temperatures*10^{-11}

Conc. (M) mol-kg^{-1}	Isothermal compressibility			
	0.5M-NaCl		0.5M-$MgCl_2$	
	293.15K	298.15K	293.15K	298.15K
0.00	6.05	5.97	6.05	5.91
0.5M	5.62	5.54	5.29	5.18
0.02	5.56	5.48	5.20	5.11
0.04	5.51	5.43	5.16	5.06
0.06	5.46	5.39	5.12	5.03
0.08	5.41	5.34	5.07	4.99
0.10	5.36	5.29	5.03	4.95
0.12	5.32	5.25	4.99	4.91
0.14	5.29	5.22	4.95	4.88
0.16	5.25	5.18	4.93	4.85
0.18	5.20	5.13	4.88	4.81
0.20	5.16	5.09	4.85	4.79

E. Intermolecular free length

Intermolecular free length (L_f) is one of the important parameter in determining the nature as well as strength of interaction between the components of solution. It is the average distance between the surfaces of two neighboring molecules, which is called intermolecular free length [10]. Variation of free length is set down in (Table 6). It is observed that the free length decreases with increase in concentration of fertilizer in saline salt solutions. This indicates that there exists a significant interaction among the fertilizer and soil salt solution. Among both the saline salts (NaCl and $MgCl_2$) intermolecular free length values are

found low in water, while in the case of electrolyte solutions, it is found low in $MgCl_2$ indicating strong intermolecular interaction of fertilizer with $MgCl_2$. Increasing trend of Intermolecular free length with rise in temperature is due to the thermal expansion of component molecules of the solution. The observed behavior shows that there is enhanced molecular association. The observed order of variation of intermolecular free length (L_f) in water as well as in salt solution is: $MgCl_2$<NaCl<H_2O.

Table 6 Intermolecular free length of potassium sulfate + (0.5M) aq. NaCl/$MgCl_2$. at 293.15K and 298.15K temperatures

Conc. (M) mol-kg^{-1}	Free length*10^{-11}			
	0.5M-NaCl		0.5M-$MgCl_2$	
	293.15K	298.15K	293.15K	298.15K
0.00	4.37	4.37	4.35	4.35
0.5M	4.23	4.24	4.13	4.13
0.02	4.21	4.22	4.10	4.11
0.04	4.20	4.21	4.09	4.09
0.06	4.18	4.19	4.08	4.08
0.08	4.16	4.18	4.06	4.07
0.10	4.15	4.16	4.05	4.06
0.12	4.14	4.15	4.04	4.04
0.14	4.13	4.14	4.02	4.03
0.16	4.12	4.13	4.02	4.02
0.18	4.10	4.11	4.00	4.01
0.20	4.09	4.10	3.99	4.00

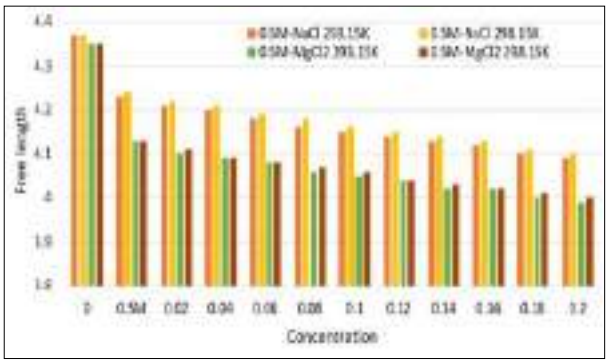

Fig 5 Intermolecular free length versus concentration at 293.15K and 298.15K temperature

F. Pseudo-Grunseien parameter

The Pseudo-Grünseien Parameter (r) measures the degree of molecular or ionic association. The calculated values of 'r' have been listed in *Table-7* and a graph is plotted against the fertilizer concentration at 293.15K and 298.15K temperature shown in (Fig 6). It is observed that the 'r' values are negative and shows a decreasing (due to negative result) trend of variation with the addition of fertilizer in the solvent. The negative values suggest the probable formation of intermolecular complex in the system and strong intermolecular interaction [11]. However, it may be noted that such a variation with change in concentration of fertilizer is trivial.

G. Internal Pressure:

As we know that the acoustical parameters have tendency to explain the ilk and strength of the interaction taking place in the solutions. In the present system the internal pressure (π_i) increases with increase in concentration of fertilizer at both the temperatures as shown in (Fig 7). This behavior of the solution indicates the intermolecular space decreases with addition of fertilizer in salt solutions and interaction increases which supports the association among the constituent molecules of the solute and solvent [12].

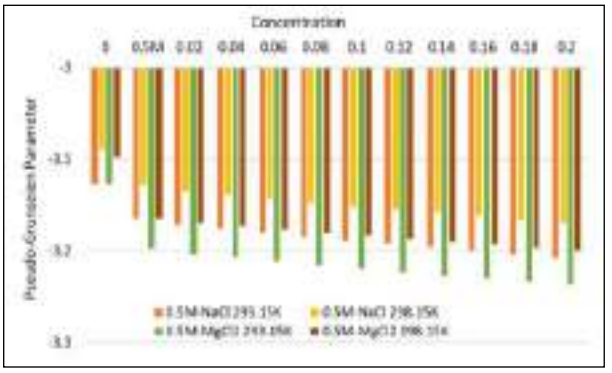

Fig 6 Pseudo-Grünseien Parameter versus concentration at 293.15K and 298.15K temperature

Table 7 Pseudo-Grunseien parameter of potassium sulfate + (0.5M) aq. NaCl/$MgCl_2$. at 293.15K and 298.15K temperatures

Conc. (M) mol-kg^{-1}	Pseudo-Grunseien parameter			
	0.5M-NaCl		0.5M-$MgCl_2$	
	293.15K	298.15K	293.15K	298.15K
0.00	-3.12742	-3.08961	-3.12742	-3.09734
0.5M	-3.16504	-3.12834	-3.19753	-3.16472
0.02	-3.17147	-3.13466	-3.20343	-3.16910
0.04	-3.17541	-3.13857	-3.20685	-3.17317
0.06	-3.18011	-3.14312	-3.21090	-3.17659
0.08	-3.18546	-3.14817	-3.21534	-3.18002
0.10	-3.18943	-3.15234	-3.21918	-3.18347
0.12	-3.19284	-3.15558	-3.22401	-3.18755
0.14	-3.19541	-3.15832	-3.22767	-3.19030
0.16	-3.19901	-3.16144	-3.23008	-3.19368
0.18	-3.20378	-3.16624	-3.23379	-3.19667
0.20	-3.20715	-3.16960	-3.23661	-3.19934

Table 8 Internal pressure of potassium sulfate + (0.5M) aq. NaCl/$MgCl_2$. at 293.15K and 298.15K temperatures

Conc. (M) mol-kg^{-1}	Internal pressure*10^{-11}			
	0.5M-NaCl		0.5M-$MgCl_2$	
	293.15K	298.15K	293.15K	298.15K
0.00	5.06	5.19	5.06	5.23
0.5M	5.39	5.53	5.68	5.85
0.02	5.44	5.58	5.76	5.93
0.04	5.48	5.62	5.80	5.97
0.06	5.52	5.66	5.84	6.01
0.08	5.57	5.71	5.89	6.05
0.10	5.61	5.75	5.92	6.09
0.12	5.64	5.79	5.97	6.13
0.14	5.67	5.82	6.01	6.16
0.16	5.71	5.85	6.04	6.20
0.18	5.76	5.91	6.08	6.24
0.20	5.80	5.94	6.11	6.27

H. Apparent molar volume

The values of the apparent molar volume were calculated with the help of densities of water (solvent) and fertilizer (solute) and listed in (Table 9). It is clear from the trends shown in (Fig 8) that apparent molar volume decreases with increase in fertilizer concentration at both the temperatures. But the obtained values are negative, this

behavior support that there is strong ionic (ion-ion) interaction existing in the fertilizer solution [13]. The same supported by increasing in molar volume with rise in concentration as a result of shrinking in the lacuna in solvent structure due to increased intermolecular hydrogen bonding established with the insertion of fertilizer.

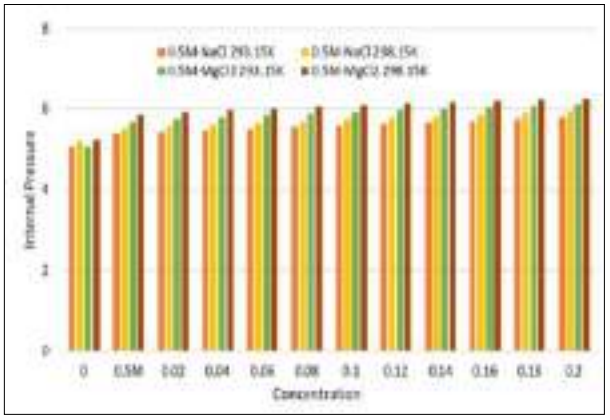

Fig 7 Internal pressure versus concentration at 293.15K and 298.15K temperature

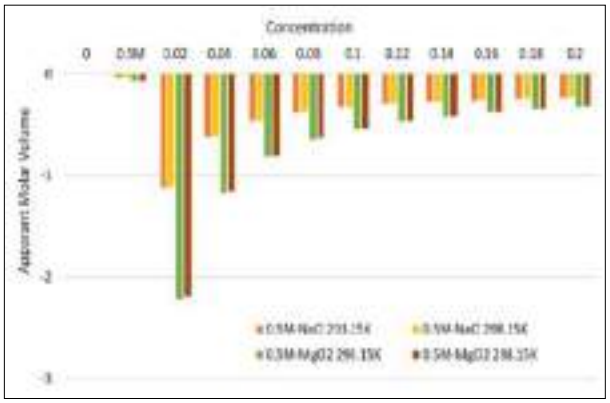

Fig 8 Apparent molar volume versus concentration at 293.15K and 298.15K temperature

Table 9 Apparent molar volume of potassium Sulfate + (0.5M) aq. NaCl/$MgCl_2$. at 293.15K and 298.15K temperatures

Conc. (M) mol-kg^{-1}	Apparent molar volume			
	0.5M-NaCl		0.5M-$MgCl_2$	
	293.15K	298.15K	293.15K	298.15K
0.00	----	----	----	----
0.5M	-0.03995	-0.03960	-0.07257	-0.07254
0.02	-1.12463	-1.11625	-2.21150	-2.18370
0.04	-0.62369	-0.62326	-1.16512	-1.15177
0.06	-0.46284	-0.45855	-0.81464	-0.80762
0.08	-0.38223	-0.37140	-0.65288	-0.63552
0.10	-0.33001	-0.32938	-0.53786	-0.53262
0.12	-0.29666	-0.29342	-0.46887	-0.46302
0.14	-0.26837	-0.27020	-0.42262	-0.4129
0.16	-0.25438	-0.24802	-0.37731	-0.37464
0.18	-0.24144	-0.23767	-0.35191	-0.34930
0.20	-0.22910	-0.22640	-0.32837	-0.32413

I. Solubility Parameter:

The solubility parameter (δ) is obtained by taking the square root of the internal pressure. The calculated values tabulated in the (Table 10). Further the (Fig 9) shows the variation of solubility parameter of fertilizer with concentration and temperature. The trends of variation of 'δ' is similar to that of internal pressure. Such an increase may attributed to an increase in the cohesive energy, viscosity and density and favors the well association among component of solution [14] The increasing trend of the solubility parameter exhibits that the solution has more tendency of soluble.

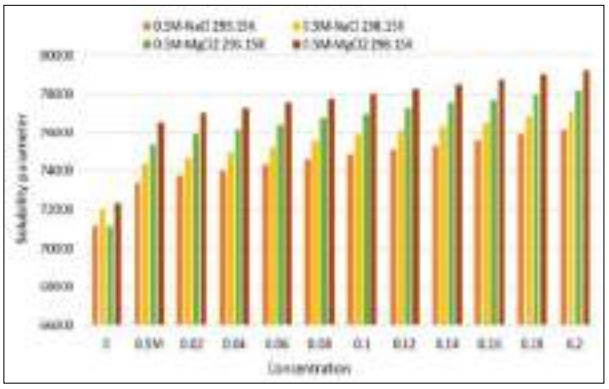

Fig 9 Solubility parameter versus concentration at 293.15K and 298.15K temperature

Table 10 Apparent molar volume of potassium sulfate + (0.5M) aq. NaCl/$MgCl_2$. at 293.15K and 298.15K temperatures

Conc. (M) mol-kg^{-1}	Solubility parameter			
	0.5M-NaCl		0.5M-$MgCl_2$	
	293.15K	298.15K	293.15K	298.15K
0.00	71163.28	72038.94	71163.28	72341.22
0.5M	73397.28	74354.47	75345.75	76506.92
0.02	73748.34	74708.67	75912.54	76999.05
0.04	74002.21	74972.91	76150.76	77269.26
0.06	74302.06	75262.28	76410.79	77513.50
0.08	74628.01	75557.43	76733.91	77758.96
0.10	74885.13	75861.02	76955.85	78007.78
0.12	75128.31	76088.31	77259.02	78278.16
0.14	75312.84	76310.56	77535.02	78492.05
0.16	75587.89	76516.66	77686.21	78727.97
0.18	75894.95	76845.14	77968.98	78984.77
0.20	76130.17	77090.19	78188.15	79184.46

J. Acoustic Impedance:

The values of acoustic impedance for fertilizer: Potassium Sulfate of different concentration viz. 0.02-0.2mol/kg in 0.5M solution of aqueous electrolyte solution of NaCl and $MgCl_2$ at 293.15 and 298.15K temperatures were calculated and tabulated in (Table 11) respectively. It is observed that the acoustic impedance (Z) values of Potassium Sulfate fertilizer increase with increase in concentration of fertilizer in the both 0.5M aqueous electrolyte solutions and the values centered around 1 Rayal. The increase in acoustic impedance with the increase in concentration indicates the greater association among solute and solvent through hydrogen bonding. Thus, increase in acoustic impedance indicates associative nature of solute and solvent and enhancement in molecular interaction [15]. The increase in acoustic impedance with rise in temperature is due to ion change in elastic and inertial properties of solution. This indicates the greater association of solute and solvent molecules. The order of variation of acoustic impedance (Z) in water as well as in salt solution is: $MgCl_2$>NaCl>H_2O.

Table 11 Acoustic impedance of potassium sulfate + (0.5M) aq. NaCl/$MgCl_2$ at 293.15K and 298.15K temperatures

Conc. (M) mol-kg^{-1}	Acoustic impedance			
	0.5M-NaCl		0.5M-$MgCl_2$	
	293.15K	298.15K	293.15K	298.15K
0.00	1478829	1486476	1478829	1493607
0.5M	1537901	1547079	1589734	1603540
0.02	1547059	1556258	1605904	1617671
0.04	1553891	1563344	1612428	1624936
0.06	1561950	1571033	1619458	1631584
0.08	1570648	1578756	1628380	1638271
0.10	1577585	1587012	1634275	1645062
0.12	1584253	1593160	1642455	1652344
0.14	1589320	1599305	1650130	1658255
0.16	1596945	1604832	1654211	1664671
0.18	1605241	1613699	1662097	1671870
0.20	1611686	1620386	1668228	1677367

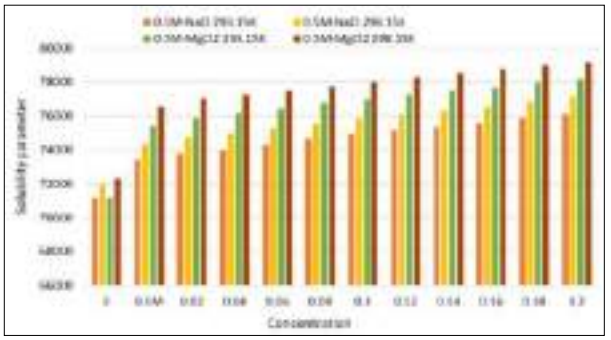

Fig 10 Acoustic impedance versus concentration at 293.15K and 298.15K temperature

CONCLUSION

The various acoustical parameters determined by using the measured values of density and ultrasonic velocity of Potassium Sulfate solutions in both electrolyte solution (NaCl and $MgCl_2$) at 293.15K and 298.15K temperature. All parameters used to investigate the intermolecular interactions between the Potassium Sulfate fertilizer molecules and saline salts. The impact of variation in concentration and temperature on these parameters were observed and studied. In the light of above observations and discussions, it may be concluded that: the concentration, nature of solute, nature of solvent and its position plays an important role in determining the interactions occurring in the solution. Also, it is concluded that H-bonding interaction is strong at higher concentration. Moreover, the values of density and compressibility for Potassium Sulfate fertilizer are found to be maximum with $MgCl_2$ coz it has weak interaction with water molecules among the electrolyte solution and ergo can bind with fertilizer molecules more effectively. Rest volumetric and acoustical parameters show that among both saline salts, potassium sulfate fertilizer develops maximum interactions with $MgCl_2$ salt solution due to superior degree of hydrogen bonding and intermolecular interactions in its aqueous soil salt solutions which indicate the prominent effect of nature of fertilizer molecule on its behavior in solutions. This kind of information can be useful in the manufacturing of more effective fertilizer by increasing their activity according to soil salinity treatment and in other application by changing the ilk of its molecule.

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Intermolecular Interactions between Saline Salts and Fertilizer : An Acoustical Approach

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ABSTRACT

An attempt is made to understand the structural/molecular changes of fertilizer in saline salts which results various solute-solvent, solvent-solvent and ion-solvent interactions in order find a way to control the salinity problem. These interactions depend on the nature of solvent, size and structure of ion. For this purpose Potassium Sulfate (PS) fertilizer is being used which contain the 43% of K concentration. The ultrasonic parameters and characterization helps to forecast and understand the behavior of intermolecular interaction, strength as well as the nature of the liquid mixture present in these system. In view of above facts, the ultrasonic velocity (U) and density (ρ) measurements studies on fertilizer (PS) of number of concentrations varying from 0.02-0.2 mol-kg-1 in 0.5M solution of saline soil salts and the results were explored in terms of solute-solvent, solvent-solvent interactions and structure making or breaking effects are of great importance in understanding the extent and nature of solutions.

Keywords : Acoustical properties, Density, Fertilizer, Intermolecular interaction, Sound velocity.

I. INTRODUCTION

The salinity of soil has great effects on nutrients availability to plants or crops and on the ability of plant roots to absorb nutrients. Because of low productivity problems in the salt affected soils, fertilizers are applied to counteract the conditions which limit the plant absorption of nutrients.[1] During literature survey it has been revealed that, a decrease in the ability of the plant to absorb K generally take place in saline soils containing excess amount of Na, Mg or Ca. Therefor application of K fertilizer not only correct the deficiencies but also decrease the adverse effect of Na, Mg and Ca on the plants. Various thermo-acoustic parameters like: adiabatic compressibility, change in adiabatic compressibility, intermolecular free length, and acoustic impedance were calculated. It was occurred that there is certain degree of variation exist in these parameters with change in concentration Therefore the present work aimed to understand the structural (molecular) changes of fertilizer in saline salts solutions which explore various solute-solvent, solvent-solvent and ion-solvent interactions in order find a way to control the salinity problem.

II. EXPERIMENTAL DETAILS

A. MATERIALS

AR grade chemicals (mass fraction purity 99.8%) as Potassium Sulfate (CAS no.: 7778-80-5), Sodium Chloride (CAS no.: 7647-14-5) and Magnesium Chloride (CAS no.: 7786-30-3), were obtained from Himedia Lab. Pvt. Ltd., Mumbai. All chemicals were used as supplied. The concentrations (0.02-0.2 mol-kg^{-1}) of Potassium Sulfate in 0.5M aqueous saline salts were changed by weight. All the glassware's was washed with double distilled water as well as with acetone and dried before use.

Figure: Structure of Ammonium Sulfate

B. METHOD

A digital ultrasonic velocity interferometer was used for measuring the ultrasonic velocity operating at frequency 2 MHz supplied from Vi Microsystems Pvt. Ltd., Chennai (Model VCT:71) with an overall accuracy 0.0001m/s.

The densities of the solutions were determined using 10ml specific gravity bottle having accuracy ±2*10^{-2} kg/m^3 and digital electronic balance (Contech CA-34) having accuracy ±0.0001gm. An average of triple measurements was taken into account for better accuracy. The experimental temperature was maintained constant by circulating water with the help of an automatic thermostatic water bath supplied by Lab-Hosp. Company Mumbai having an accuracy ±1K temperature.

Table 1: Density and Ultrasonic velocity of water at 288.15K temperature.

Current Work Data		Literature Data	
U. Vel. (U)	Density (ρ)	U. Vel. (U)	Density (ρ)
m/sec	kg/m^3	m/sec	kg/m^3
1466.032	999.103	1466.25	999.1

Table 2: Abbreviations used.

M	Molal Concentration in mol./kg
CAS	Chemical Abstract Service
MHz	Mega Hertz
U_∞	Infinite Value of Ultrasonic Velocity

DEFINING RELATIONS

For the derivation of several acoustical and thermo-dynamical parameters the following defining relations reported in the literature are used:

- Adiabatic Compressibility $(\beta) = 1/(U^2\rho)$
- Change in Adiabatic Compressibility $(\Delta\beta) = \{\beta-\beta_0\}$
- Intermolecular Free Length $(L_f) = K(\beta)^{1/2}$

Where, K be the Jacobson temperature dependent constant.

- Acoustic Impedance $(Z) = U\rho$

III. RESULT AND DISCUSSION

A. ULTRASONIC VELOCITY & DENSITY:

In the present work ultrasonic velocity of pure water has been measured at 288.15K temperature and the observed data tabulated in the Table 1. Comparison of observed data with literature data reported for water indicated that our results are in assent with the literature data.[2] The ultrasonic velocity (U) of fertilizer of varying concentrations (0.02-0.2 mol/kg) in 0.5M solution of both the saline salts solvents: NaCl and $MgCl_2$ measured at 288.15K temperature. The observed data of ultrasonic velocity increases with increase in concentration is tabulated in Table 3. Temperature and concentration affects the ultrasonic wave passing through solution. The increase in sound speed is accredited to the cohesion brought about by

the ionic hydration and the construction of hydrogen bond between the fertilizer-water as well as fertilizer-saline salts. [3]

Density of pure water has been measured at 288.15K temperature and the observed data tabulated in the Table 3. After Comparison of observed data with literature data reported for water indicated that our results are shows well agreement with the literature data. [4, 5] The density (ρ) of both the systems, increases with increase in concentration due to improve in compactness or structure of solvent by the addition of solute molecules. This indicates association occurs between solute and solvent molecules. [6] The increase in density results increase in the molar volume indicating the association in the components of the constituent molecules and confirms the structural rearrangement.

Table 3: Density and Ultrasonic velocity of PS + (0.5M) aq. NaCl/$MgCl_2$. at 288.15K temperature.

CONC. (M)	DENSITY		U. VELOCITY	
	0.5M-NaCl	0.5M-$MgCl_2$	0.5M-NaCl	0.5M-$MgCl_2$
0.00	1019.7	1037.4	1496.1366	1521.688
0.02	1023.0	1046.8	1501.275	1525.827
0.04	1025.8	1049.1	1504.145	1528.797
0.06	1028.6	1052.0	1507.604	1532.377
0.08	1031.4	1054.9	1511.660	1534.773
0.1	1034.1	1057.2	1514.571	1537.779
0.12	1036.4	1059.9	1516.908	1538.984
0.14	1039.7	1062.5	1518.665	1540.796
0.16	1042.6	1065.0	1521.015	1543.826
0.18	1045.0	1067.7	1524.553	1545.650
0.2	1048.0	1070.4	1526.921	1548.088

B. ADIABATIC COMPRESSIBILITY & CHANGE IN ADIABATIC COMPRESSIBILITY:

Physico-chemical properties of liquid can be understood by adiabatic compressibility (β) as the hydrogen bonding between the unlike components in the solutions decreases with the compressibility. In the present case it is found that the adiabatic compressibility decreases with increase in concentration. Because, as water is polar solvent and when salts and fertilizer mixed, the well intermolecular interaction occurred, resulting in close packing of molecules. The decrease values of adiabatic compressibility listed in Table 4 indicate the strong association of fertilize and saline salts molecules. The compressibility of the solvent is higher than that of solution and decreases with increase in concentration of the solution.[7]

After calculating the values of change in adiabatic compressibility against concentration as listed in Table 4 it is found that the negative values of 'Δβ' is due to the solute-solvent interaction. Such an increase in 'Δβ' with increase in concentration may be attributed to an increase in the cohesive forces in solution. [8] The negatively increase in 'Δβ' values confirms the negatively increase of bulk modulus values with concentration indicates that the hydrogen bonding between the unlike components in the solution increases. [9]

Table 4: Adiabatic Compressibility and Change in Adiabatic Compressibility of PS + (0.5M) aq. NaCl/$MgCl_2$. at 288.15K temperature.

CONC. (M)	ADI. COMPRESSIBILITY		CHANGE IN AD. COMPR.	
	0.5M-NaCl	0.5M-$MgCl_2$	0.5M-NaCl	0.5M-$MgCl_2$
0.00	4.38112E-10	4.16296E-10	0	0
0.02	4.33714E-10	4.10323E-10	-4.398E-12	-5.9734E-12
0.04	4.30882E-10	4.07834E-10	-7.230E-12	-8.4622E-12
0.06	4.27739E-10	4.04812E-10	-1.037E-11	-1.1485E-11
0.08	4.24292E-10	4.02439E-10	-1.382E-11	-1.3857E-11
0.1	4.21559E-10	3.99995E-10	-1.655E-11	-1.6301E-11
0.12	4.19328E-10	3.98352E-10	-1.878E-11	-1.7944E-11
0.14	4.17031E-10	3.96443E-10	-2.108E-11	-1.9853E-11
0.16	4.14587E-10	3.93961E-10	-2.352E-11	-2.2335E-11
0.18	4.11717E-10	3.92038E-10	-2.640E-11	-2.4258E-11
0.2	4.09266E-10	3.89819E-10	-2.885E-11	-2.6478E-11

C. INTERMOLECULAR FREE LENGTH & ACOUSTIC IMPEDANCE:

Intermolecular free length (L_f) is one of the important parameter in determining the nature as well as

strength of interaction between the components of solution. It is the average distance between the surfaces of two neighboring molecules, which is called intermolecular free length.[10] Variation of free length is set down in Table 5. It is observed that the free length decreases with increase in concentration of fertilizer in saline solution. This indicates that there exists a significant interaction among the fertilizer and electrolyte solution. Among both the saline salts (NaCl and $MgCl_2$) intermolecular free length values are found low in water, while in the case of electrolyte solutions, it is found low in $MgCl_2$ indicating strong intermolecular interaction of fertilizer with $MgCl_2$. The observed order of variation of intermolecular free length (L_f) in water as well as in salt solution is: $MgCl_2$>NaCl>H_2O

The values of acoustic impedance for fertilizer: Potassium Sulfate of different concentration viz. 0.02-0.2mol/kg in 0.5M solution of aqueous electrolyte solution of NaCl and $MgCl_2$ was calculated and tabulated in Table 5 respectively. It is observed that the acoustic impedance (Z) values of Potassium Sulfate fertilizer increases with increase in concentration of fertilizer in the both 0.5M aqueous electrolyte solutions and the values centered around 1Rayal. The increase in acoustic impedance with the increase in concentration indicates the greater association among solute and solvent through hydrogen bonding. Thus increase in acoustic impedance indicates associative nature of solute and solvent and enhancement in molecular interaction.[11] The order of variation of acoustic impedance (Z) in water as well as in salt solution is: MgCl2>NaCl>H2O.

Table 5 : Intermolecular Free Length and Acoustic Impedance of PS + (0.5M) aq. NaCl/$MgCl_2$. at 288.15K temperature.

CONC. (M)	INTER. FREE LENGTH		ACOUSTIC IMPEDANCE	
	0.5M-NaCl	0.5M-$MgCl_2$	0.5M-NaCl	0.5M-$MgCl_2$
0.00	4.2266E-11	4.1201E-11	1525610.491	1578599.131
0.02	4.2054E-11	4.0904E-11	1535804.325	1597235.704
0.04	4.1916E-11	4.0780E-11	1542951.941	1603860.933
0.06	4.1763E-11	4.0628E-11	1550721.474	1612060.604
0.08	4.1594E-11	4.0509E-11	1559126.124	1619032.038
0.1	4.1460E-11	4.0386E-11	1566217.871	1625739.959
0.12	4.1351E-11	4.0303E-11	1572123.451	1631169.142
0.14	4.1237E-11	4.0206E-11	1578956.001	1637095.75
0.16	4.1116E-11	4.0080E-11	1585810.239	1644174.69
0.18	4.0974E-11	3.9982E-11	1593157.885	1650290.505
0.2	4.0851E-11	3.9869E-11	1600213.208	1657073.395

IV. CONCLUSION

The various acoustical parameters determined by using the measured values of density and ultrasonic velocity of Potassium Sulfate solutions in both electrolyte solution (NaCl and $MgCl_2$). All parameters used to investigate the intermolecular interactions between the Potassium Sulfate fertilizer molecules and saline salts. The impact of concentration on these parameters were observed and studied. In the light of above observations and discussions, it may be concluded that: the concentration, nature of solute, nature of solvent and its position plays an important role in determining the interactions occurring in the solution. Also it is concluded that H-bonding interaction is strong at higher concentration. Moreover, the values of density and compressibility for Potassium Sulfate fertilizer are found to be maximum with $MgCl_2$ coz it has weak interaction with water molecules among the electrolyte solution and ergo can bind with fertilizer molecules more effectively.

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To Study theImpact of Concentration and Temperature on Intermolecular Interaction Between Dextrose and Electrolyte Solution

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ABSTRACT
Densitiesand Ultrasonic velocity of Dextrose in electrolyte solution have beendeterminedexperimentally at 283.15K,288.15K,293.15 and 28.15K with different concentration. From these experimental data the Adiabatic compressibility (βs), Acoustic impedance (Z), Intermolecular free length(Lf), Non-linearity parameter(β/A), will be calculated. The variation in concentration and temperature is useful in understanding the nature of molecular interaction in terms of physical parameters.On the basis of trends obtained for different parameter, it is cleared that there exist solute-solvent interaction shows greater molecular association through hydrogen bonding.

Keywords: Acoustic parameters, Adiabatic compressibility, Density, Dextrose and Ultrasonic velocity.

I. INTRODUCTION

Ultrasonic techniques are widely applied to estimate the acoustic property and the intermolecular interaction between the liquid mixture and ionic interaction of dextrose in electrolyte solution. [1] By these technique velocity, density and related parameter of electrolyte solution (NaCl) can be determine. Andalso, in the mixture of solute-solute, solute-solvent system we evaluate the structure making and nature of the system. Characterizing the physico-chemical behaviour of liquid mixtures. Further, they play an important role in many chemical reactions. Due to their ability of self-association with manifold internal structure. [2-3]
The interaction of solute-solvent is understanding by Ultrasonic technique. The implementation of Ultrasonic methods for probing the structural vital of polysaccharides has been the theme of extensive research. [4]
Carbohydrates is one of the main nutrients which gives energy to our body, tissues. And Dextrose is a example of carbohydrates which is soluble in water and these biomolecules of significant importance present in the biological system. Dextrose gives calories and may be given drip in combination of amino acid and fats. [5] To study the thermodynamic properties in electrolyte solution is an important process to understanding the behaviour biological fluids including different ionic species and study the stability. [6]

II. MATERIAL AND METHODS

The monosaccharide dextrose {[CAS No. 50-99-7] [Molecular weight – 180.16 g/mol]} used in the present work is of analytical reagent (AR) grade with 99% purity which is used as a solute and the fresh distilled water + NaCl [Molecular wt. -18.051528 g/mol and 58.44g/mol] with density [1000 kg/m^3] is used as a solvent. This process was done at different temperature (283.15K, 288.15K, 293.15K, 298.15K) which were maintained by using a digital water bath.

The measurement of weight was done by using a digital weighing machine having an accuracy of ±0.1mg some basic parameters like [(a) Ultrasonic velocity were measured on a digital Ultrasonic interferometer with a 2MHz frequency having an accuracy of 0.1%. (b) The Ultrasonic density of this solution was accurately determined by a using a 10ml density gravity bottle.] By using these two basic parameters of dextrose solution measured at different temperatures and concentrations, we can estimate other various acoustical parameters.

Defining Relation:

1. **Adiabatic Compressibility (β):** It is the fractional change (decrease) in volume per unit increase of applied pressure when no heat flows in or out of the system. Quantitatively, the reciprocal of bulk modulus,$\beta = 1/ U^2\rho$
2. **Acoustic Impedance (Z):** It is the ratio of sound pressure to particle velocity at a single frequency and is expressed as 'rayals'. It is depending on the density of the medium and the speed of the sound wave. $Z = U\rho$
3. **Non – linearity parameter (B/A):** It is a basic parameter for determining the degree of waveform distortion. From the Non - linearity Parameter we can gather information about some physical properties of the liquid mixture such as internal pressure and structural behaviour etc.
4. **Relative Association (R_A):** It is a parameter used to assess the association in any solution relative to the association existing in solvent. It is estimated using the following relation,$R_A = \{(\rho/\rho_0)\ (U/U_0)^{1/3}\}$
5. **Intermolecular free length (L_f):** It is the distance between the surfaces of neighbouring molecules in the medium. The intermolecular free length can be calculated from the relation, $L_f = \{K(\beta)^{1/2}\}$
6. **Isothermal Compressibility:** Isothermal Compressibility is a useful concept in determining the compressible properties of the reservoir.$K_T = \gamma .\ B_a$

III. RESULT AND DISCUSSION

The oversufficiency of thermo-acoustic parameters which plays an important role to understanding the nature of molecular interaction of liquid mixtures have been studied by several researchers. The variation obtained by experimentally determined values of Ultrasonic velocity, density and other acoustical parameters of dextrose solution at different temperatures (283.15K, 288.15K, 293.15K, 298.15K) and different concentration as shown in fig. 1-8.[7]

Ultrasonic velocity is a major parameter which provide information and it is greatly affected by the concentration and the temperature. It depends upon the change in elastic properties of liquid solution during its propagation. Ultrasonic velocity of the solution increases with increase in concentration and temperature as shown in fig.1. Compressibility of the solution decreases with the increase in concentration therefore ultrasonic velocity increases which clearly denote that rise in solute-solvent interaction shows greater molecular association through hydrogen bonding one of the Constituent in the solution.

The density of dextrose in the present investigation increases with increase in concentration and decrease with increase in temperature (as shown in fig.2) as the temperature increases, the particle become weakly packed Therefore the density is decrease.[8] Adiabatic compressibility decreases with increase in concentration and temperature, this decrease value of adiabatic compressibility indicates strong intermolecular Association between the dextrose and solvent (NaCl+ water) as shown in fig. 3. because adiabatic compressibility depends on electron donor and acceptor capacity. Water is universal polar solvent when Dextrose is added, the association of solute -solvent molecules shows the close packing of molecules.[9]

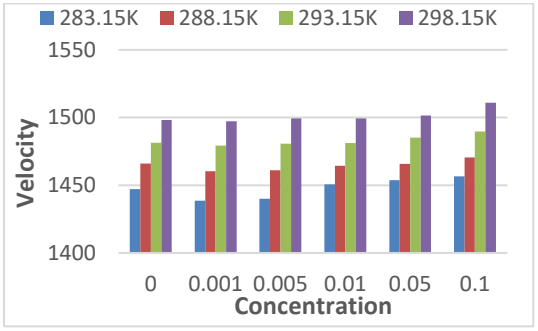

Fig. 1. Variation of Ultrasonic Velocity withConcentration and temperature.

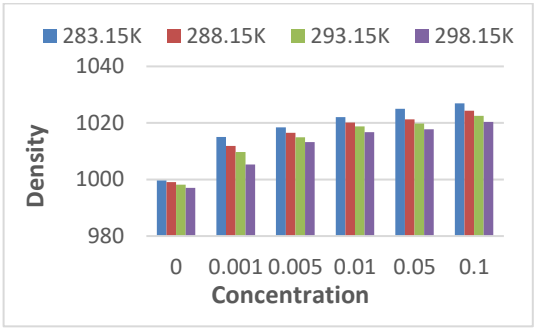

Fig. 2. Variation of Density with concentration and temperature.

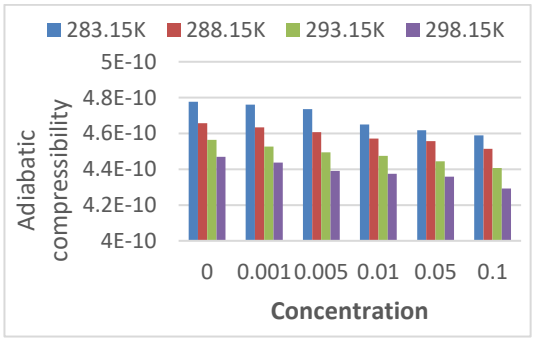

Fig.2. Variation of adiabatic compressibility with Concentration and temperature.

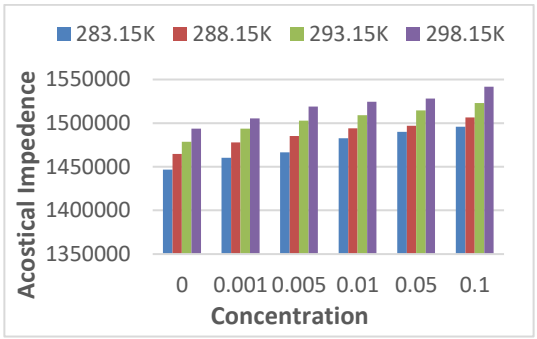

*Fig. 4.*Variation of Acoustic Impedance with Concentration and temperature..

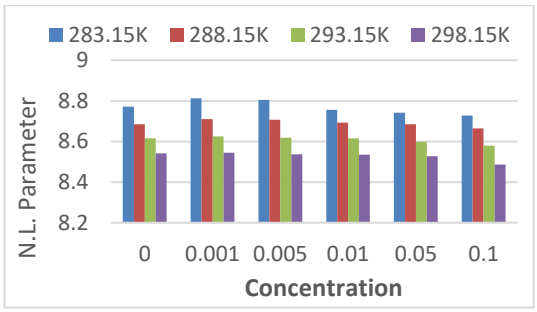

Fig. 5. Variation of Non Linearity Parameter with Concentration and temperature.

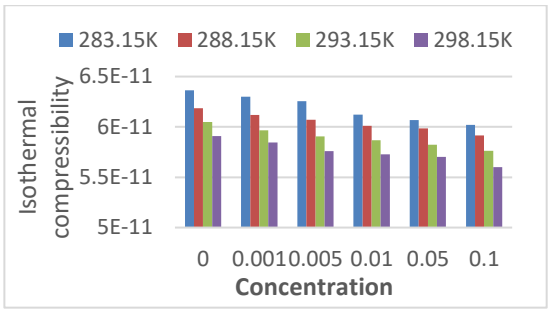

Fig. 6. Variation of Isothermal Compressibility with Concentration and temperature..

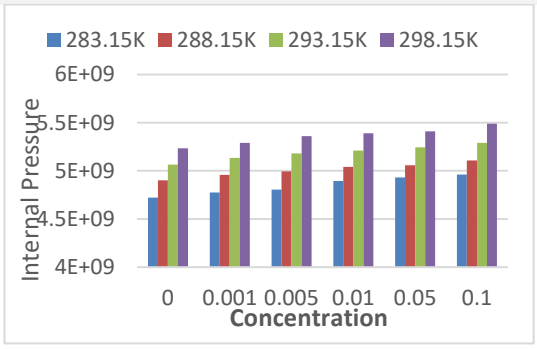

Fig. 7. Variation of Internal Pressure with Concentration and temperature.

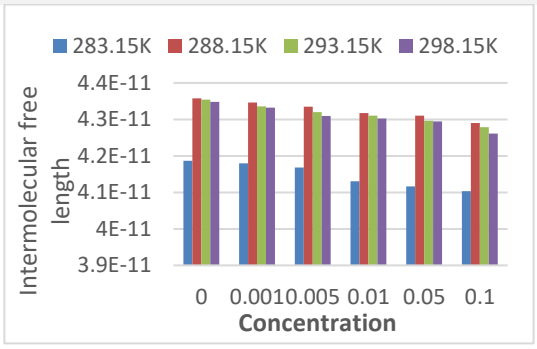

Fig. 8. Variation of Intermolecular free length with Concentration and temperature.

Acoustical Impedance values increase with increase in concentration of dextrose at all temperature in fig. 4. It is found that accords with experimental data the values of velocity and density both increases with increase concentration of solute. The increasing of impedance shows that effective solute-solvent interaction. From the fig.5 shows that the Non linearity Parameter for Dextrose as a function of concentration and temperature. From it is observed that the value of B/A decreasing with increase in temperature. This process indicates that less array value of B/A and confirms the less interaction at low temperature.[10]

The all over observation of the isothermal compressibility (K_T) are as shown in fig. 6 from the trend it is found that the decreasing the Isothermal compressibility with increasing concentration and temperature. From these the result of dextrose decreasing free volume and average Kinetic energy of the constituent solute -solvent molecules in the solution.[11] The trend of Internal Pressure increases with increasing concentration and temperature as resulting the association through ionic bonding. It gives the increasing magnitude of interaction between Dextrose and NaCl in fig. 7. [12]

Intermolecular free length is used to determining the mobility and understanding the nature as well as strength of interaction between solute-solvent. From the fig.8 it observed that the Intermolecular free length decreases with increasing concentration.[13]

IV. CONCLUSION

Ultrasonic Technique is a very efficient, sensitive and powerful probe for characterizing the acoustical and physico-chemical parameters, such as measure values are velocity and density of the dextrose in the solvent at different temperature and concentrations. The impact of concentration and temperature on the above parameters were observed and derived the presence of strong interaction between solute-solvent and greater molecular association through hydrogen bonding or ionic bonding and in some parameter, interaction is weak and to understanding the effective nature of solute-solvent.

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Molecular Interaction Between the Monosaccharide and Salt Solution by Acoustical Approach

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ABSTRACT
The different Thermo-acoustical properties have been investigated from the ultrasonic velocity & density measurement through ultrasonic velocity interferometer and 10 ml specific gravity density bottle. The sound velocity and density of monosaccharide (D- Glucose) in aqueous electrolytic solution (Magnesium chloride) provide valuable information regarding the ilk, strength of interaction and the formation of hydrogen bonds. The result is analyzed and explains on the basics of possible molecular interaction in term of structure – making and structure- breaking effects of monosaccharide in the aqueous solution of magnesium chloride at different temperature.

Keywords: Monosaccharide, electrolyte, thermo-acoustic property, intermolecular interaction.

I. INTRODUCTION

Ultrasonic sound refers to instantaneous sound pressure with a high frequency than human audible sound frequency (20Hz to 20 kHz). Ultrasonic is most useful in the investigation of various specialization like excess pressure grain size microstructure, elastic constant etc. ultrasonic is the non-destructive flexible method. Acoustical parameter calculating from the values determined by the ultrasonic viscosity, velocity and density. [1]

Ultrasonic measurements are astronomically used to study the intermolecular interaction in pure and mixtures of liquids. residual acoustical properties of mixture are used in the study of arrangement and Molecular interaction. [2] Theoretical treatment and analysis of the experimental thermodynamic properties of liquids and mixtures depends upon reliable equations of the parameters for the pure liquids. Properties of liquid-liquid mixtures are thermodynamically very important as a part of studies of thermodynamic, acoustic and transport aspects [3]. The present Work mainly deals with aqueous solution of monosaccharide the (D-glucose), they are of the same family and having many common properties with a sharp feature differences, which are the most expressive bimolecular of life on the earth. The carbohydrates, constantly termed as sugars are “Staff of life” for most living organism. They are widely distributed in plant and animal.[4] All the carbohydrates (D-glucose, sucrose,-B-D lactose) were made anhydrous. The low conductivity of water as used for preparing the Solution, which is made up of passing distilled water through a cation and anion Resin’s. [5]

D-Glucose is the most common naturally occurring simple sugar and is a building block for disaccharides sucrose and lactose and higher olio- and polysaccharides. It is the only sugar unit in cellulose and starch. Animals and plants produce D-glucose by glycogenolysis and photosynthesis, respectively, and use it as a primary energy source empirical formula for monosaccharide is $(C_{12}H_{22}O_{12})_n$, predict the great variety of structures and interesting conformational flexibility. The physical properties of monosaccharide in aqueous solution are monosaccharides are colorless and crystalline compound. They are readily soluble in water, they have sweet taste. D- glucose and L-glucose are mirror images of each other, the presence of asymmetric carbon atoms in a compound give rise to the formation of isomers of that compound, etc. [6]

II. EXPERIMENTAL DETAILS

A. MATERIALS

In the present work, we have used analytical reagent (AR) grade with 99% purity of D-Glucose {[CAS No-50-99-7] [molecular wt. – 180.156 g/mol]} used as solute , magnesium chloride with 99% purity of {[CAS No-7786-30-3][molecular wt-203.30 g/mol]} and fresh distilled water having [molecular wt. 18.01528 g/mol with density – 1000 kg/m3] was used as a pure universal solvent and this work was done at different temperatures (i.e.283.15,288.15, 293.15 & 298.15K) and concentrations.

B. METHOD

A digital ultrasonic velocity interferometer was used for measuring the ultrasonic velocity operating at frequency 2 MHz supplied from Vi Microsystems Pvt. Ltd., Chennai (Model VCT:71) with an overall accuracy 0.0001m/s.

The densities of the solutions were determined using 10ml specific gravity bottle having accuracy $\pm 2*10^{-2}$ kg/m^3 and digital electronic balance (Contech CA-34) having accuracy ±0.0001gm. an average of triple measurements was taken into account for better accuracy. The experimental temperature was maintained constant by circulating water with the help of an automatic thermostatic water bath supplied by Lab-Hosp. Company Mumbai having an accuracy ±1K temperature.

III. DEFINING RELATIONS

For the derivation of several acoustical and thermo-dynamical parameters the following defining relations reported in the literature are used:

- Adiabatic Compressibility $(\beta) = 1/(U^2\rho)$
- Acoustic Impedance $(Z) = U\rho$
- Non linearity parameter by Hartmann: $B/A = 2+0.98 *10^4/ u$
- Relative association (R_A): $(R_A) = (\rho/\rho 0)\ (u_0/u)^{1/3}$

IV. RESULT AND DISCUSSION

A. ULTRASONIC VELOCITY & DENSITY:

In the present work ultrasonic velocity of pure water has been measured at temperature and the observed data tabulated in the *table (1)*The ultrasonic velocity of the system grow with the grow of temperature as well as concentration In *table (2)* this indicates that increscent in the molecule of solute and solvent due to dipole-Dipole, ion dipole interaction. [8]

In the present Investigation of D-glucose in aqueous solution of magnesium chloride increases with the increase in concentration and decrease with an increasing temperature in *table (1)* thus particle become loosely packed to cause a decrease in density as the temperature increases.[9]

Table 1: Experimentally determined values of Ultrasonic velocity at different concentration and temperature.

Velocity				
Conc.	**283.15K**	**288.15K**	**293.15K**	**298.15K**
0	1447.101	1466.032	1481.496	1498.101
0.001	1447.437	1466.822	1482.906	1484.514
0.005	1447.653	1467.661	1482.692	1512.688
0.01	1449.001	1467.870	1483.105	1498.284
0.05	1448.53	1468.403	1484.722	1499.554
0.1	1449.441	1470.802	1484.735	1500.560

Table 2: Experimentally determined values of Density at different concentration and temperature.

Density				
Conc.	**283.15K**	**288.15K**	**293.15K**	**298.15K**
0	**999.76**	**999.1**	**998.202**	**997.031**
0.001	**1020.982**	**1019.197**	**1015.667**	**1013.9009**
0.005	**1024.2287**	**1019.1567**	**1017.1951**	**1014.4769**
0.01	**1024.916**	**1021.2209**	**1018.4**	**1017.033**
0.05	**1029.9534**	**1025.2821**	**1022.254**	**1021.0031**
0.1	**1032.9516**	**1029.34**	**1026.9552**	**1023.767**

B. ADIABATIC COMPRESSIBILITY:

Physico-chemical properties of liquid can be understood by adiabatic compressibility (β) as the hydrogen bonding between the unlike components in the solutions decreases with the compressibility. In the present case it is found that the adiabatic compressibility decreases with increase in concentration. Because, as water is polar solvent and when salts and monosaccharide mixed, the well intermolecular interaction occurred, resulting in close packing of molecules. The decrease values of adiabatic compressibility listed in *table (3)* indicate the strong association of monosaccharide and salts molecules. The compressibility of the solvent is higher than that of solution and decreases with increase in concentration of the solution.[10]

Table 3: Calculated values of Adiabatic Compressibility at different concentration and temperature.

Adiabatic Compressibility(β)*10^{-10}				
Conc.	**283.15K**	**288.15K**	**293.15K**	**298.15K**
0	4.77646	4.65698	4.56437	4.46899
0.001	4.67501	4.56023	4.47735	4.47544
0.005	4.6588	4.5552	4.47192	4.30784
0.01	4.64702	4.5447	4.46414	4.38003
0.05	4.6273	4.52341	4.43763	4.35561
0.1	4.60807	4.49089	4.41724	4.33803

C. ACOUSTIC IMPEDANCE:

In *table (4)* the acoustic impedance is a acoustical parameter which depends on the temperature and concentration of solution. Acoustic impedance is increases with increasing concentration. The increase of acoustic impedance is an indication of strong interaction between D-glucose and aqueous magnesium chloride. [11]

Table 4: Experimentally determined values of Acoustic Impedance at different concentration and temperature.

Acoustic Impedance (Z)				
Conc.	**283.15K**	**288.15K**	**293.15K**	**298.15K**
0	1446753.6	1464712.5	1478832.2	1493653.1
0.001	1477807.1	1494980.5	1506138.6	1505150.0
0.005	1482727.7	1495776.5	1508187.0	1534587.0
0.01	1485104.3	1499019.5	1510394.1	1523804.2
0.05	1491918.3	1505527.3	1517763.0	1531049.2
0.1	1497202.4	1513955.3	1524756.3	1536223.8

D. NON LINEARITY PARAMETER BY HARTMANN:

This interaction can be described in terms of Non linear parameters which measure how much each compound contributes to the mixtures overall polarity and internal pressure in *table (5)*. [12]

Table 5: Calculated values of Non Linearity parameter at different concentration and temperature.

Non Linearity Parameter				
Conc.	**283.15K**	**288.15K**	**293.15K**	**298.15K**
0	8.77216	8.684710	8.614935	8.54161
0.001	8.770588	8.681110	8.608645	8.601486
0.005	8.769578	8.677291	8.609599	8.478577
0.01	8.763280	8.676340	8.607758	8.546027

0.05	8.765479	8.673917	8.60056	8.576489
0.1	8.761227	8.663031	8.600504	8.531214

E. Relative association (RA):

It is studies to understand the ion-ion or ion-solvent interaction. In present study the relative association increases as increase in concentration due to decrease in intermolecular free length. It suggest that the salvation of D-glucose predominates over breaking up to the solvent structure, as observed in table 8 it is varying irregularly with increase in temperature due to addition of D-glucose in *table (6)*. [13]

Table 6: Calculated values of Relative Association at different concentration and temperature.

Relative Association (R_A)				
Conc.	**283.15K**	**288.15K**	**293.15K**	**298.15K**
0	1	1	1	1
0.001	1.021148	1.019931	1.017173	1.020013
0.005	1.024344	1.019697	1.018753	1.014216
0.01	1.024713	1.021714	1.019865	1.020020
0.05	1.029861	1.025653	1.023353	1.023712
0.1	1.032643	1.029152	1.028056	1.026004

V. CONCLUSION

It concluded that the system explained on the basis of molecular interaction in term of structure –making and structure- breaking effects of monosaccharide in the aqueous solution of magnesium chloride at different temperature was determined.

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Molecular Interaction and Thermodynamic Properties of Potassium Nitrate at Various Concentrations and Temperatures by Ultrasonic Method

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ABSTRACT
In the present manuscript, we intend to examine the type of solute-solvent interactions present in such a system which is valuable to various sector. Systematic knowledge of the thermodynamic properties in conjunction with other volumetric properties provides useful information about water-solute interactions. We examine, therefore velocity, density, and viscosity of various concentrations of KNO3 that have been measured in various aqueous solutions at 2MHz and 283.15K to 298.15K, to study the ion-solvent interactions. With the use of these experimental values desired thermodynamical and acoustical parameters such as available volume, ultrasonic attenuation, entropy, enthalpy, and L.J.P have been calculated.

Keywords- KNO3, Acoustical parameters, ultrasonic velocity

I. INTRODUCTION

Ultrasonic studies help in characterizing the acoustical and thermodynamic behavior of various liquid mixtures.[1-2]Ultrasonic and thermodynamic properties of a liquid mixture are of great significance in obtaining an in-depth knowledge of inter and intra-molecular interactions.[3]The thermophysical parameters are a very easy tool for understanding and correlating the result. This result predicts a direct correlation of physical parameters of the liquid system. The study of ultrasonic is found to be useful in measuring several physicochemical parameters [4-6]

Potassium nitrate is used as a diuretic in medicines. It is also used as an ingredient in toothpaste. It makes the teeth less sensitive to pain, by interfering with the transmission of pain signals to the nerves of the teeth. It is also added to the drugs for back pain and joint pain. Potassium nitrate affects nucleic acid synthesis in the greening cucumber cotyledons [7] and the stability of tropomyosin [8]

Hence present work mainly provides useful information on the measurement of velocity, density, and viscosity values of KNO_3 solution at different temperatures and concentrations. This information is useful to understand various biochemical reactions occurring in living organisms.

II. MATERIAL AND METHOD

AR grade of Potassium Nitrate having a molecular weight of 101.1032g/mol was obtained from HIMEDIA private ltd. The purity of the compound is 99.99%. The various concentrations ranging from 0.01-0.10 mole/Kg were prepared from the standard formula and used on the day were prepared.

In the proposed work we have planned to measure Ultrasonic velocity at different solutions using a digital Ultrasonic interferometer or pulse-echo overlap technique with the function of concentration and temperature. The density measurement of solutions would be carried out using specific gravity density bottles respectively. The temperature variation of different samples will be maintained constant using a thermostatically controlled digital water bath with a flowing water technique. The viscosity has been calculated with the help of Oswald's Viscometer.

III. DEFINING RELATION

Using measured data, the following acoustical parameters have been computed using the standard relations,

Ultrasonic Attenuation (α) :

Ultrasonic attenuation has been calculated using the relation

$$\alpha = \frac{0.1151}{v} U_t \ldots\ldots\ldots\ldots\ldots\ldots 1$$

Available volume(V_a):

Available volume can be calculated as

$$V_a = V_m\left(\frac{1-c}{c_\infty}\right) \ldots\ldots\ldots 2$$

Where C is the Velocity of the compound and C_∞ infinite velocity

Enthalpy(ΔH_i): Enthalpy can be calculated using the equation

$$\Delta H_i = \frac{P_i \times V_m}{M_{eff}} \ldots\ldots\ldots\ldots 3$$

M_{eff} is an effective molar mass and P_i is internal pressure and V_m is the molar mass

Entropy(ΔS): Entropy is given by the formula

$$\Delta S = \frac{(\Delta H_i - \Delta G)}{T} \ldots\ldots\ldots\ldots 4$$

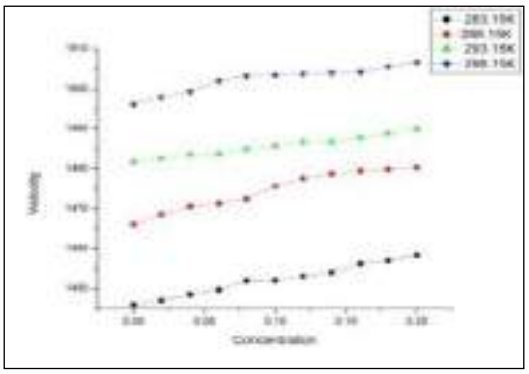
Where ΔH_i is Enthalpy of the system ΔG is Free energy of activation of the system, and Absolute temperature in Kelvin

Lenard Jones Potential (L.p.j): It can be calculated using the relation

$$(LJ)\ 6 - \left(\frac{v_m}{v_a}\right) - 13 \ \ldots\ldots\ldots\ldots 5$$

IV. RESULT AND DISCUSION

1) **Graph:** Graphical representation of Potassium Nitrate at temperatures 288.15k, 288.15K, 293.15K 298.5K respectively the ultrasonic attenuation, available volume, enthalpy, are calculated by using the following standard relation [1-5]



Fign IV.a Variation of velocity with concentration

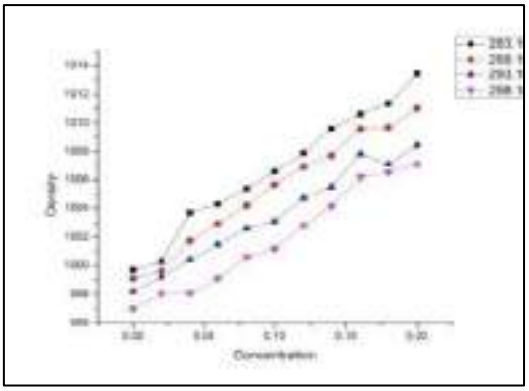
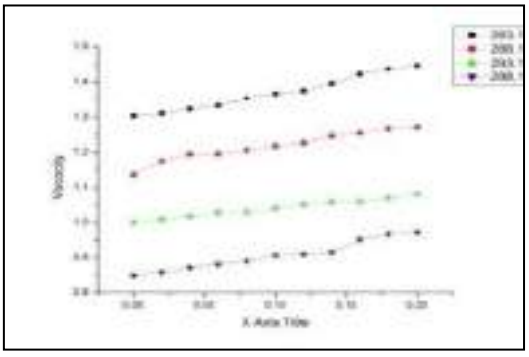
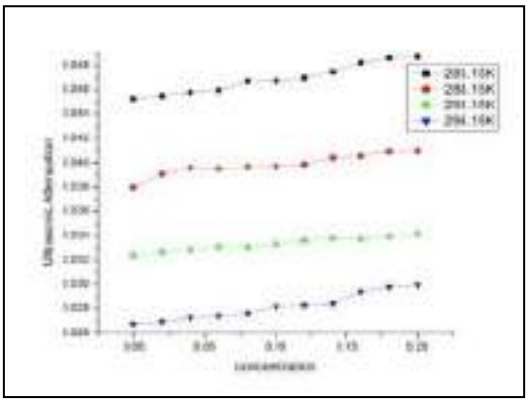


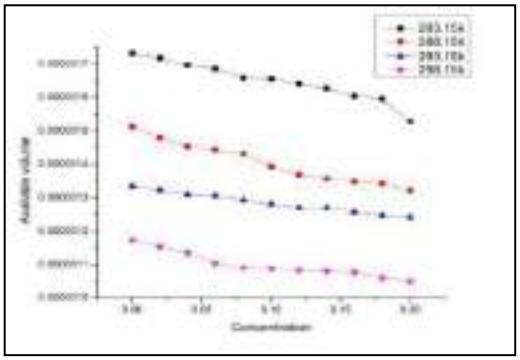
Fig IV.b Variation of density with *concentration*



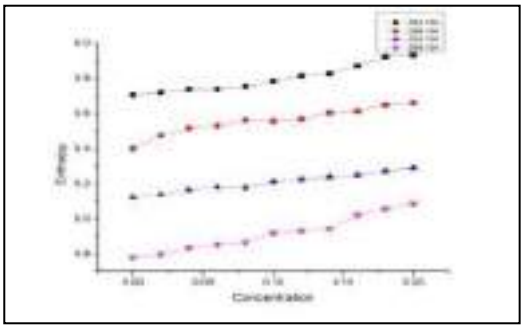
FigIV.c Variation of viscosity with concentration



FigIV.d Variation of ultrasonic attenuation with concentration



FigIV.e Variation of available volume with concentration



FigIV.f Variation of enthalpy with concentration

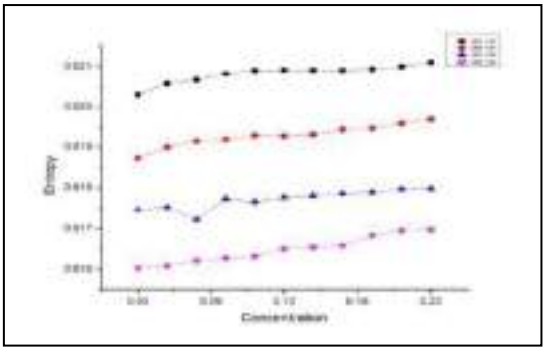


Fig IV.g Variation of entropy with concentration

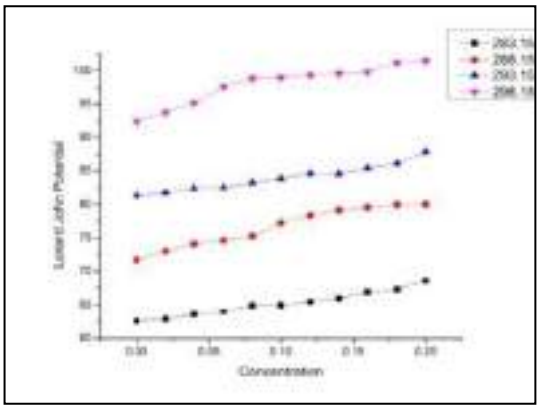


Fig IV.h Variation of L.J.P with concentration

From the graph IV.a to IV.b we observe the trends of all acoustical parameters with variation in concentration and temperature. The ultrasonic velocity increases with the molar concentration of solute as well rise in temperature. This increase in ultrasonic velocity, in the aqueous solution of potassium nitrate may be attributed to the cohesion brought by the ionic hydration. The increase in density with molar concentration may be due to enhancing solute-solvent, and solvent-solvent interaction exists between water and potassium nitrate. [9-10]

Fig IV.(c) suggests that the viscosity of potassium nitrate increases with an increase in molar concentration. An increase in viscosity of solution indicates a greater association among the molecules of solution. A decrease in viscosity with temperature is because of cohesion and frictional forces diminished due to frictional forces of the molecule.[11]

Ultrasonic attenuation values increase with an increase in the concentration of solute fig IV.(d). Decrease in viscosity and density whereas, an increase in sound speed with the temperature affects the absorption of ultrasonic waves causing a decrease in the attenuation with temperature.[12]

The variation of available volume is shown in Fig IV.(e) it is observed that the fig that the available volume of potassium nitrate solution decreases with the rise in concentration and also with temperature. This indicates that there exists a significant solute-solvent interaction that leads to structure-promoting behavior. [13] Fig IV.(f) shows that the Entropy increases with an increase in the concentration of potassium nitrate. This indicates the availability of more solute molecules in a given region, giving rise to solute-solvent interaction. [14]

From the fig IV.(g) shows the variation of Entropy with temperature. From the observed graph, it is concluded that the entropy decreases with the increasing value of temperature. [15] This variation leads to the conclusion that the medium is closely packed and favors the solute-solvent interactions, constant is given in fig All these constant shows a minor increase in their respective values due to an increase in concentration. These variations conclude that the medium is closely packed and favors the increase in solute-solvent interactions.[16] As monitored from fig IV.(h) values of Lenard john's potential increase with an increase in concentration and decrease with an increase in temperature the Lenard John Potential values indicate that dipole-dipole attraction is stronger than induced dipole-dipole attraction.[17]

V. CONCLUSION

The ultrasonic study of the aqueous solution of potassium nitrate confirms the presence of strong ion-dipole interactions. The experimental parameters give valuable information regarding ion-solvent interaction in an aqueous solution.KNO3 is added as a solute result breaking hydrogen bonds in the solvent system and thus producing free solvent molecules. This result increases the value of ultrasonic velocity and decreases with available volume with concentration which shows the solute-solute interaction is smaller than solute-solvent interactions.

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Measurement of Thermo-Acoustic and Volumetric Properties of Zinc Sulphate in Aqueous Solution of Monosaccharide

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ABSTRACT
Ultrasonic velocity and density measurement of Zinc Sulphate have been performed by ultrasonic interferometer technique in aqueous solution of monosaccharides (glucose) as a function of concentration (i.e. 0.2 and 0.5 Mole/kg) and temperature (i.e. 298.15k, 293.15K 288.15k and 283.15k) .The different acoustical properties have been explore data from the density and ultrasonic velocity such as adiabatic compressibility, acoustic impedance ,specific heat ratio, non-linearity parameter ,relative association and isothermal compressibility. The result have been explain on the basis of association or dissociation exist between zinc sulphate and aqueous glucose solution or effect of structure making and breaking of solute in solvent.

Keywords: acoustical parameters, density,ultrasonic velocity and Zinc Sulphate.

I. INTRODUCTION

Ultrasonic measurement are astronomically used to study the intermolecular interaction in pure and mixtures of liquids. Residual acoustical properties of mixture are used in the study of arrangement and molecular interaction.[1] Ultrasonic sound refers to instantaneous sound pressure with a high frequency than human audible Sound frequency (20Hz to 20kHz). Ultrasonic is most useful in the investigation of various specialization like excess pressure grain size microstructure, elastic constant etc. ultrasonic is the non-destructive flexible method. Acoustical parameter calculating from the values determined by the ultrasonic velocity and density.[2] ultrasonic is the resourceful or all around and non-destructive techniques and gives an extensive large application in distinguish thermodynamic and physiochemical behavior of liquid mixture. [3]

The current work mainly deals with aqueous solution of monosaccharide (glucose) which is the most expressive biomolecule of life on the earth. The carbohydrates, constantly termed as sugars are “Staff of life” for most living organism. They are widely distributed in plant and animal. [4] C_n $(H_2O)_n$ is the general formula for all carbohydrates. This formula is only valid for simple sugars, which are made up of the same amount of carbon and water. All the carbohydrates (D-Glucose, sucrose, -B-D lactose) were made anhydrous. The low conductivity of water as used for preparing the Solution, which is made up of passing distilled water through a cation and anion resins. [5]

Empirical formula For monosaccharide is $(CH_{22}0)_n$, predict the Great variety of structures and interesting conformational flexibility. The physical properties of monosaccharide in aqueous solution are monosaccharide are colorless and crystalline compound. They are readily soluble in water; they have sweet taste. D-glucose and L-glucose are mirror images of each other, the presence of asymmetric carbon atoms in a compound give rise to the formation of isomers of that compound, etc. [6]

II. MATERIAL AND METHOD

In the present work, we have used analytical reagent (AR) grade with 99% purity of Glucose {[CAS No- 50-99-7] [molecular wt. – 180.156 g/mol]} used as solute, Zinc Sulphate with 99% purity of {[CAS No-7733-02-0][molecular wt-161.47 g/mol]} and fresh distilled water having [molecular wt. 18.01528 g/mol with density – 1000 kg/m3] was used as a pure universal solvent and this work was done at different temperatures (i.e.283.15,288.15, 293.15 & 298.15K) and concentrations

1. This experiment was carried out at different temperatures (i.e.283.15, 288.15, 293.15 & 298.15K) which were maintained by a digital water bath.
2. The measurement of weight was done by using a digital weighing machine having an accuracy of ±0.1mg.
3. Some basic parameters like, Ultrasonic velocity were measured on a digital ultrasonic interferometer with a 2MHz frequency having an accuracy of 0.1%.
4. The ultrasonic density of this solution was accurately determined by using a 10ml density gravity bottle.
5. Using the measured data, some other acoustical parameters have been calculated using standard relation.

Defining Relation:

1 **Adiabatic Compressibility** The adiabatic compressibility is defined as 'the fractional decrease volumeter unit Increase of pressure. $\beta a = 1/u^2\rho$,,
Where, u=ultrasonic velocity and ϱ=densityof solution

2 **Acoustic Impedance** The specific acoustic impedance is given by $Z=u\rho$
Where, u=ultrasonic velocity ϱ =densityof solution

3 **Specific Heat Ratio:** $\gamma = (17.1/ T^{4/9} * \rho^{1/3})$
Where, T= temperature and ϱ = Density

4 Nonlinear it y parameter by Hartmann.[10]
$B/A = 2+0.98 *10^4/ u$
Where, u is ultrasonic velocity, u is in m/s

5 **Relative association (RA):** The relative association parameter is the relative association between the component's molecules in a liquid mixture and is given by $(R_A) = (\rho/\rho 0)\ (u_0/u)^{1/3}$where, ρ is density, u ultrasonic velocity, ρ_0 is the density of water, u_0 is the ultrasonic velocity of water.

6 **Isothermal compressibility (βi):** Isothermal Compressibility is a useful concept in determining the compressible properties of the reservoir. $\beta i = \gamma Ba$, Whereγ =specific heat ratio

III. RESULT & DISCUSSION

The experiment value of ultrasonic velocity (U) density (ρ), and other allied parameter of zinc sulphate in aqueous solution of monosaccharides for the experimental system atdifferent temperature (283.15k,288.15k,293.15k & 298.15k) and Concentration are demonstrated in figures.

The Ultrasonic velocity, density have been used by many workers to calculate different acoustical parameters such as adiabatic compressibility, acoustic impedance and so on these parameters were successfully employed to understand the structural change and the nature of molecular interactions between the interacting component in the mixtures. These parameters were used to explain different types of molecular interaction, such as strong, weak charge transfer, complex formation and hydrogen bonding interaction and the structure making and breaking properties of the interacting components

Ultrasonic velocity is the most important parameter that gives information concerning the nature of molecular interaction & is affected by temperature and concentration. The ultrasonic velocity of the system increases with the increase in concentration as well as temperature (as show in fig.1). This suggests, association in the molecular of solute and solvent, due to ion-dipole, dipole-dipole interaction.[7]

The density of zinc sulphate in aqueous glucose in the present investigation increases with the increase in concentration and decreases with an increase in temperature (as shown in fig. 2) as the temperature increases, particle become loosely packed to cause a decrease in density. [8]

The dependence of adiabatic compressibility of zinc sulphate in aqueous solution of glucose on concentration at different temperature is as shown in fig (3) It is oblivious that if ultrasonic velocity increases, then adiabatic compressibility of solution decreases as there exists inversely proportional relationship between them. In the present investigation, the decrease in adiabatic compressibility value with rise in concentration at constant temperature is observed. The decrease in adiabatic compressibility with rise in temperature at a given concentration is observed. [7]

The acoustic impedance is the parameter which depends on concentration and temperature of solution. Acoustic impedance increases with increase in concentration. The increase of acoustic impedance is an indication of strong interaction between zinc sulphate and aqueous solutions of glucose. [9]

Fig. 5 displays the variation of specific heat ratio at different concentration of zinc sulphate biomolecules in 0.2 mol/kg solution of glucose at different temperature. The heat capacity ratio constantly decreasing which throw light on the fact that specific heat at constant volume is decreasing constantly with increasing concentration. [10]

Nonlinear parameter (B/A) obtain by to the Hartmann Balizer is related to the internal pressure hardness intermolecular potential, molecular structure & molecular interaction of liquid. fig. 6 shows the non-linearity parameter for zincsulphate biomolecules asa function of concentration in glucose at various temperature. [10]

Relative association (R_A) is depended upon the factor. The breaking of solvent structure on addition of solute to shown in fig 7 increase of relative association (R_A) with concentration suggest that close association of component of molecule andthere exist intermolecular interaction. [10].

The overall trends in the isothermal compressibility (βi) are as shown fig 8. It has been found to be decrease in concentration. The decrease in isothermal compressibility (βi) value with increase in concentration of biomolecules seems to be the result of corresponding decreases in free volume and average kinetic energy of the constituent solute - solvent molecules in the aqueous solution ofglucose.[10]

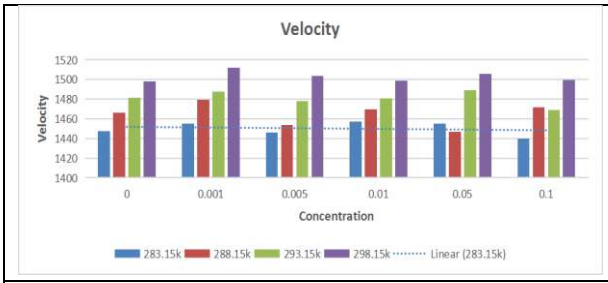


Fig.1 Variation of Ultrasonic Velocity with Concentration and temperature

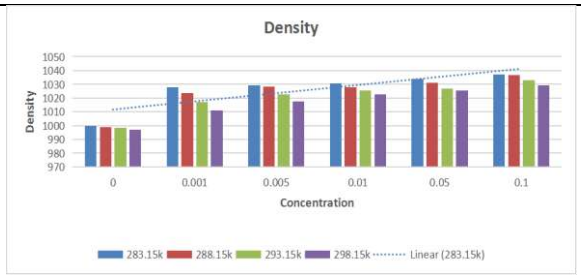


Fig.2 Variation of Density with Concentration and temperature

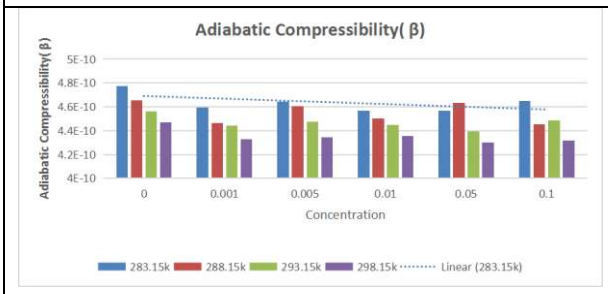


Fig.3 Variation of Adiabatic compressibilityConcentration and

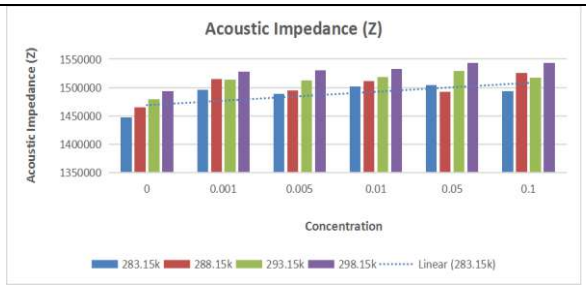
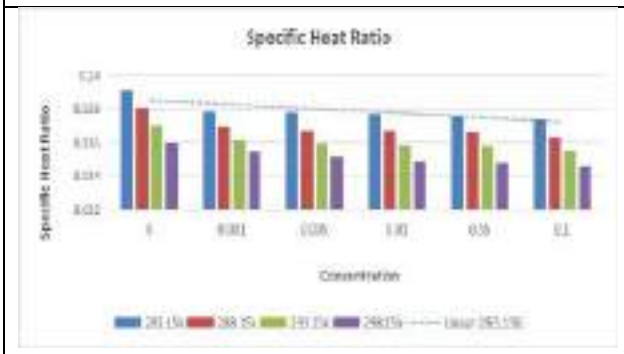
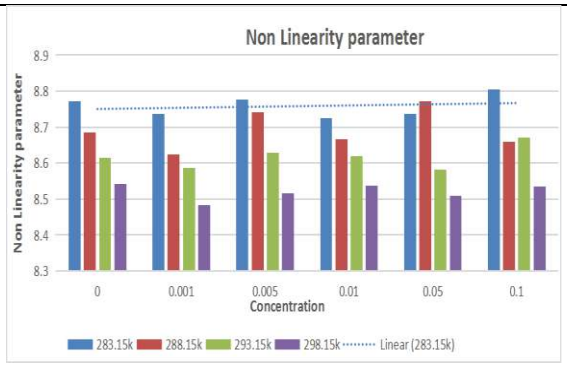


Fig.4 Variation of Acoustic Impedance with Concentration and temperature.





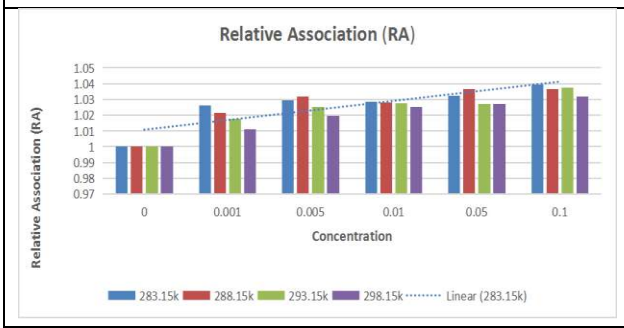


Fig.7. Variation of Relative association with concentration and temperature.

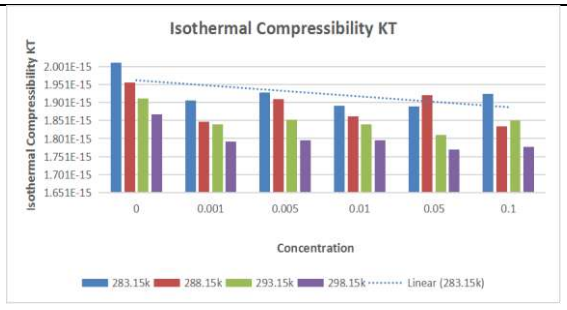


*Fig.7.*Variation of Isothermal compressibility with concentration and temperature.

IV. CONCLUSION

Basic physical parameters such as ultrasonic velocity and density of zinc sulphate in aqueous solution of glucose of different concentration and temperatures were measure initially. Using these basic parameter various acoustical parameters were calculated. The effect of temperature and concentration of this parameter was discussed appropriately. The addition of solute in solvent has been structure making tendency through molecular hydrogen bonding. It concluded that the system explains on the basis of association or dissociation exist between zinc sulphate and aqueous glucose solution or effect of structure making and breaking of solute in solvent and This information suggest the molecular interaction of liquid mixture.

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A Physico-Chemical and Thermo-Acoustical Study of Aqueous Potassium Sulphate at Different Temperature and Concentrations

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ABSTRACT
The experimentally determined quantity such as ultrasonic velocity, density and viscosity for aqueous potassium sulphate solution of various concentrations have been determined at different temperatures (288.15, 293.15 & 298.15K). These data have been used to calculate various thermos-acoustical parameters{viz. Free volume (Vf), Wada's constant (W), Hydration number(nH), Specific heat ratio(γ), Relaxation strength(r), Solubility parameter(δ),and Ballou's constant(B/A)2}. These all parameters proved the intermolecular interaction between solute (potassium sulphate) and solvent (water) and also observed the Physico-chemicalbehaviour of the solution.Thermo-acoustical studies could also be used successfully and well supported in this regard.

Keywords: Density, potassium sulphate, thermos-acoustical parameters, ultrasonic velocity, viscosity.

I. INTRODUCTION

Today, ultrasonic is one of the best-suited techniques for Physico-chemical as well as thermo-acoustical studies to determine the solute-solute, solute-solvent, ion-solvent interaction of the liquid system. In recent years ultrasonic waves have acquired the status of an important study of the structure and properties of matter. In an infield of technology, the waves are being used for detection of flaws, testing of material, mechanical cleaning of surfaces etc. And also, these waves are used in medical science, agricultural industry, chemical industry, computer technology, underwater acoustic and many other industrial areas.In the agriculture industry, fertilizer is the most important factor. Fertilizersreplace the nutrient that crops remove from the soil, without the addition of fertilizer agriculture productivity would be reduced. That's why mineral fertilizer is used in the soil as a supplement that can be quickly absorbed and supply more nutrients for the better growth of plants.

Thus, in this paper, we are studying the different thermo-acoustical parameters of aqueous potassium sulphate solution which is mainly used as fertilizer at different temperatures and concentrations. Potassium is needed to complete many essential functions in plants, (such as activating enzyme reactions, synthesizing protein, forming starch & sugar and regulating water flows in cells & leaves. And the salt index of potassium

sulphate solution is very low near about 0.88. By using this fertilizer, we can reduce the risk of soil-salt build up in agriculture.

II. MATERIAL AND METHOD

In the present paper, we have used potassium sulphate [molecular wt. – 174.259 g/mol]as a solute of AR grade with 99% purity and fresh distilled water having [molecular wt. 18.01528 g/mol] was used as a pure universal solvent and this work was done at different temperatures (i.e., 288.15, 293.15 & 298.15K) and concentrations (0.2……2M).

This experiment was carried out at different temperatures (i.e., 288.15, 293.15 & 298.15K) which were maintained by a digital water bath. The measurement of weight was done by using a digital weighing machine having an accuracy of ±0.1mg. Some basic parameters like Ultrasonic velocity, density and viscosity,(ultrasonic velocity were measured on a digital ultrasonic interferometer with a 2MHz frequency having an accuracy of 0.1%, Ultrasonic viscosity was determined by using Ostwald's viscometer with ±0.001pa-sec accuracy and the ultrasonic density of this solution was accurately determined by using a 10ml density gravity bottle). Using the measured data, some other thermos-acoustical parameters have been calculated using standard relation.[1]

Defining Relation:

The thermo-acoustical parameters can be calculated using the following relation:

1. Free volume (V_f): $\mathbf{V_f = (M_{eff} \cdot U) / K\eta}$

M_{eff} – effective molar mass, K – $4.28*10^9$, U – ultrasonic velocityandη – viscosity

2. Wada's constant (W): $\mathbf{W = \beta_a^{1/7}.V_m}$

β_a– adiabatic compressibility &V_m– molar volume

3. Hydration number (n_H): $\mathbf{n_H = \{(n_1/n_2).\ (1 - \beta/\beta_0)\}}$

n_1 - number of moles of solute, n_2– number of moles of solvent, β – adiabatic compressibility of solute and β_0 – adiabatic compressibility of the pure solvent.

4. Specific heat ratio (γ): $\mathbf{\gamma = \{17.1 / (T^{4/9} * \rho^{1/3})\}}$

T – temperature & ρ – density of the solution

5. Relaxation strength (r): $\mathbf{r = \{1 - (U/U_\infty)^2\}}$

U – ultrasonic velocity of solution & U_∞ - 1600 m/s

6. Solubility parameter (δ): $\mathbf{\delta = (\pi_i)^{1/2}}$

π_i – internal pressure

7. Ballou's constant$(B/A)_2$: $\mathbf{(B/A)_2 = \{ -0.5 + [(1.2 * 10^4) / U]\}}$

U – Ultrasonic velocity of solution

III. RESULTS AND DISCUSSION

The thermos-acoustic parameter of aqueous potassium sulphate solution at different concentrations (0.2 to 2 M) and temperatures (288.15, 293.15 & 298.15K) is given in below fig. 1-10. The increase in ultrasonic velocity with concentration shown in fig.1 in solution indicates the presence of solute-solvent interaction.[2] An increase in velocity with a concentration in the present system confirms the greater molecular association. And also, as temperature increases breaking of hydrogen bonding increases and thus ultrasonic velocity increase with the increase in temperature.[3]The measured density of all systemsincreases with rising in concentration (shown in fig. 2),this indicates a good association between solute and solvent molecules.[4] It is also found that the density decreases as the temperature increases. This is becausethe thermal motion of a particle of the medium also increases. Thus, particles become loosely packed to cause a decrease in density.[5] From graph 3 it is observed that the viscosity of the solution is found to increase with the increase in concentration which suggests that a strong association in potassium sulphate solution may be due to the intermolecular hydrogen bonding, dipole-dipole and ion-dipole interaction between solute and solvent molecules.[6] It is also found that viscosity decreases as the temperature of the system increases. This is because as the temperature increases, the kinetic energy of the molecules increases which diminishes the viscosity of the medium.[5]From fig. 4 it concludes that free volume is decreasing with an increase in concentration and increase with the increase in temperature which suggests the structure making and breaking tendency of the solute molecule[7] in a solvent can be properly understood with the help of an important physical parameterfree volume. Wada constant is also known as molar isothermal compressibility. from fig. 5 it is found that as concentration increases, The value of the Wada constant decreases,and it confirms existing intramolecular interaction between solute and solvent molecule.[8] The hydration number is also known as the solvation number. It is one of the important parameters in terms of explaining the degree of interaction structure making or breaking behaviors of solute molecules. From fig. 6, it is observed that the n_H value of fertilizer decrease with an increase in concentration. This decreasing trend is due to a lack of solvent for all ions.[9] And when rise in a temperature dropsin hydration number.Specific heat ratio is an important property which depends upon the density and temperature of liquid mixture fig. 7 displays the variation of specific heat ratio, it constantly decreases with a variation of concentration of solute fact that closer packing of the molecule in a solution through hydrogen bonding.[10] And also fig.7 shows thatγincreases with the temperature rise.

It is an important property to elucidate the molecular interaction present in the system. Relaxation strength directly correlates with adiabatic compressibility. It can be calculated by using the formula.[11] The decrease in values of relaxation strength with an increase in concentration and temperature indicates solute-solvent interaction in the system (shown in fig.8). Thissuggestsa greater association between fertilizer and salts as compared to fertilizer and water.[12]Solubility parameter data are useful in the description and interpretation of different phenomena occurring between solute and solvent such as their miscibility, compatibility or adsorption.[4] Variation of the solubility parameter of potassium sulphate solution at different temperatures and concentrations (shown in fig. 9) shows the value of this parameter increases with increasing

concentration due to an increase of internal pressure in the solution. The increasing trend of the solubility parameter exhibits that the solution has more tendency to be soluble.Ballou's constant is also known as the non-linearity parameter, the value of this parameter has been interpreted as the quantity representing the magnitude of the hardness of liquid. Fig. 10 show the non-linearity parameter for potassium sulphate fertilizer at different concentration and all temperature, from observation it is clear that the value of B/A is decreasing with an increase in concentration and temperature. Thus, it leads to the tight packing of the medium and enhancement in molecular interaction.[13] This tightening of the medium creates a better way for the propagation of sound waves or ultrasonic waves.

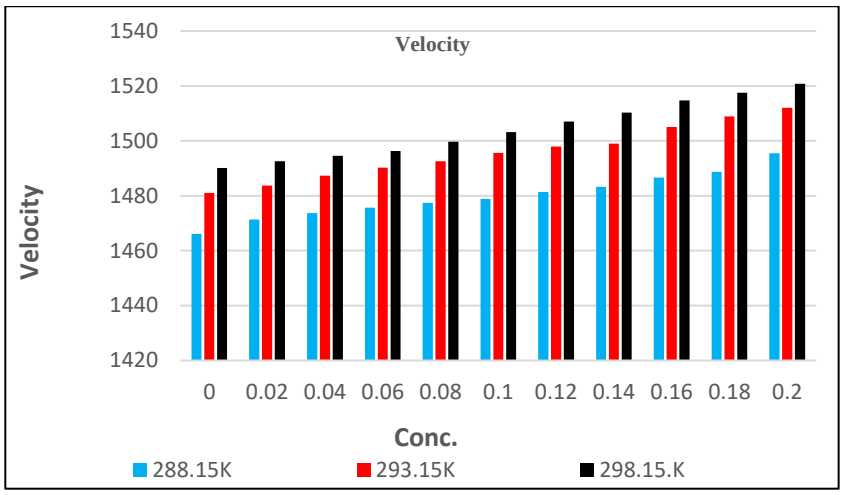

Fig.1 Variation of Velocity with Conc.

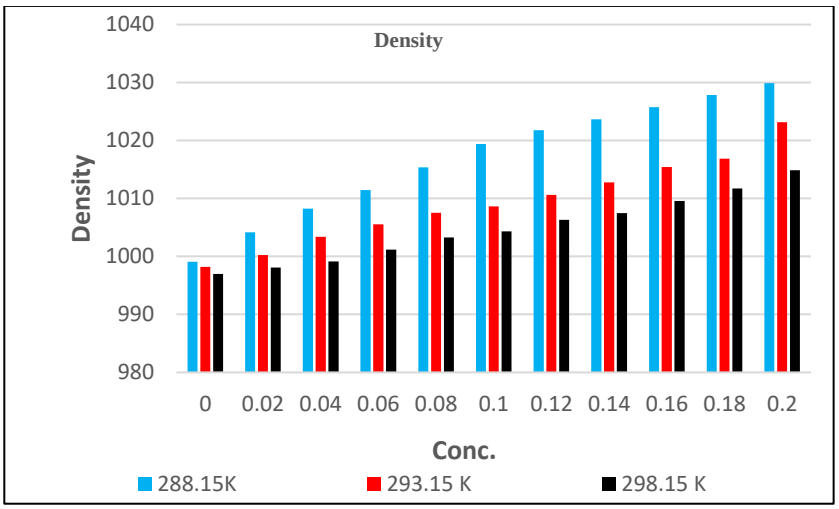

Fig.2 Variation of Density with Conc.

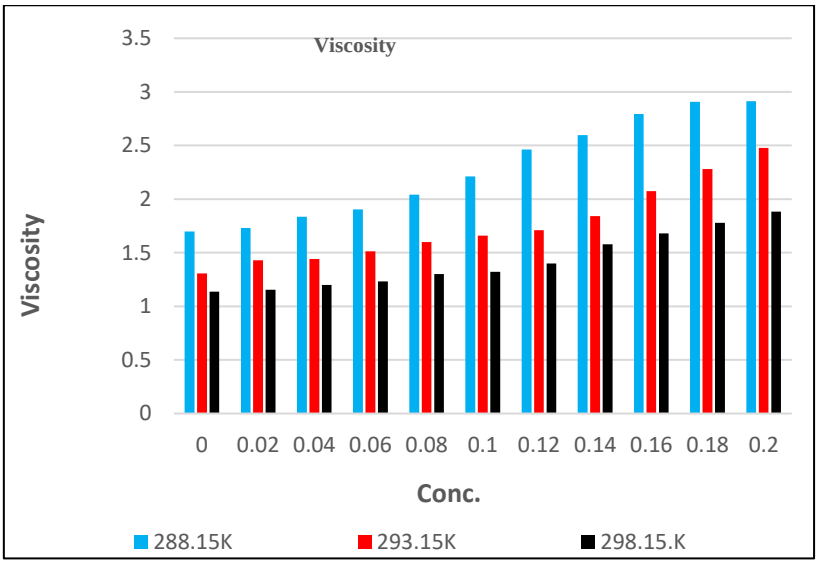

Fig.3 Variation of Viscosity with Conc.

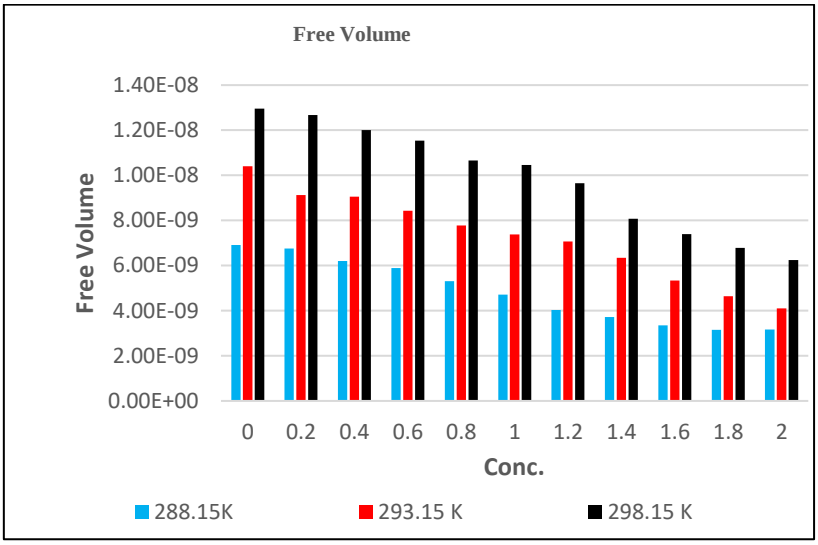

Fig.4 Variation of Free vol with Conc.

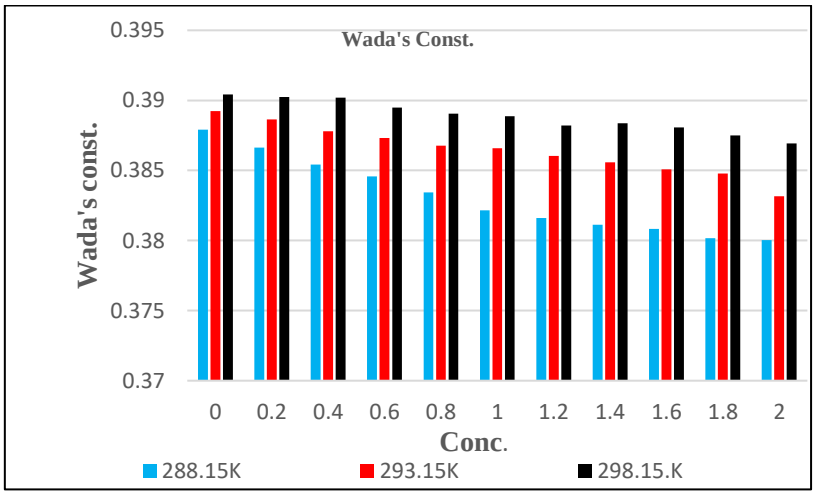

Fig.5 Variation of W. C. with Conc.

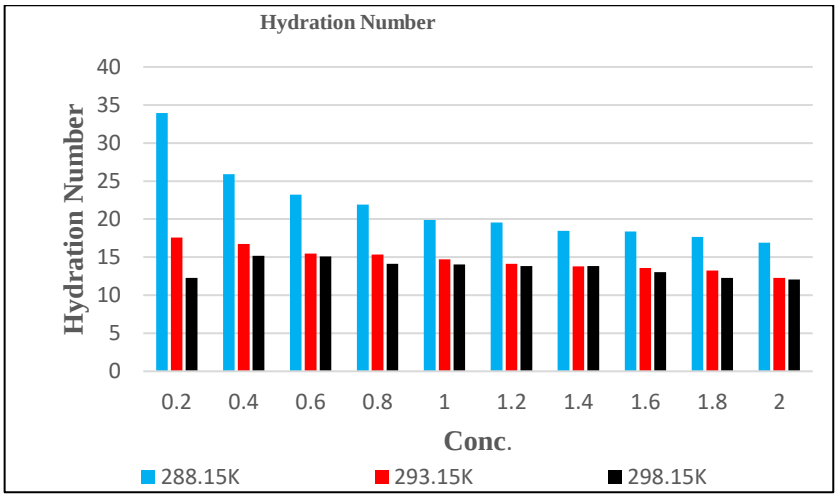

Fig.6 Variation of H. N. with Conc.

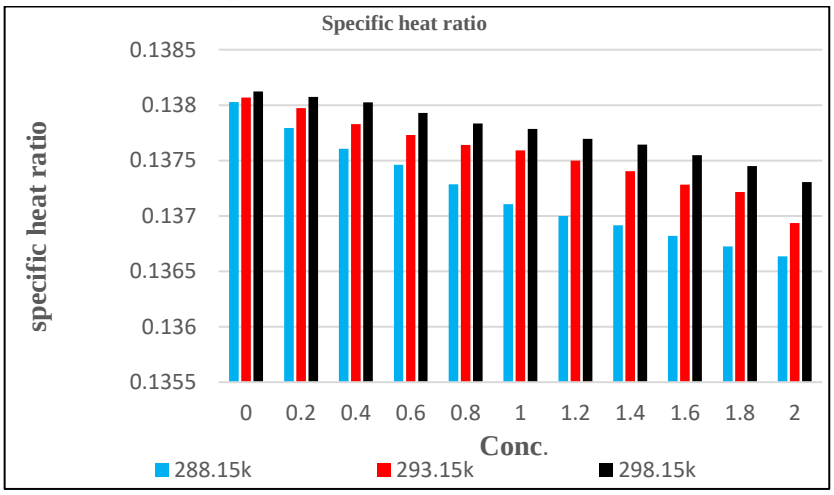

Fig.7 Variation of S.H.R. with Conc.

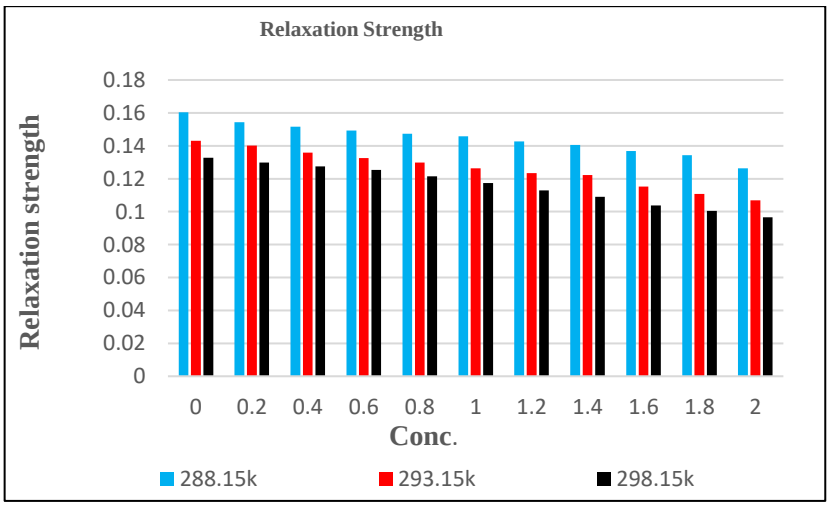

Fig.8 Variation of R.S. with Conc.

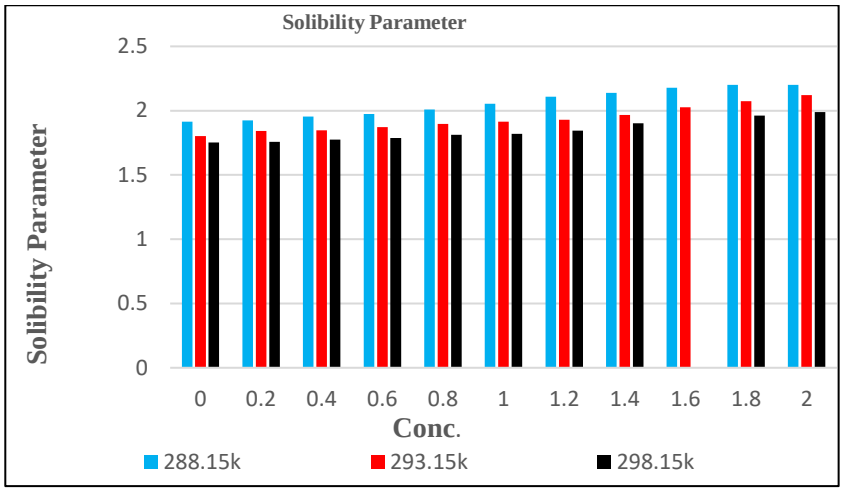

Fig.9 Variation of S.P. with Conc.

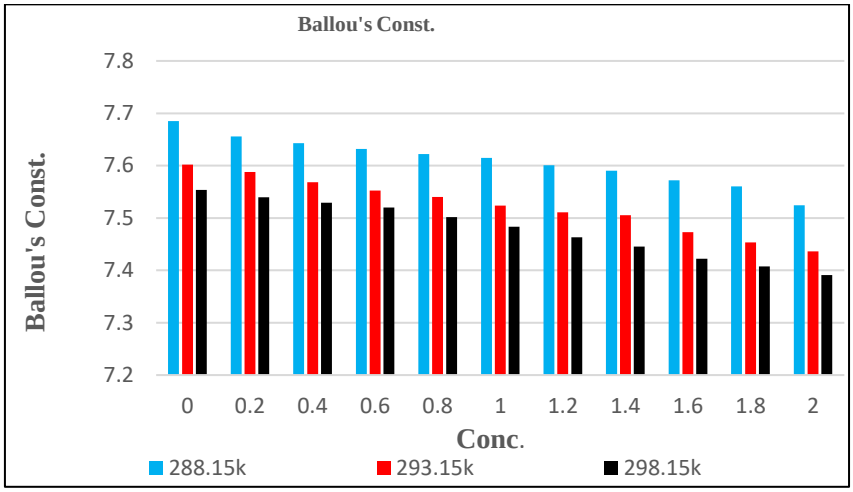

Fig.10 Variation of B. C. with Conc.

IV. CONCLUSION

The various Physico-chemicaland thermo-acoustical parameters were determined by using the experimentally measured values of density, velocity and viscosity at different concentrations (0.2…...2) and temperatures (288.15, 293.15 & 298.15K). All computed thermo-acoustical parameter shows the intermolecular interaction between solute and solvent and observed Physico-chemicalbehaviour of potassium sulphate solution. Thermo-acoustical studies could also be used successfully and well supported in this regard.

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An Acoustical Study to Explore the Interaction Between Dextrose and Electrolyte Solution Using Ultrasonic Technique

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ABSTRACT
The impact of solute in solvent has a great importance in to drug delivery in body as well as in nutrient uptake by plants from the soil. This will be studied by observing the tendency of structure making and breaking effect and their interactions by the introduction on of solute in solvent. In this work an attempt is made to evaluate the ultrasonic velocity and density for dextrose in 0.5mol/kg solution of aq. Potassium chloride. The different acoustical and transport properties of the given system using the sound speed and density of solute as well as solvent at different temperatures (viz. 283.15k, 288.15k, 293.15k, 298.15k).

Keywords: Acoustical Parameter, Density, Dextrose, Potassium chloride, Ultrasonic velocity, water.

I. INTRODUCTION

Ultrasonic investigation have been extensively used for characterizing the thermodynamics properties and to predict the solute and solvent and ion solvent interaction in aqueous solution. [1] This technology has been used for quite some time to determine bonding and formation of complexes at different temperatures. polysaccharides has been the subject of wide research and ultrasonic velocity measurements allow to accurately measure some [2] important and applicable thermodynamics and acoustic parameter. These excess ultrasound, intrinsically molecular free length, adiabatic compressibility and acoustic impedance in liquid mixtures plays an important role to understand the interaction between the solute and the solvent. Ultrasonic velocity measurements can reveal the molecular interaction that are present in binary and ternary liquid mixtures.[3]

Jackfruit seed starch was obtained by hydrolysis with alpha amylase enzyme and then dried to form malto dextrin . The characteristic of jack fruit seed. Maltodextrin had a brownish yellow color, 64% yield a water content of 3.07%, PH 6, dextrose equivalent 15.44, and water solubility 95.5 %.[4]. The density measurements are made with a density balance which provides a resolution of 0.0001g/ cm^3 . The ultrasonic velocity is measured by pulse-echo techniques with an accuracy of 1 m/s . In the work, glycerine a non-electrolyte dextrose a monohydric alcohol were chosen as probe molecules. In these system Na_2CO_3 and $NaHCO_3$ were used as buffer because they exhibit different types of behaviour in their solutions. [5]

II. MATERIAL AND METHOD

The compound dextrose (molecular wt. 180.16g/mol. Used in present work is of analytical reagent which use as solute and potassium chloride (molecular wt. 74.56g/mol) used as solvent and fresh distilled water (Molecular wt. 18.01528g/mol with density 1000 kg/m^3 is used as universal solvent. This process is done at different temperatures (viz. 283.15k, 288.15k, 293.15k, 298.15k) which were maintained by using a digital water bath.

The measurement of weight has done by using a digital weighing machine having having an accuracy of +- 0.1%. Some basic parameter like, [(a) ultrasonic velocity were measured on a digital ultrasonic interferometer with 2MHZ frequency having an accuracy of 0.1% [.(b) ultrasonic viscosity was calibrated by using Ostwald's viscometer with an accuracy of +_ 0.001pa-sec and (c) The Ultrasonic density of this solution was accurately determine by using a 10ml density gravity bottle. By using this three basic parameters of KCl solution measured at different temperatures and concentration we can calibrate other various acoustic parameter.

Defining relation :

For the derivation of several acoustical and thermo-dynamical parameters the following defining relation reported in the literature are used.

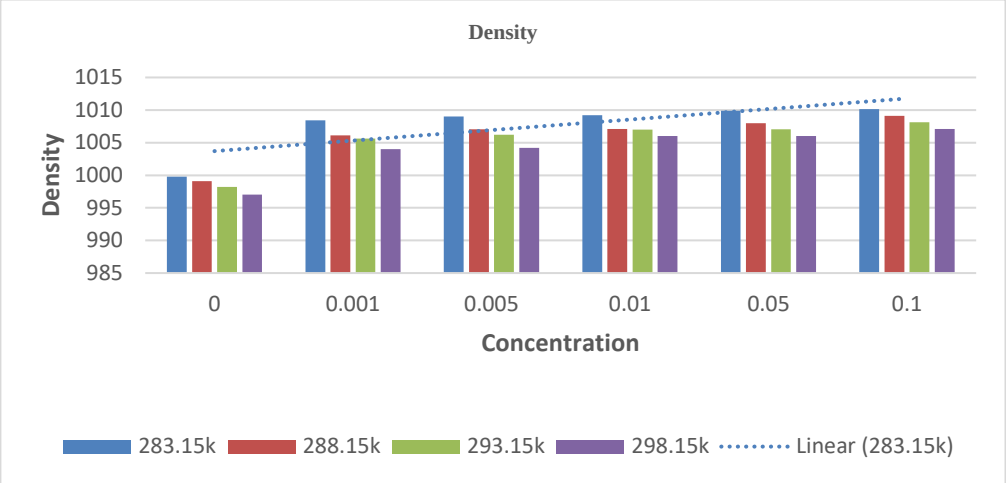
1. Acoustic Impedance : Acoustic impedance (also known as shock impedance) is defined as ratio of sound pressure (p) to particle velocity (U) at a single frequency and is expressed as 'rayals'.
   Z = Ue
2. Adiabatic compressibility: it can be calculated from the speed of sound (U) and the density (ρ) of the medium using he equation of Newton's laplace as,Adiabatic compressibility : $\beta = 1/ U^2e$
3. Specific Heat Ratio: Specific heat ratio is the ratio of isothermal compressibility and adiabatic compressibility and can be calculated using the following relation.
   Specific Heat Ratio: $\{17.1/ T^{4/9} *()^{1/3}$.
4. Non-Linearity parameter: $(B/A) = \{2+ [0.98^{*}.10^4/U.]\}$
5. Isothermal Compressibility: $(K_t)= 1.33*10^{-8} / (6.4 *10^{-4} U^{3/2} e^{3/2})$
6. Relative association: The value of relative association (RA) for liquid system have been (dextrose +water+ KCl) estimate using relation.

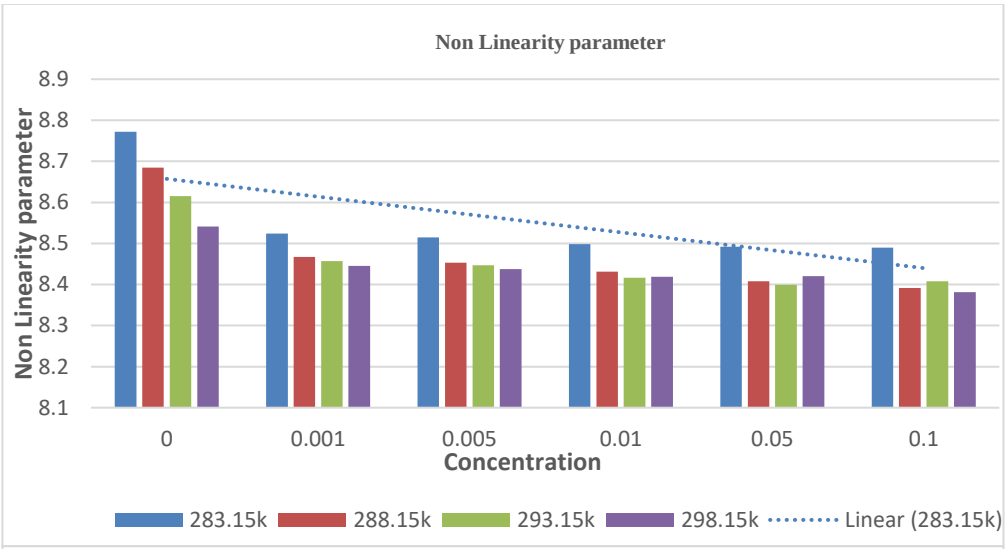
$(RA) = \{(\rho/\rho_0 (U/U_0)^{1/3}$.

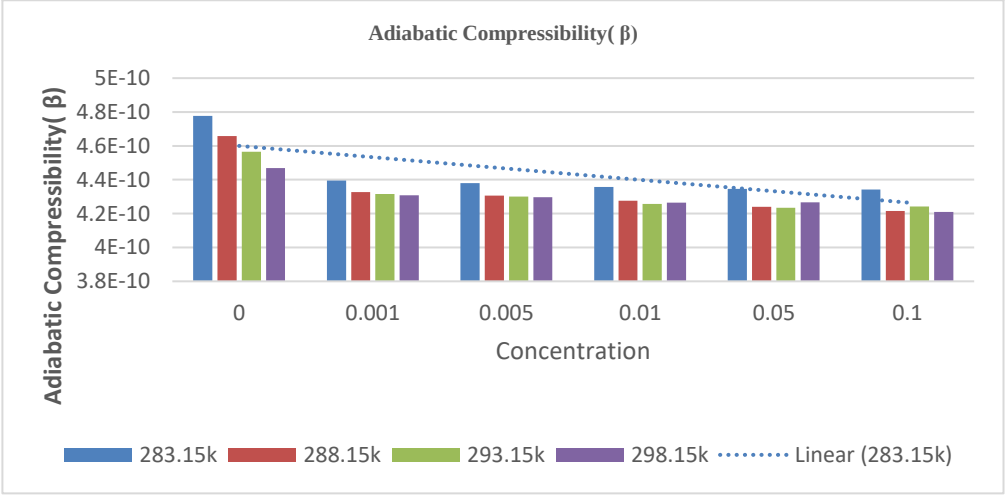
III. RESULT AND DISCUSSION

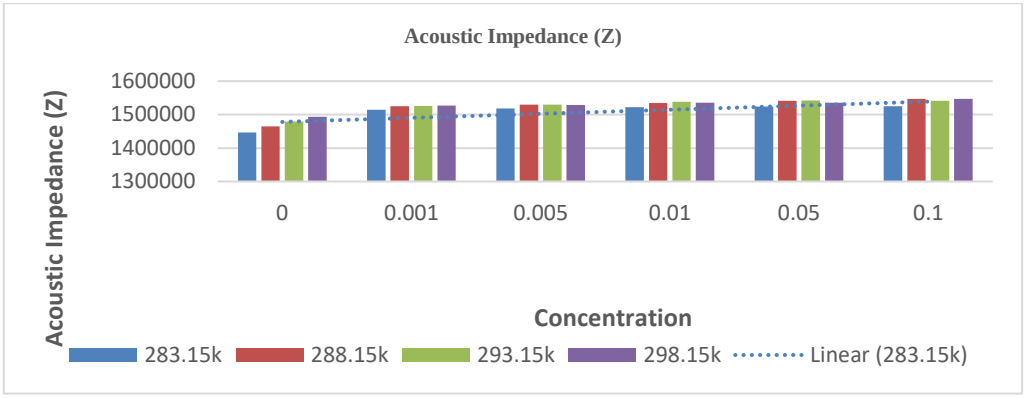
Ultrasonic density and velocity of dextrose compound have been found to have various values to understand the effect of structuring on molecular interaction. Several acoustic and thermodynamic parameter were derived from experimental measurements of ultrasonic velocities and density. In dextrose compound the variation of density of dextrose compound increases as gradually with increasing concentration of the solution. The Ultrasonic velocity is measured with the frequency of ultrasound i.e. at 3and 10 MHz of

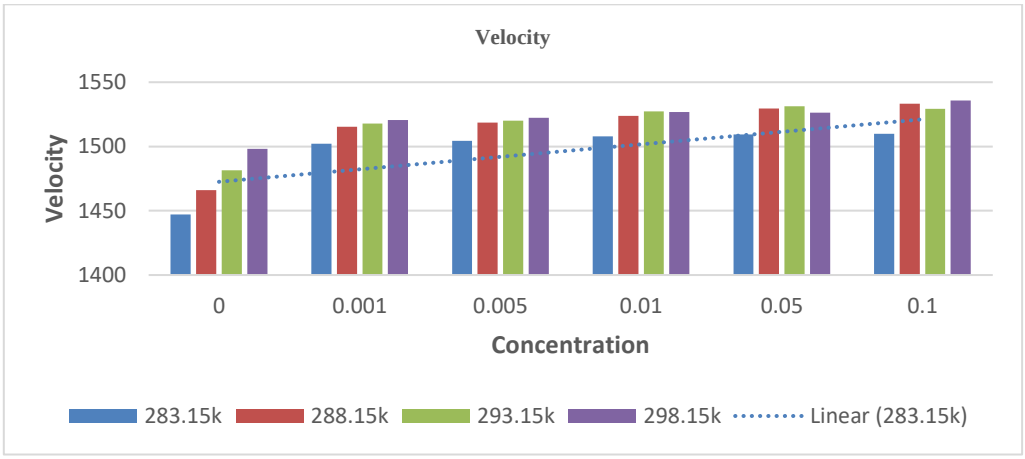
concentration of solution. At both frequencies ultrasonic velocities increases gradually with an increases of concentration . However there is an increase in velocity at low frequency at high frequency.

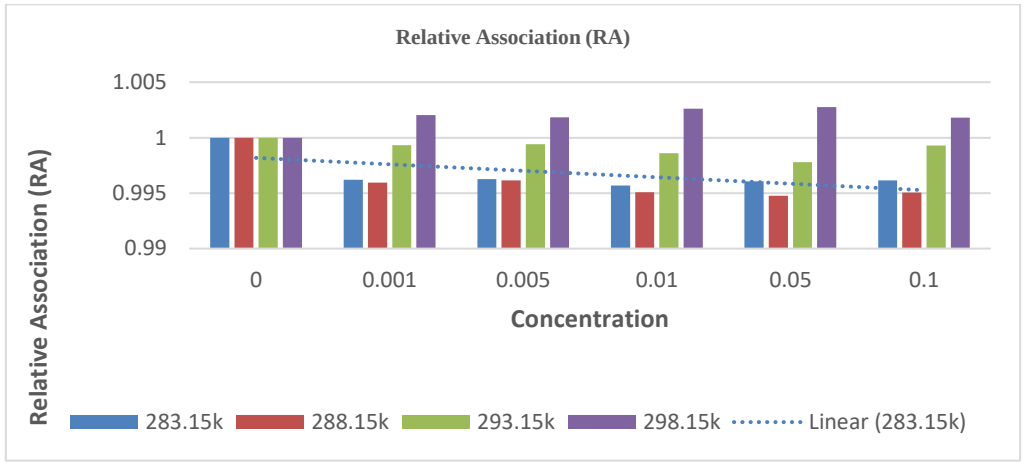


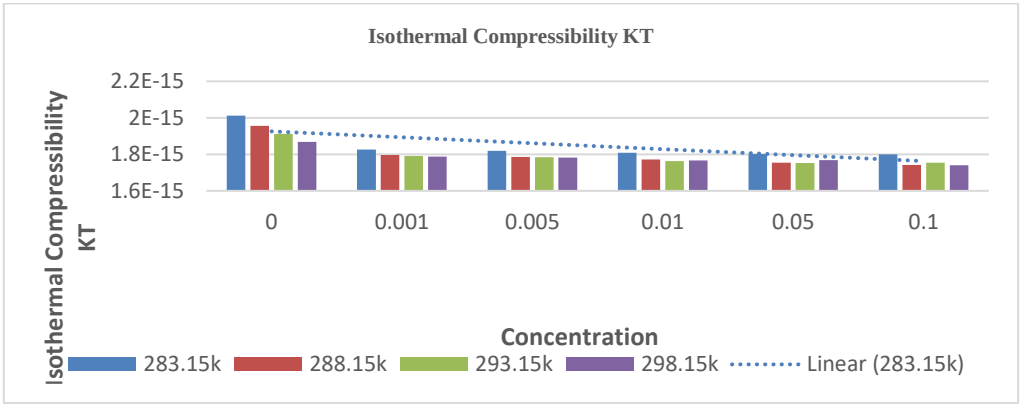





Acoustic Impedance (Z)
Acoustic Impedance (Z)
1600000
1500000
1400000
1300000
0
0.001
0.005
0.01
0.05
0.1
Concentration
283.15k
288.15k
293.15k
298.15k
Linear (283.15k)


Velocity
Velocity
1550
1500
1450
1400
0
0.001
0.005
0.01
0.05
0.1
Concentration
283.15k
288.15k
293.15k
298.15k
Linear (283.15k)


Relative Association (RA)
Relative Association (RA)
1.005
1
0.995
0.99
0
0.001
0.005
0.01
0.05
0.1
Concentration
283.15k
288.15k
293.15k
298.15k
Linear (283.15k)


Isothermal Compressibility KT
Isothermal Compressibility KT
2.2E-15
2E-15
1.8E-15
1.6E-15
0
0.001
0.005
0.01
0.05
0.1
Concentration
283.15k
288.15k
293.15k
298.15k
Linear (283.15k)

In addition these compounds increases acoustically impedance as concentration increases. Our scientist aren't 100% sure why this happens, but they think it might have something to do with the fact that most of the molecules in the compound are interacting with each other via. Hydrogen bonds but more research is needed to confirm this hypothesis.[6].The adiabatic compressibility decreases in concentration of dextrose in shown in fig it indicates that there is strong solute solvent interaction. The solution become more and more compressible as adding the concentration of drug.[7].

The heat capacity ratio is constantly decreasing which thrown light on the fact that specific heat at constant volume is decreasing constantly with increasing both concentration as well as temperatures. When chemical compounds are mixed together, they interact with each other through the bonds between their molecules. This interaction can be described in terms of Non linear parameters which measure how much each compound contributes to the mixtures overall polarity and internal pressure.[8] Decrease in kinetic energy – The decrease in isothermal compressibility (KT) value with increase in concentration of biomolecules seems to be the result of corresponding decreases K.E of the constituent solute-solvent molecules in an aq. Solution of dextrose . This relative association of a given solute is a function of its concentration, it has been observed that the breaking of solvent on addition of solute to it increases this is shown in fig. Increases of relative association R_a with concentration on suggest that close association of component of molecule and their exist intermolecular interaction.

IV. CONCLUSION

The result shown in this section indicate that there is a positive association between potassium chloride and dextrose, which means that there is more structure formation between the two solutes at higher concentration.

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Intermolecular Interaction Between Ascorbic Acid & Salt Solution: A Thermo-Acoustical Study

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ABSTRACT
The ultrasonic velocity, density of different concentration of ascorbic acid (Vitamin C) have been studied at various temperature. The measurement of ultrasonic velocity & density were carried out by using the ultrasonic digital velocity interferometer & 10ml specific gravity density bottle. By using this experimental data other thermo-acoustical relation like adiabatic compressibility, internal pressure, acoustic impedance, etc. have been calculated & studied. The aim of these study is to determine the geometry, nature, kind & strength of interaction of the liquid mixture. Such experimental data is helpful in pharamaceutical& food industries due to its wide application.

Keywords: Ultrasonic velocity, density, viscosity, ascorbic acid, sodium chloride, molecular interaction

I. INTRODUCTION

Ultrasonic is a branch of physics in which frequency sound wave is concerned. Usually, people can capable to perceive sounds with a frequency range varies between 16 Hz to 20 KHz (20,000 cycles per second). Ultrasonic was very useful & powerful tool for research areas in the field of physics. [1] Ultrasonic is used to measure the distance & also used to detect the obstacles. It is also used in medical field. Ultrasonic velocity in chemical physics, biochemical science, industrial technology and food industries. The measurement of the ultrasonic enables the accurate determination of some useful acoustical and thermodynamic parameters.
Vitamin C, also known as ascorbic acid or ascorbate, is a six-carbon compound naturally found in many fruits and vegetables. It is required in many " reaction involved in body process, including collagen synthesis , carnitine synthesis, tyrosine synthesis and catabolism, and neurotransmitter synthesis ", etc. Nevertheless, vitamin C is not just an essential nutrient for maintaining human health. In fact, due to its multiple biological and chemical properties, vitamin C plays a useful role in different areas, such as food and cosmetic industries. In food industry, vitamin C has double role; it act as a nutrient as well as food antioxidant and product improver. Due to its physical structure, vitamin C is highly unstable. It is extremely heat-sensitive & can be easily destroyed under various conditions, such as enzymatic reaction, exposure to oxygen or light, use of inappropriate containers, & the presence of antioxidants or preservatives. Vitamin C i.e. Ascorbic acid can be significantly reduced during food manufacturing and storage process. The use of vitamin C is not only limited to food related areas; actually its application extend to areas other than just food and beverages

industry. Like the role of vitamin C plays in food industry, its excellent reducing capacity makes it an effective ingredient in cosmetic products. It protects & strengthens skin tissues and cells against external attacking factors such as oxidation damage resulting from attack of free radical and oxygen derived species, ultra violet radiation, pollutants and other exogenous agents which lead of elasticity of skin, etc. [2]

In the present study, we report the value of density, ultrasonic velocity for different molar concentration of ascorbic acid with NaCl solution at different temperature. The various physical parameters were calculated by using density , ultrasonic velocity.

II. MATERIALS AND METHODS

In the present work, analytical reagent (AR) grade with 99% purity of L-Ascorbic acid ($C_6H_8O_6$) {[CAS No-50-81-7] [Mol.Wt.-176.12 g/mol]} used as solute, Sodium Chloride (NaCl) with 99% purity of {[CAS No-7647-14-5] [Mol.Wt.-58.44 g/mol]} & fresh distilled water [havingMol.Wt.-18.01528 g/mol with density – 1000g/m^3] was used as universal solvent and this work was done at different temperatures& different concentrations.

1. This experiment was carried out at different temperatures (i.e. 283.15K, 288.15K, 293.15K & 298.15K) which werw maintained by using a digital water bath.
2. The ultrasonic velocity have been measured by using ultrasonic digital velocity interferometer with an accuracy of 0.1%.
3. The measurement of weights was done by using a digital weighing machine accurately.
4. The ultrasonic density of the solution were measured accurately by using 10ml specific gravity density bottle.

The various acoustical parameters were calculated from the measured data by using some standard relations. [3]

Defining Relation :

1. **Ultrasonic Velocity :** The formula used to determine the ultrasonic velocity is, $u = 2d / t$

Where, d = separation between transducer and reflector

t = travelling time period of ultrasonic wave

2. **Density :** The formula by which density calculated is, $\rho = (W / W_w)\rho_w$

Where, ρ = density of liquid mixture at experimental temperature

W = weight of liquid mixture at experimental temperature

W_w = weight of water at experimental temperature

ρ_w = density of water at experimental temperature

3. **Adiabatic Compressibility :** The adiabatic compressibility is defined as ' the fractional decrease to volume per unit increase of pressure '.

$\beta_a = 1 / u^2\rho$

where, u = ultrasonic velocity

ρ = density of solution

4. **Acoustic Impedance :** The specific acoustic impedance is given by ,

$Z = u\rho$

Where, u = ultrasonic velocity

ρ = density of solution

5. **B/A for Hartmann :** Non linearity parameter B/A is,

$B/A = 2+0.98\times10^{4}/U$

Where, U is in m/s.

6. **Relative Association :** The relative association parameter is the relative association between the components molecule in a liquid mixtures and is given by

$R_A = (\rho/\rho_0)(u_0/u)^{1/3}$

7. **Isothermal Compressibility (β_i) :** Isothermal compressibility is a useful concept in determining the compressible properties of the reservoir.

$\beta_i = \gamma . B_a$

III. RESULTS & DISCUSSION

By the experimental data, the variations in ultrasonic velocity, density, adiabatic compressibility & acoustic impedance and variation in different parameters are shown in the graphs (fig.1-8)for different temperature & different concentrations.

The variation of ultrasonic velocity and adiabatic compressibility with molar concentration are shown in fig.1 & fig.3. It is observed that ultrasonic velocity and adiabatic compressibility are increases and decreases in molar concentration of ascorbic acid. This shows that the strong intermolecular force exists between solute and solvent. This enhance the degree of association among molecules of solute-solvent components. [4]

The variation of the density with molar concentration is shown in the fig.2 . The density of solution increases as the molar concentration of ascorbic acid also increases. [5]

Fig.4 shows the variation of acoustic impedance (Z) with different molar concentrations. As the concentration of ascorbic acid increases, the acoustic impedance also increases. It shows that molecular interaction is associative.[6] Fig.(5,6,7)& fig.(8) shows the variation in the specific heat ratio, non-linearity parameter, relative association (RA) & isothermal compressibility with different molar concentration of ascorbic acid. Fig.(5,6) indicates that as the concentration increases the specific heat ratio and non-linearity parameter decreases. These are inversely proportional to the concentration of solute.[7] The variation in relative association (RA) increases as the concentration of solute increases. This variation is shown in the fig.(7). And fig.(8) gives the variation in the isothermal compressibility with concentration. As the concentration of the solute increases, the isothermal compressibility decreases. It is inversely proportional to the concentration of solute.

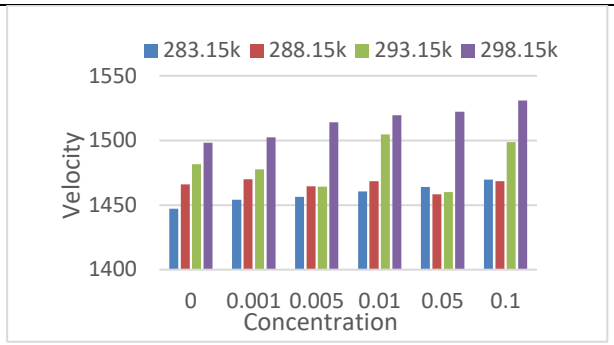

Fig1.Variation of ultrasonic velocity with concentration & temperature

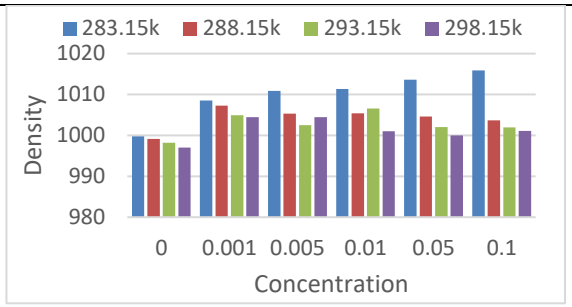

Fig2.Variation of density with concentration & temperature

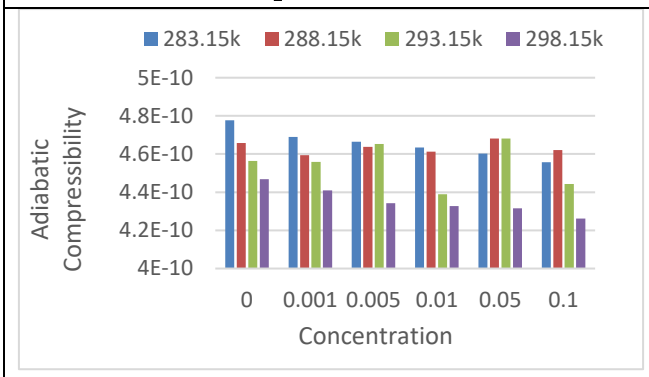

Fig3.Variation of adiabatic compressibility with concentration & temperature

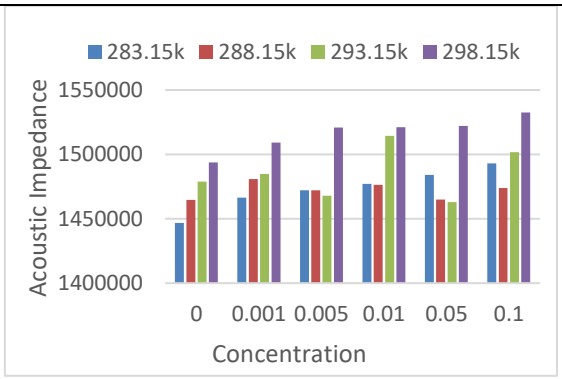

Fig4.Variation of acoustic impedance with concentration & temperature

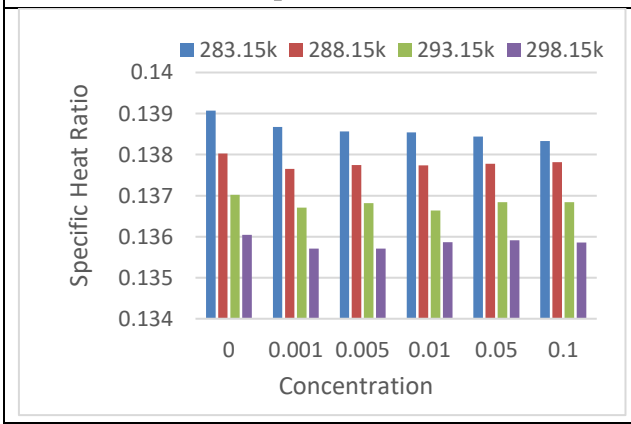

Fig5.Variation of specific heat ratio with concentration & temperature

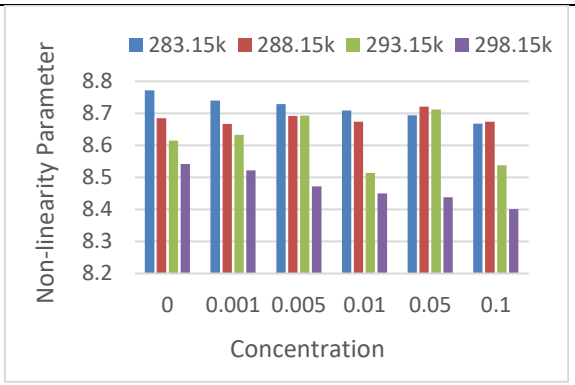

Fig6.Variation of non-linearity parameter with concentration & temperature

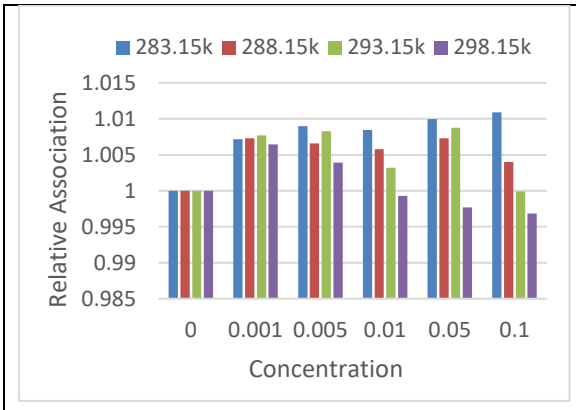

Fig7.Varition of relative association with concentration & temperature

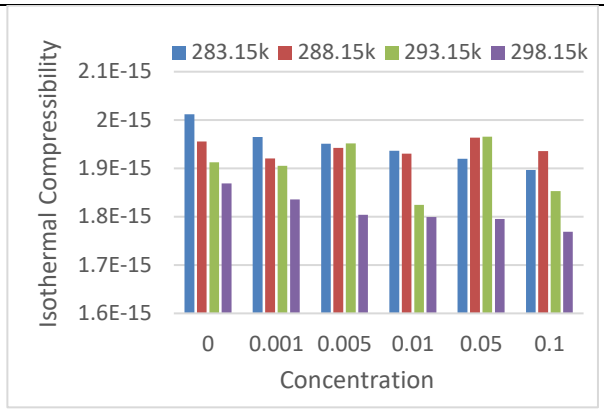

Fig8.Variation of isothermal compressibility with concentration & temperature

IV. CONCLUSIONS

The ultrasonic velocity, density of ascorbic acid of different concentration measured at different temperature & the thermos-acoustical parameters are calculated. The ultrasonic velocity, density & acoustic impedance (Z) are increases with the concentration. This indicates that solute-solvent interaction are present in the solution. The adiabatic compressibility decreases with rise in the concentration shows that there is strong solute-solvent interaction in a system. Hence, association takes place.

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Ultrasonic Characterization on Solution of Niacinamide in Aqueous Sodium Sulphate

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ABSTRACT
The Purpose of this paper is to Expose the Observable and Extraordinary Nature of Intermolecular Interaction inNiacinamide of Concentration (0.001N, 0.005N, 0.01N,0.05N,0.1N mol/kg) in the Aqueous Solution of Sodium Sulphate of (0.2 N &0.5N mol/kg).The main Velocity and Density data for the said system were used to calculate the various Acoustical and Thermodynamic parameter in view to specify the Nature of Solute in the Solvent. These studieswill help in View to investigate the tendency ofstructureMaking and Breaking Effect, as well as Existence of a Significant Solute – Solvent Interaction.

Keywords: Niacinamide, Sodium Sulphate, Acoustical Parameter,Thermodynamic parameters, Ultrasonic Velocity.

I. INTRODUCTION

The viscosity of the medium has a significant impact on the speed with which an ultrasonic wave propagates.This property can be a useful tool in investigating the viscosity of materials. Because different viscosities distinguish different regions of a living cell, acoustical microscopy can exploit this property of cells to "see" inside living cells, as detailed below under Medical Application.The Thermodynamic features of compressed liquids, which are crucial substances in numerous industries such as pharmaceutical, chemical, leather, cosmetics, and so on, are obtained by acoustic studies of liquid mixes. Because of the intimate links between the structure of the liquid and its macroscopic properties, measuring density and sound speed for any liquid mixture has become a valuable approach for analysing its condition. Because it is a non-destructive approach, ultrasonic research has grown in importance as a vital instrument for determining the molecular structure of matter and its properties. [1]

The intramolecular and intermolecular interactions of Niacinamide with Sodium sulphate and water were studied using ultrasonic velocity and density measurements.Ultrasonic has a wide range of practical applications, including underwater explanation, bottle and can sanitation for leak detection, ultrasonic cleaning, and medical applications (diagnosis, therapy and surgery). Niacinamide, commonly known as Nicotinamide, is a vitamin B3 derivative. Meat, fish, milk, eggs, green vegetables, and cereals are just a few of the foods that contain Niacinamide.

Niacinamide is needed for the body's fats and sugars to work properly, as well as to keep cells healthy. When niacin is consumed in quantities more than what the body requires, it is transformed to niacinamide. Niacinamide, unlike niacin, does not aid in the treatment of elevated cholesterol.

Vitamin B3 deficiency and disorders like pellagra are treated with niacinamide. It's also used to treat acne, diabetes, cancer, osteoarthritis, ageing skin, skin discoloration, and a host of other conditions, though most of these claims are unsubstantiated.

II. MATERIAL AND METHOD

In the present work, we have used analytical reagent (AR) grade with 99% purity of Niacinamide {[CAS No-98-92-0] [molecular wt. – 122.13 g/mol]} used as solute ,Sodium sulphate with 99% purity of {[CAS No-7757-82-6][molecular wt-142.04 g/mol]} and fresh distilled water having [molecular wt. 18.01528 g/mol with density – 1000 kg/m3] was used as a pure universal solvent and this work was done at different temperatures (i.e.283.15,288.15, 293.15 & 298.15K) and concentrations.

1. This experiment was carried out at different temperatures (i.e.283.15, 288.15, 293.15 & 298.15K) which were maintained by a digital water bath.
2. The measurement of weight was done by using a digital weighing machine having an accuracy of ±0.1mg.
3. Some basic parameters like, Ultrasonic velocity were measured on a digital ultrasonic interferometer with a 2MHz frequency having an accuracy of 0.1%.
4. The ultrasonic density of this solution was accurately determined by using a 10ml density gravity bottle.
5. Using the measured data, some other acoustical parameters have been calculated using standard relation.

Defining Relation :

1. **AdiabaticCompressibility**

Theadiabaticcompressibilityisdefinedasthefractional decrease in volumeperunit increase of pressure.$\beta a = 1/u^2\rho$. Where,u=ultrasonic velocity and ρ=densityof solution.

2. **Acoustical Impedance**

Thespecificacousticimpedance isgivenby, Z=uρ

3. **Non linearity parameter**

Nonlinearityparameter B/A is,

$B/A = 2+0.98 * 10^4 / U$

Where U is in m/s

4. **Relationassociation(RA):**

Therelativeassociationparameteristherelativeassociation Betweenthecomponent'moleculesinaliquidmixtureandisgivenby$(R_A) = (\rho/\rho 0)\ (u_0/u)^{1/3}$

5. **Isothermal compressibility (βi)**: Isothermal Compressibility is a useful conceptindeterminingThecompressiblepropertiesofthereservoir.

$\beta i = \gamma . Ba$

III. RESULT AND DISCUSSION

For the systematic study the variation in ultrasonic velocity and density of the niacinamide with aqueous sodium sulphate solution under the study at different concentrations and temperatures (283.15,288.15, 293.15 & 298.15K) are plotted. These are shown in fig. (1-8).[2]

In the present study one can observe that in given fig. 1 the niacinamide system, the value of ultrasonic velocity is increased with an increase in concentration and Temperature. This increasing trend of ultrasonic velocity in the mixtures suggests a moderate strong electrolytic in which the solute (Niacinamide) tends to attract solvent (Aqueous Sodium Sulphate) molecules [3]. i.e., it shows a greater association between solute and solvent molecules.[4] From fig. (2) it is found that slightly density increases for some concentrationof Niacinamide solution.Thus, the increase in density with concentrationmay be due to the closed packing of solute-solvent interaction among the constituent particle of the mixture. [5] It is found that the density slightly decreases as the temperature increases. This is because as the temperature increases, the thermal motion of a particle of the medium also increases. Thus, particles become loosely packed to cause a decrease in density. [6]

The dependence adiabatic compressibility of Niacinamide in aqueous solution of sodium sulphate on concentration at different temperature is shown in fig (3) It is obvious that if ultrasonic velocity increases the adiabatic compressibility of solution decreases as there exists inversely proportional relationship between them. In the present Investigation , the decrease in adiabatic compressibility value with rise in concentration at constant temperature is observed . the decrease in adiabatic compressibility with rise in temperature at given concentration is observed [6]. From fig (4), It is seen that expansion in Acoustical impedance(Z) esteem with convergence of niacinamide at all temperature might be might be ascribed to the powerful solute-dissolvable cooperation .The acoustic impedance also increase with increase in temperature due to structural properties of niacinamide in the solution and there occurs a structural rearrangement as a result of hydration (salvation) leading to comparatively more ordered state.[7]

Non-linear parameter (B/A) obtains by Hartmann-Balizer and Ballou is related to the internal pressure, hardness, intermolecular potential, molecular structure and molecular interaction of liquid Fig (6) shows the non-linearity parameter for niacinamide with aqueous sodium sulphate as a function of concentration and temperature It is observed that the values of B/A show decreasing trend with increasing temperature . This trend indicating that less array of molecules at low temperature hence high value of B/A and confirms the less interaction at low temperature . [8] It is studies to understand the ion-ion or ion-solvent interaction. In present study the relative association increases as increase in concentration due to decrease in intermolecular free length. It suggest that the salvation of niacinamide predominates over breaking up to the solvent structure, as observed in fig (7), it is varying irregularly with increase in temperature due to addition of niacinamide [9]

From fig (8), It is observed that the isothermal compressibility decreases with the increase in concentration of the solute at all temperature. That's what the explanation is, when solute breaks down in fluid sodium sulphate(dissolvable) a portion of the encompassing dissolvable atoms are firmly connected to the particles

because of the impact of electrostatic field of the particles.Since the dissolvable particles are arranged in the ionic field, the dissolvable atoms are minimalistic ally pressed in the essential solvation shell as thought about without a trace of the particles.[10]

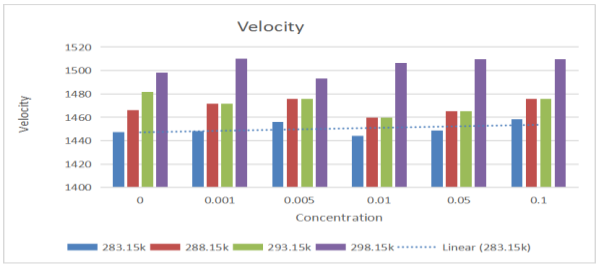

Fig.1 Variation of Ultrasonic Velocity with concentration and temperature.

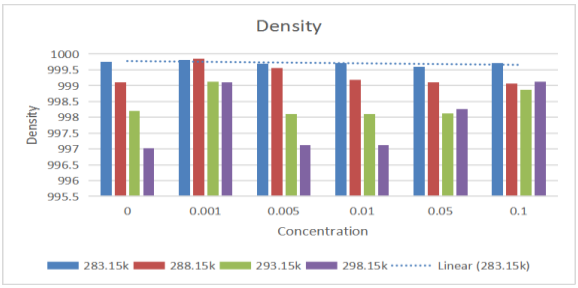

Fig.2 Variation of Ultrasonic Density with concentration and temperature.

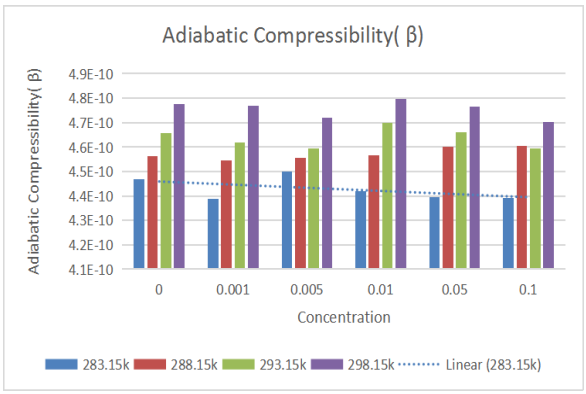

Fig.3 Variation of Adiabatic Compressibility with concentration in and temperature.

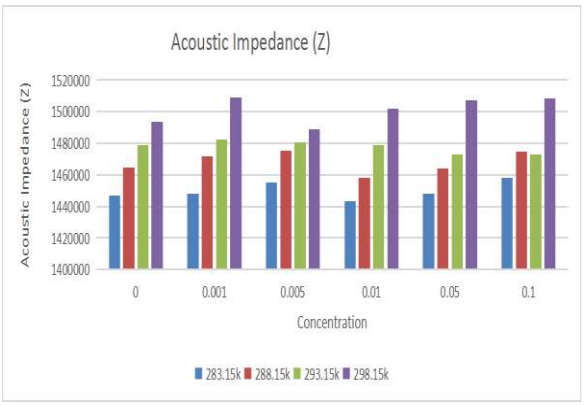

Fig.4 Variation of Acoustic Impedance with concentration in and temperature

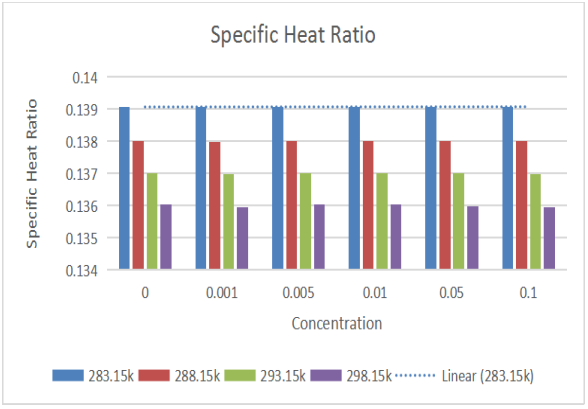

Fig.5 Variation of Specific heat ratio with concentration in and temperature.

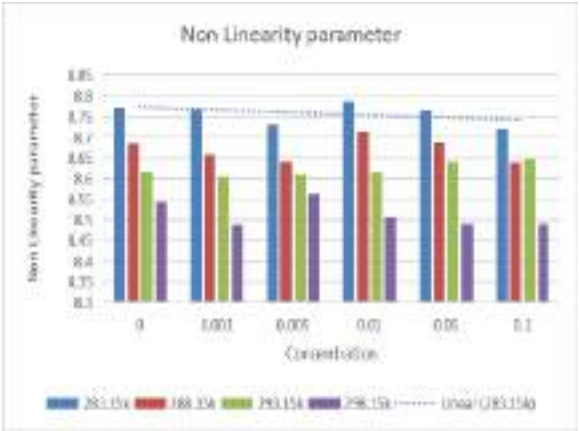

Fig.6 Variation of Non linearity parameterwith concentration in and temperature

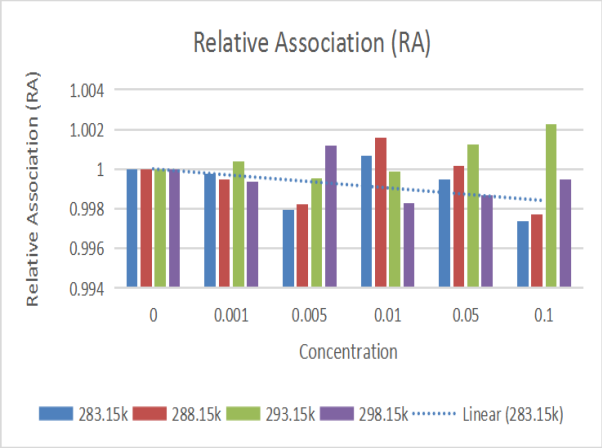

Fig.7 Variation of Relative association withconcentration in and temperature.

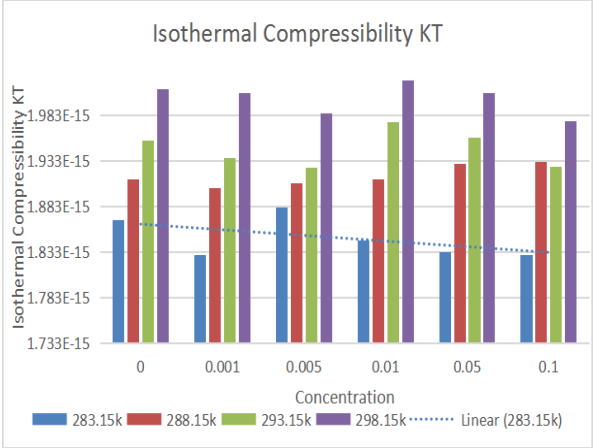

Fig.8 Variation of Isothermal Compressibilitywith concentration in and temperature

IV. CONCLUSION

From the present experiment it is conclude that the solute-solvent interaction exists in the systems of Niacinamide and aqueous sodium sulphate and structural changes may occur. The ultrasonic investigation of niacinamide in aqueous sodium sulphate determine the presence of strong ion-dipole interaction, there is complex interaction found for the system (Niacinamide + Sodium sulphate + water), there is solvent, solute and substituent are playing vital role in finding the interaction happening in the solutions.

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INTERMOLECULAR INTERACTION BETWEEN POTASSIUM NITRATE AND WATER; AN ACOUSTICAL STUDY

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ABSTRACT: Measurements of ultrasonic velocity, density and viscosity have been measured for potassium nitrate solutions at different temperatures ranging from 283.15K to 298.15K under atmospheric pressure. Ultrasonic velocity has been measured using frequency interferometer at 2MHz. The experimental data has been further used determined acoustic and thermodynamic parameters such as acoustic impedance, internal pressure, relaxation time, and Gibb's Free Energy, and molar volume were calculated. The variation of this parameter with respect to the molarities has been explained on the basis of solute- solvent interaction and structure forming tendency of solute in the solvent. From our study, it is quite clear that the variation of acoustic parameters with temperature and concentration indicated the existence of intermolecular interaction in the present system.

Key words: - Potassium nitrate, ultrasonic velocity, density, viscosity and acoustical parameters.

INTRODUCTION :

Ultrasonic is multifaceted non-fatal technique and highly beneficial for the exploration of various physical and chemical properties. Recent development have found use of ultrasonic energy engineering and agriculture medicine.[1] ultrasonic studies have vast application due to their ability to characterize the chemical behavior of solution.[2-3] Over the last few years ultrasound has commanding tool to provide useful information about the physio-chemical properties of liquid system .Ultrasonic wave frequency is more than 20 KHz up to several MHz which is beyond audible range. At low amplitude it gives valuable information. [4-5] Ultrasonic velocity and other thermodynamic parameters are used to study molecular interaction in pure, binary and ternary mixture, and it gives useful information about structure of molecule, inter and intra molecule interaction etc.[6-8]study of various molecule interaction in binary ternary mixture plays an important role in molecular science gives understanding of behavior of different liquid and there functional group. This information is very useful in design of industrial process and development. [9]

The study of propagation of ultrasonic wave through mixture is an effective mean of investigation of physical and chemical properties of medium. Salts have large effects on the structure and properties of proteins. Nitrogen increase deep green color in plants and cell and makes the cell wall thinner, Nitrogen increases the proportion or water and decreases calcium content in plant tissues.[10] Potassium nitrate is used in diuretic medicine, it also include as ingredient in tooth paste and it is also added with drugs for joint and back pain[11-12]

Hence present work mainly provides useful information on the measurement of velocity, density and viscosity values of KNO3 solution at different temperature and concentration. This information is useful to understand various biochemical reactions occurring in living organism.

MATERIAL AND METHOD:

AR grade of Potassium Nitrate having molecular weight 101.1032g/mol was obtained from

HIMEDIA private ltd. The purity of compound is 99.99%.The various concentrations ranging from 0.01-0.10 mole/Kg were prepared from the standard formula and used on the day were prepared.

In the proposed work we have planned to carry out the measurement of Ultrasonic velocity at different solutions using digital Ultrasonic interferometer or pulse echo overlap technique with the function of concentration and temperature. The density measurement of solutions would be carried out using specific gravity density bottle respectively. The temperature variation of different samples will be maintained constant using a thermostatically controlled digital water bath with flowing water technique. The viscosity has been calculated with the help of Oswald's Viscometer.

DEFINING RELATION:

Using measured data, the following acoustical parameters have been computed using the standard relations,

Acoustic Impedance depends on density and velocity by the equation given as (Z) = uρ.....1

Internal Pressure $\pi_i = bRT\,[K\eta/U]^{1/2}\,[\rho^{2/3}/M_{eff}]^{7/6}$

Where,b stands for cubical packing. Which is assumed 2 for all the liquids

Relaxation Time was calculated from the relation

$\tau = 4/3\ \eta_s\ \beta_a$ (s) 3

Surface tension it is given by the formula $\sigma = (6.3*10^{-4})\ \rho u^{3/2}$ $(N\backslash m^{-1})$.....4

Gibb's free energy can be calculated from acoustic relaxation time (τ)as follows,

$\Delta G = -K_B T \ln(h/TK_BT)$ $(Jmol^{-1})$.....5

Where K is Boltzmann constant ,T is absolute temperature and h is Plank's constants

RESULT AND DISCUSION:

In the present work density, velocity and viscosity have been measured at different temperature and concentration of potassium nitrate, which is shown in graph.

The plot of velocity of potassium nitrate with water at different temperatures are shown in fig 4.1.It is observe that ultrasonic velocity are found to increase with increase in molar concentration of potassium nitrate. This increasing trend suggests a moderate strong electrolytic nature in which solute tends to attract the solvent (aqueous potassium nitrate) molecules. Thus molecular interaction is responsible for the observed increase in density, viscosity and ultrasonic velocity. [1] The increase in ultrasonic velocity with concentration in any solution indicates the presence of solute solvent interaction. The increase in ultrasonic velocity with rise in concentration for the present system conform the greater molecular association.[13]

From Fig4.2 it can be noticed that density of potassium nitrate increases with increase in concentration of solution; whoever it falls with increase in temperature. This result is obvious as the volume of solution increases with rise in temperature, and mass of solution increases with increase in concentration this result suggest a solute-solvent interaction exist between KNO3 and water. In other words increase in density may be interpreted to the structure maker....of..2solvent due to H-bonding.[14-15]

Viscosity of potassium nitrate solution increases with increase in concentration and decreases with increase in temperature. Increase in viscosity of solution with concentration suggests the strong interaction of solute and solvent molecule. With the rise in temperature (fig4.3) molecules in solution acquires more and more thermal energy. The motion of molecules increases at the expense of cohesive force acting between the molecules. Since the solution faces lesser resistance to flow, the viscosity of the solution will decrease.[16]

Experimentally determined values of acoustic impedance, (z) Gibb's free energy of potassium nitrate solution shows in (fig4.4and 4.8) increase with increase in concentration this is due to the addition of solute. The increase in Gibb's

free energy potassium nitrate solution suggests the greater association among the component of the mixture. As temperature increases, the thermal motion of the particle increases and medium become loosely packed. The rupture of such a bonds becomes easy. Hence temperature increases Gibb's free energy of potassium nitrate solution also increases [17]

From fig(4.5) It is observe that the internal pressure increases with increase in concentration, this type of variation might to be due to increase of cohesive force and solute-solvent interaction in solution. It indicates the formation of hydrogen bonding in between the solute-solvent molecule. Decrease in internal pressure with rise in temperature reduces the solute solvent interaction.[4]

Surface tension is used to study the surface composition of aqueous solution of the mixture. The variation of surface tension shows in fig (4.6) there occurs attractive interaction between the two solutions. A surface tension of a liquid mixture is not a simple function of surface tension of a pure liquid. As interface there is migration of species having lowest surface tension.Their migration of interface result in a liquid face rich in the component with the lowest surface tension. Surface tension increases with addition of solute.

Relaxation time is the time taken for the excitation energy to appears as translational energy and it depends on temperature and impurities. The relaxation time (fig 4.7) shows regular decrease showing evidence of dipole-dipole type of interactions.[18-19]

CONCLUSION:

In this study, the Ultrasonic velocity and acoustical parameters of potassium nitrites solution was studied in different concentrations at various temperature .The experimental Ultrasonic Velocity data and other acoustical parameters contain valuable information regarding the solute solvent interactions in the aqueous solutions. Based on other measurements, it can be conclude that the concentration of the potassium nitrate affects the dipole-dipole interaction and also affects the dielectric constant of the solution. The concentration of the potassium nitrate decreases the chain interaction in the binary solution.

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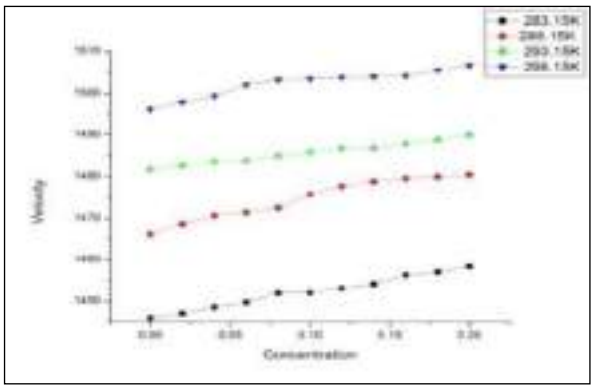
Graph: Graphical representation of Potassium Nitrate at temperature 288.15k,288.15K, 293.15K 298.5K respectively



Fign4.1Variation of velocity with concentration

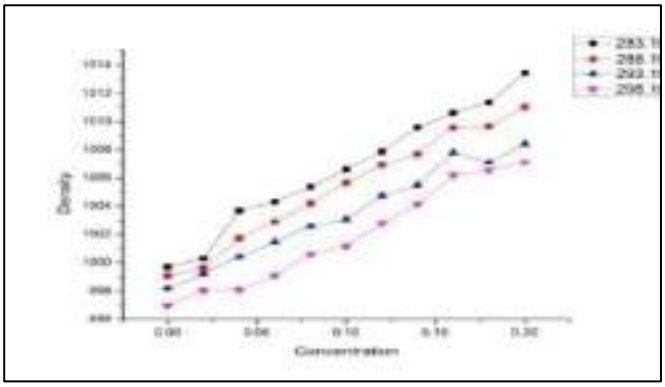


Fig4.2Variation of density with concentration

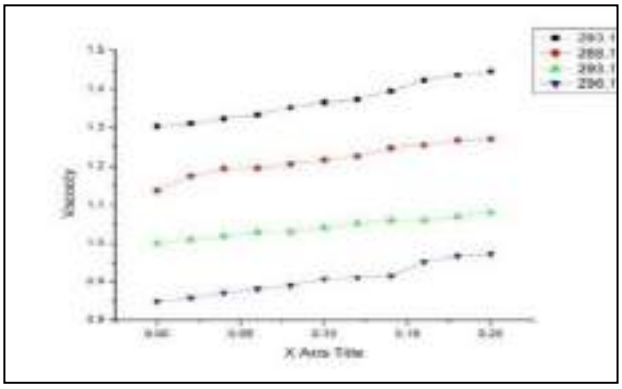


Fig4.3Variation of viscosity with concentration

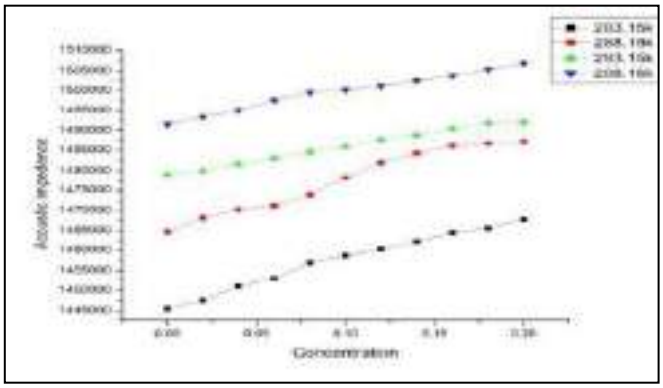
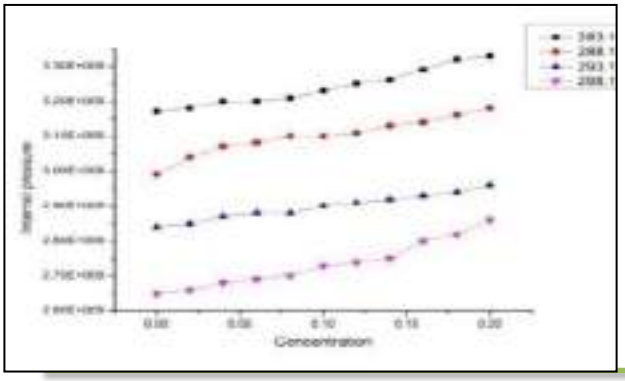


Fig4.4Variation of acoustic impedance with concentration



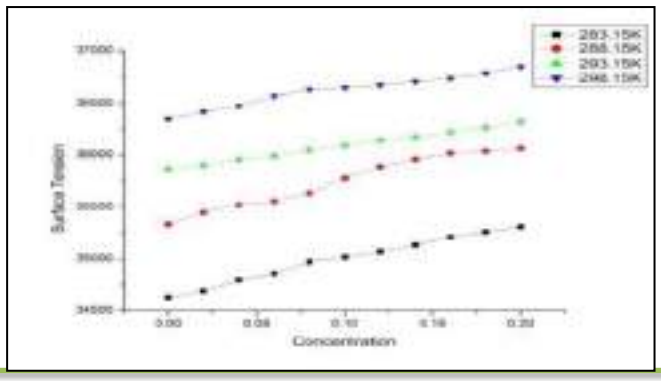


Fig4.5Variation of internal pressure with concentration

Fig4.6Variation of surface tension with concentration

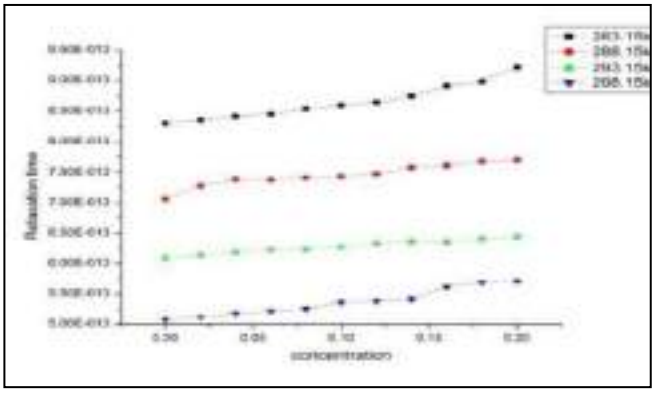


Fig4.7Variation of relaxation time with concentration

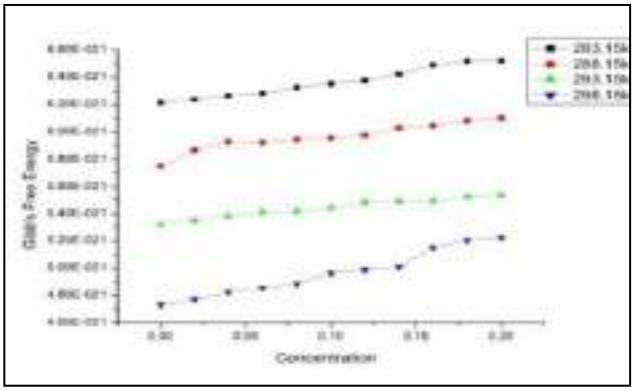


Fig4.8Variation of Gibb's free energy with concentration

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STUDY OF ACOUSTICAL PARAMETERS OF AQUEOUS POTASSIUM SULPHATE AT DIFFERENT TEMPERATURE AND CONCENTRATION

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ABSTRACT: Ultrasonic velocity (μ), viscosity (η) and density (ρ) have been measured in the aqueous solution of potassium sulphate + water having frequency 2MHZ at temperature 288.15K, 293.15K and 298.15K. Ultrasonic velocity, density and viscosity have been supported for the evaluation of acoustical parameters viz. Adiabatic Compressibility, Molar Volume, Available Volume, Lenard Jones Potential, Rao's Constant, Acoustic Impedance & Free Length from experimental data. The acoustical parameter proved the intermolecular interaction in the aqueous solution of potassium sulphate water. These provide important information about solute-solvent, ion-ion, dipole-dipole and ion-solvent interaction in the solution. The result has been interpreted in the light of various inter and intramolecular interactions of liquid mixture.

Key words: - Potassium sulphate, ultrasonic velocity, density, viscosity, acoustical parameters.

INTRODUCTION :

Ultrasonic is a non-destructive flexible method and is very useful in the investigation of variousphysical fieldslike residual pressure, stiffness, grain size microstructure, elastic constant etc. Different acoustical parameters will be calculated from the values determined by the ultrasonic velocity, density & viscosity. [1] Current advances have been made in the use of ultrasonic power in medicine, engineering, and agriculture. The ultrasonic method has become widely accepted for non-variance imaging of the human body and thus offers greater potential for further development in diagnostic medicine. Thus, characterization of material by the determination of ultrasonic wave propagation parameter is encouraged.

Due to the widespread use of ultrasonic in the field of Acoustic microscopy, Sono-chemistry, Drug Chemistry, textile industry, paint industry, food and oil industry, Metal Flaw Detector, Polymers, Surfactants, Binary and Ternary liquid, Computer technology, Underwater acoustics, Medical imaging technology, Electro-chemistry and many other industrial areas. [2] This type of research is very important in understanding the quality and type of solution.A Fertilizer is any material of natural or synthetic origin that is applied to soil or to plant tissues to supply one or more plant nutrients essential to the growth of the plant. Many sources of fertilizer exit both natural and industrial.[3]

Ultrasonic studies help in the understanding of various molecular interactions in the aqueous fertilizer through light on the nature of intermolecular interaction existing in the solution. Thus in this paper, we are reporting the various acoustical parameter of aqueous potassium sulphate. K_2SO_4 does not contain chloride, which can be harmful to some crops. The dominant use of potassium sulphate is as a fertilizer. Potassium sulphate is preferred for these crops, which include tobacco and some fruits and vegetables. Less sensitive crops may

still require potassium sulphate for optimal growth if the soil accumulates chloride from irrigation water [4]. These data are useful to understand the nature of the biological molecule.

Experimental Details:

The solutions of various concentration of potassium sulphate were prepared in distilled water as the solvent. The densities of these solutions were determined accurately using 10 ml density bottle in an electronic balance with ±0.01mg accuracy. The basic parameter ultrasonic velocity had been measured on Digital Ultrasonic Interferometer with single frequency of 2MHz having an accuracy of 0.1%. Ostwald's viscometer calibrated the viscosities of the solutions with accuracy of ±0.001 Pa.sec. This basic parameter of potassium sulphate solution was measured at 288.15, 293.15 and 298.15K. The various acoustical parameters were determined from μ, η and ρ values by using following formulae.

Defining Relations:

Acoustical and volumetrical parameters can be calculated using the following relations:

1. Adiabatic compressibility (βa):$\beta_a = 1/u^2\rho$
2. Molar volume(V_m): $V_m = \frac{Meff}{\rho}$
3. Available volume(V_a) : $V_a = V_m(1-u/u_\infty)$
4. Lenard Jones Potential (L.J.P.): L.J.P.=6-(V_m/V_a) −13
5. Rao's Constant (Ra): $Ra = (M_{eff}/\rho)\ (u)^{\frac{1}{3}}$
6. Acoustic Impedance (Z):$Z = u\rho$
7. Free Length (L_f):$L_f = K\ (\beta_a)^{\frac{1}{2}}$

RESULTS AND DISCUSSION:

From fig.1, it is observed that ultrasonic velocity is found to increase with the increase in temperature & concentration. The greater association is due to dipole-dipole, ion-dipole and hydrogen bonding between solute (potassium sulphate) and solvent (water) molecules. [5] Now Fig.2 show that density increase with the increase in concentration it may be due to closed packing of the solute-solvent interactions among the particles of the mixture. Thus Increase in density indicate the structure-maker of the solvent due to the added solute. Also found is that density decreases as the temperature of the system increases. As the temperature increases, the thermal motion of the particles also increases. Thus particles become loosely packed to cause a decrease in density. [6]

The viscosity of potassium sulphate solution is found to increase in fig. 3 with the increase in concentration. The strong association in potassium sulphate solution may be due to the intermolecular hydrogen bonding between solute and solvent molecules. It is found that viscosity decreases as the temperature of the system increases. This is because as the temperature increases, the kinetic energy of the molecules increases which diminishes the viscosity of the medium. [7]

The adiabatic compressibility (βa) decreases with an increase in the concentration of potassium sulphate is due to interaction between the ions and the water molecules show in fig. 4 and decreases with increases in temperature because of the molecular interaction of solute and solvent molecules.[8] Fig.5 Show the trend of Molar volume (V_m) expressing the solute-solvent interaction in the solution. It shows that, as value decrease in the percentage of concentration at 288.15k, 293.15k, and 298.15k. Molar volume decreases with an increase in concentration & temperature and the available volume of the solution decreases with the rise in concentration but increases with the rise in temperature as expected due to the thermo-molecular interaction of solute and solvent molecules show in fig. 6. [9]

Fig.7 Show that the Lenard Jones Potential values are negative and increase in all the systems. The small negative values show that

the repulsive forces are higher and the attractive forces are lesser in these systems. It is increasing as an increase in concentration indicated that the dipole-dipole attraction is stronger. [10]

From fig. 8 found that the variation of Rao'sconsant with concentration and temperature.The decreasing trend of Rao's constant with increases in temperature exhibit the interaction among the compound of solute and solvent.

Acoustic impedance of potassium sulphate solutions is increase in concentration. Hence acoustic impedance increases with the strong association in the solution.[11] It is found that acoustic impedance decreases as the temperature of the system increases. This is because acoustic impedance is inversely related to the temperature of the medium.[12] and also from graph 10 it is observed that the value of Intermolecular free length (L_f) decreases steadily with an increase of concentration. This indicates the significant dipole-induced dipole interaction between solute and solvent due to which structural arrangement is affected.

CONCLUSION:

The variation of ultrasonic velocity, density and viscosity and other related thermodynamic parameters such as adiabatic compressibility, molar volume, available volume, Lenard Jones Potential, Rao's constant, Acoustic Impedance & Free Length at various concentrations and temperature in potassium sulphate shows the non-linear increase or decrease behavior. The non-linearity observed the presence of solute-solvent, ion-ion, dipole-dipole, ion-solvent interactions. This suggests information about inter and intramolecular interaction of liquid mixture.

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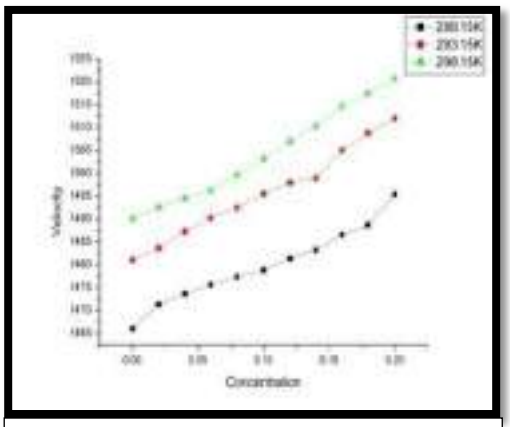

Fig .1. Variation of Velocity with molar conc.

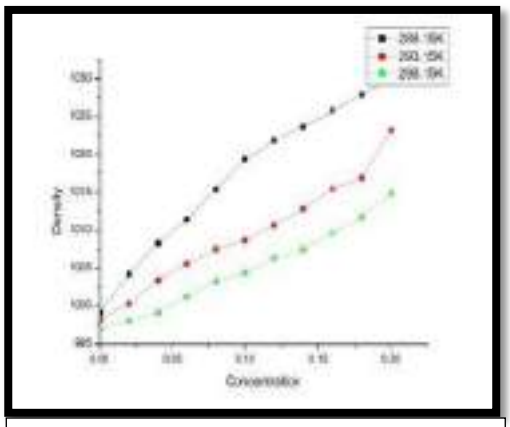

Fig 2. Variation of Density with Molar conc.

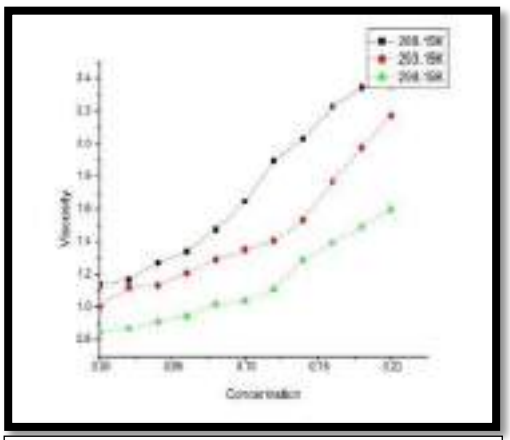

Fig. 3 Variation of Viscosity with molar conc.

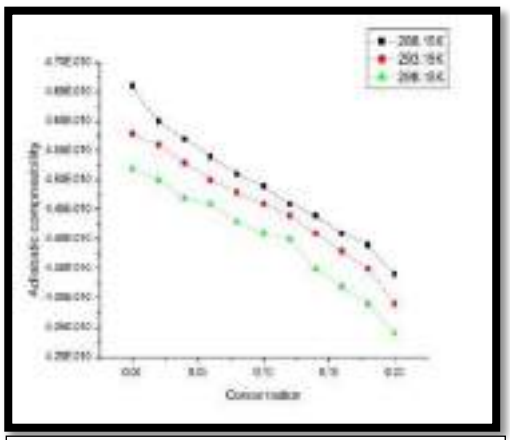

Fig. 4 Variation of Adiabatic Compressibility with molar conc.

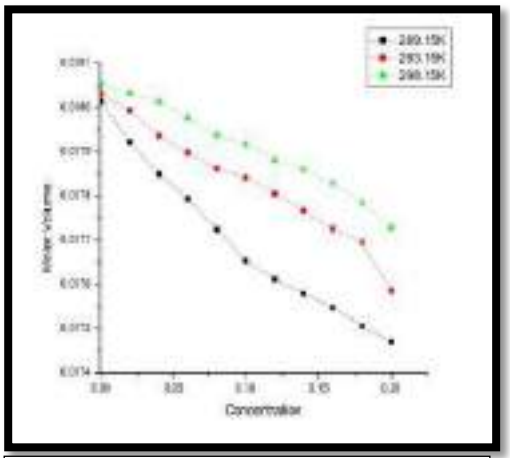

Fig. 5 Variation of Molar Volume with molar conc.

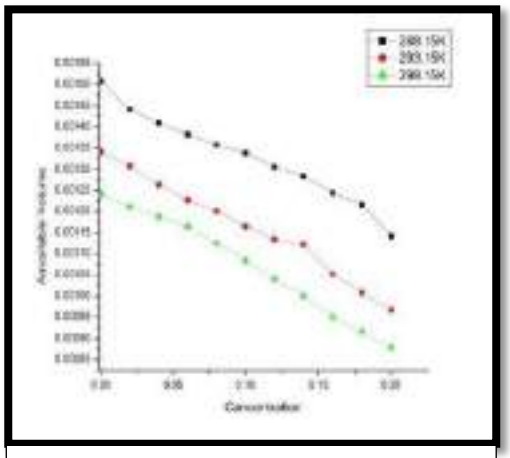

Fig.6 Variation of Available volume with molar conc.

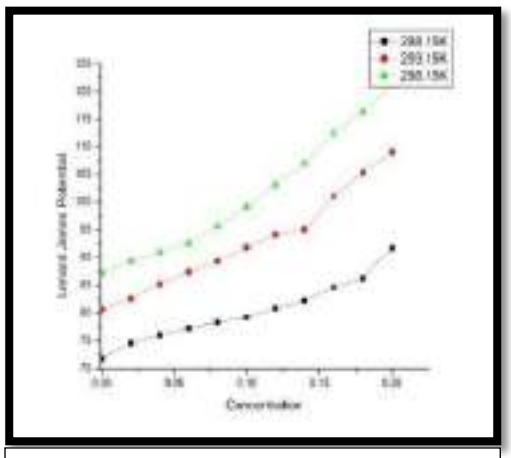

Fig. 7 Variation of Lenard Jones Potential with molar conc.

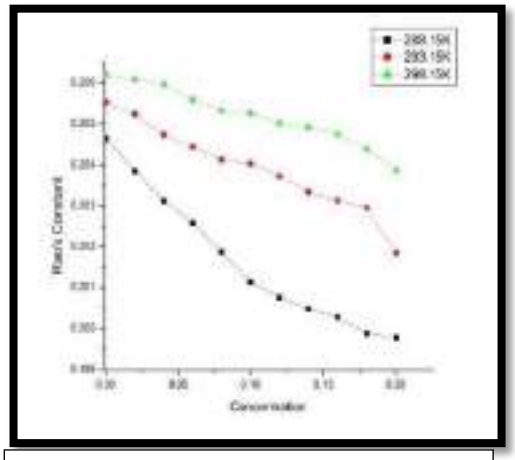

Fig. 8 Variation of Rao's Constant with molar conc.

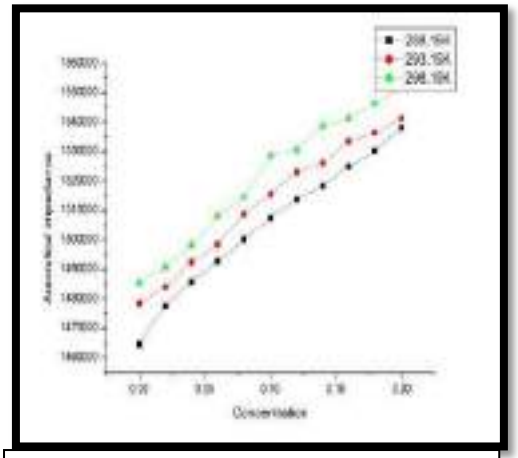

Fig.9. Variation of acoustical Impedance with Molar conc.

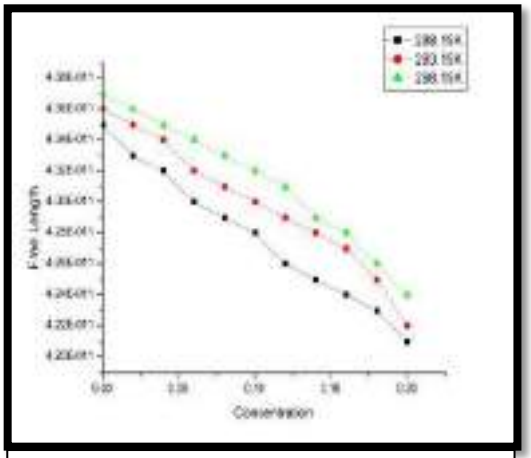

Fig .10.Variation of Free length with molar conc.

Molecular interaction study of potassic fertilizer in water at different temperature using ultrasonic technique

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***Abstract*: Ultrasonic velocity (U), density (ρ) for potassium chloride and potassium sulphate have been measured separately for different concentration (0.001-0.1 mol/kg) at different temperature. Experimental data have been used for the study of molecular interactions at different concentration using different parameters such as adiabatic compressibility, internal pressure, apparent molal volume, hydration number. Nature of interaction between them is indicated at different temperature by variation in above parameters.**

***Keywords*: Ultrasonic velocity (U), density (ρ), potassium chloride**

Introduction: Ultrasonic technique has been used effectively to study properties of any substance to understand the molecular interactions nature in pure liquid [1]. Ultrasonic investigation is useful in understanding the degree and nature of interaction because intramolecular and intermolecular association related to structural changes affects the ultrasonic velocity.[2] Various interactions exist between the ions in solution helps in understanding the nature of solute and solvent, whether the solute modifies or distorts the structure of the solvent. The solute added to the solvent causes a volume contraction due to interaction with the molecule of solvent and this may influence other acoustical properties of solution. The apparent molal volume, internal pressure, adiabatic compressibility and hydration number are useful in finding the structural interactions occurring in solutions. Based on these considerations, a comparative study of hydration properties was performed to determine the mutual interaction of potassium sulphate and potassium chloride in water at various temperatures.[3]

Material and method: This study was conducted using AR grade with 99% purity of solute potassium chloride and solvent fresh distilled water and this study was done at different temperature (283.15K, 288.15K, 293.15K and 298.15K) and concentration (0.001-0.1 mol/kg) . In this work, the ultrasonic velocity of a solution was measured using digital ultrasonic interferometer having frequency 2MHZ with an accuracy of 0.1%. The density of the solution was accurately measured using a 10 ml density bottle and an electronic balance. The temperature of the experiment was kept constant by circulating water using a thermostatic water bath. The measured data were used to calculate some other acoustic parameters using standard proportions.

Theory of Evaluated Parameter:

1. Adiabatic Compressibility ($\boldsymbol{\beta}$): Adiabatic Compressibility is fractional change in volume per unit increase of applied pressure where no heat flows in or out of the system.
$$\boldsymbol{\beta} = \{1/(U^2 \rho)$$
2. Internal Pressure **(**Πi**):** The internal pressure is the cohesive force, which is a resultant of force of attraction and force of repulsion between the molecules. It is calculated by the relation,
$$\Pi i = bRT(K\eta/U)^{1/2.}\rho^{2/3}/Meff^{7/6}$$
3. Molal hydration number (n_H):
$$n_H = \{ n1/n2 (1- \boldsymbol{\beta}/ \boldsymbol{\beta}_0)\}$$
4. Apparent Molal Volume (V_ϕ): Apparent Molal Volume are subjective to the size of the solvated solute molecules which may be influenced to the size of the solvated solute molecules which may be influenced by a change in solvent, concentration of the solution and temperature.
$$(V_\phi) = \{M/ \rho – [1000 (\rho – \rho_0)/m \rho \rho_0]\}$$

Result and Discussion:

The obtained changes in the experimentally determined values of ultrasonic velocity and density and other relevant parameters of potassium chloride and potassium sulphate solutions at various temperatures and concentrations are shown.[4] Ultrasonic velocity is an important parameter that provides information about the nature of molecular interactions and is highly dependent on concentration at temperature as shown in fig.(1). The ultrasonic velocity of potassium chloride increases with increasing temperature as well as concentrations. The same change is also observed in potassium sulphate in suggesting a fairly strong interaction between solute and solvent molecules binding.[5]

In this study, the density of potassium chloride and potassium sulphate solution as shown in fig. (2) increases with increasing concentration temperature[6]. As the temperature increases, the particles become loosely filled and the density decreases[7].

The

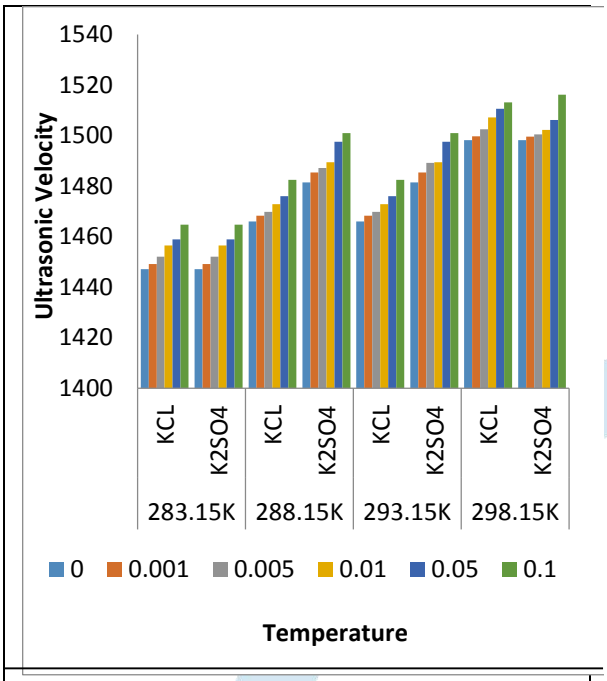

Fig.1 Ultrasonic Velocity versus concentration and temperature

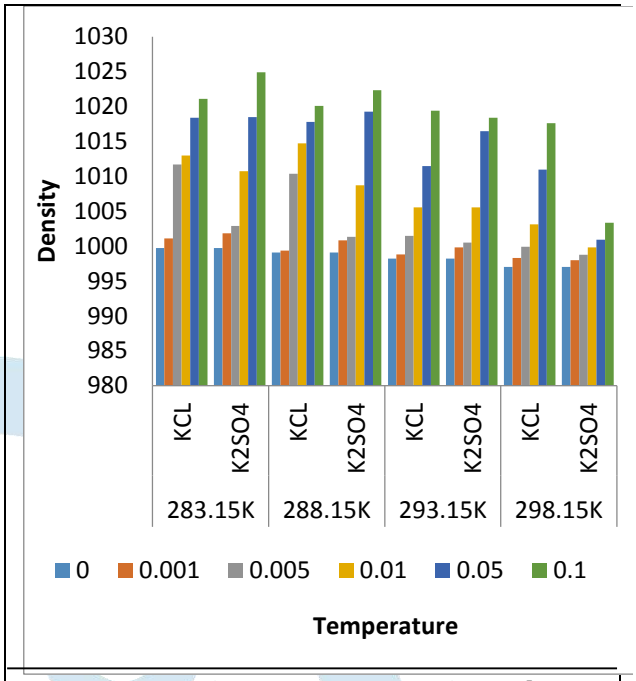

Fig.2 Density versus concentration and temperature

adiabatic compressibility of Potassium Chloride and Potassium Sulphate tends to decrease with the increase in concentration and temperature in both systems as shown in fig. (3) which confirmed an increase in the electrostrain compression of the solvent around the solute molecules, which significally reduced the compressibility of the solutions.[8] The decrease in adiabatic compressibility with increasing concentration confirms the presence of ionic interactions with solvents through ionic dipole interactions between solute ions and surrounding water molecules.[9-10]

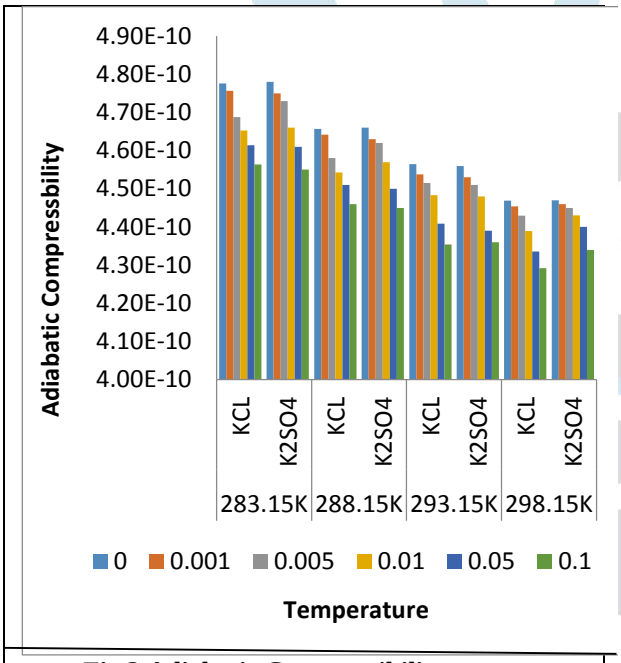

Fig.3 Adiabatic Compressibility versus concentration and temperature

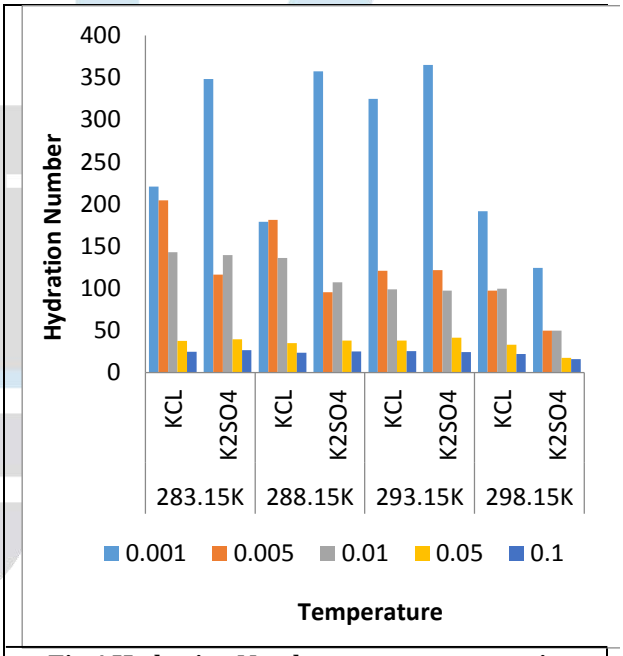

Fig.4 Hydration Number versus concentration and temperature

Hydration number is shown in fig. (4). The values are positive in both systems taken for the study, indicating noticeable dissolution of the solute.[11] Further confirmation of the structure showing nature of solute and the dipolar interaction between the solute and water molecules suggest that the compressibility of the solution is lower than that of the solvent. The decreasing behaviour indicates that the interaction strength between the dissolved solvent molecules is weakening.[12] From this it can be concluded that a stronger molecular bond was found in potassium sulphate than in potassium chloride[13]

The apparent molal volume values are negative for both potassium chloride and potassium sulphate as shown in fig. (5) and when the apparent molal volume values are compared, the change is not uniform, and the potassium sulphate value is greater than that of the potassium chloride solution. Apparent molal volume value is negative because the value is larger for potassium sulphate, which again confirms that molecular bonds are greater in this potassium sulphate than in potassium chloride.

Acoustic parameters tends to describe the nature and strength of interactions that occur in a solution. In the potassium chloride, the internal pressure increases with increasing concentration and temperature. Same changes occur in potassium sulpahte in as shown in fig. (6) suggesting the strength of molecular association through hydrogen bonding[15]

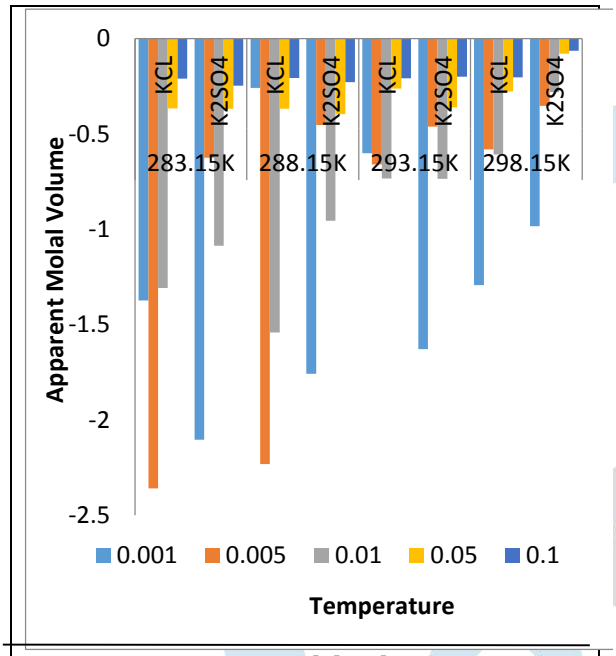

Fig.5 Apparent Molal Volume versus concentration and temperature

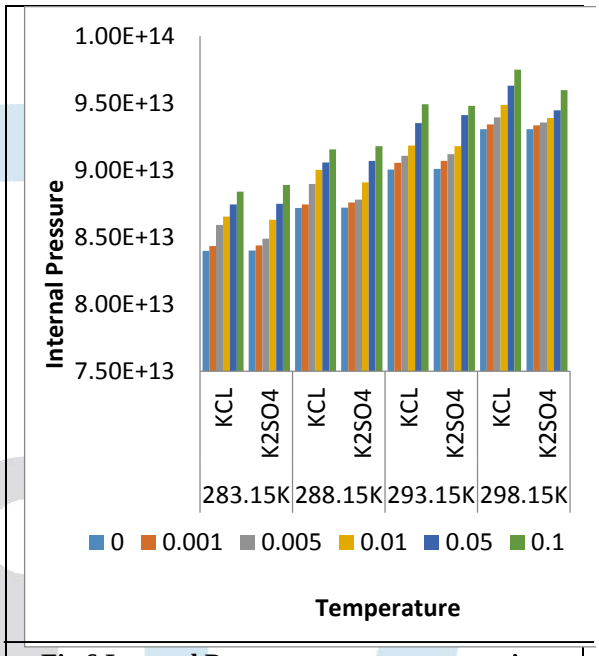

Fig.6 Internal Pressure versus concentration and temperature

Conclusion:

The density and ultrasonic velocity of potassium chloride and potassium sulphate aqeous solutions were measured at different temperatures (283.15K, 288.15K, 293.15K and 298.15K) . Using these data, hydration number, apparent molal volume, adiabatic compressibility, internal pressure were calculated to account for solute-solute interactions present in solution. It was found that molecular bonding was predominant in potassium sulphate solution over potassium chloride

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Role of ultrasonic in soil salinity remediation

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Densities and ultrasonic velocities were measured for the pure (distill water), binary and ternary liquid mixtures formed by distilled water-potassium sulfate and distilled water-potassium sulfate-sodium chloride/ magnesium chloride at 288.15 K over the entire concentration range 0.02-0.2 mol-kg^{-1}. The experimental data is used to calculate the different acoustical and volumetric parameters. These parameters are explained on the basis of molecular interactions between the components of the mixtures. The potassium sulfate shows, maximum molecular interactions at higher concentration in all the solvents (water, sodium chloride and magnesium chloride), which can also be castoff to control the salinity of soil using electrostatic interactions among saline salts and fertilizers.

Keywords: Potassium sulfate, fertilizer, non-linearity parameter, isothermal compressibility, salinity

Introduction

Excess amount of salts affect the proper growth of plants due to increasing soil osmotic pressure. During literature survey it was found that, high salt concentration in soil solution reduces the ability of plants to uptake water, which is referred to as water-deficit effect of salinity. Damage occurs on crops/plants when the concentration of saline salts is higher than a particular proportion, to begin reducing crop/plant growth. Moreover, salt stress reduces plant growth due to specific-ion toxicities and nutritional imbalances[1] or a combination of these factors[2]. Furthermore, salinity let down the total photosynthetic capacity of the plant through decreased leaf growth and inhibited photosynthesis, limiting its ability to grow[3]. On reviewing the numerous literature papers, it was found that decrease in the ability of the plants to absorb K usually takes place in saline soils containing excess Na, Mg, or Ca. Hence, application of potassium (K), fertilizer not only corrects their deficiencies but also decreases the adverse effects of sodium (Na) on the plants[4].

Proper crop fertilization is one of the sources of de-salinization of soils. To maintain this impact, the fertilizer characteristics, the method of fertilizer application, irrigation water quality, and fertilization scheduling, etc., must be considered[5]. The application of fertilizers through irrigation water (fertigation) can reduce soil salinization and mitigate salt stress effects because it improves the efficiency of fertilizer use, increases nutrient availability and timing of application, and the concentration of fertilizers are easily controlled[6]. The strategy used in the addition of inorganic fertilizers is mainly based in competition between ions (one ion limits the uptake of another ion).

Knowledge about different thermo-acoustical properties by the proper explanation of their physico-chemical behavior provides an insight into molecular interactions in solutions and could be helpful for pick out a suitable and specific fertilizer for saline soil under ambient conditions of temperature and concentration. Therefore, the present work is aimed to explore the molecular interactions between macro nutrients fertilizers, water and saline salts using electrolytic (NaCl and $MgCl_2$) solutions by ultrasonic and volumetric approach.

In present study an attempt was made for soil salinity remediation using the ultrasonic approach. For that Potassium Sulfatehas been cast-off as a solute (fertilizer) of different weight fraction (0.02-0.2 mol-kg^{-1}) and numerous ultrasonic and volumetric parameters like:

adiabatic compressibility *(β)*, isothermal compressibility *(k_T)*, solubility parameter *(δ)*, Non-linearity parameter (B/A) and Pseudo-Grüneisen parameter *(Γ)* determined by using standard relations. Which provide the useful information about the molecular interactions among the solute and solvent molecules[7].

Experimental Details

Materials : The mole fractions of fertilizer were varied over an entire range (0.02-0.2 mol-kg^{-1}) in 0.5 mol-kg^{-1} solutions of electrolytic salts so as to have the experimental liquids (mixture) of different compositions. All the glassware's were rinsed off with freshly double distilled water and acetone and dried well afore use in order to minimize unnecessary errors.

Fig. 1. Molecular Structure of Potassium Sulfate

Method : The method used in this study is analogous to that described in our previous communications[8,9]. The speed of the sound in the experimental liquids were measured with the help of a digital ultrasonic velocity interferometer operating at frequency 2 MHz supplied from Vi Microsystems Pvt. Ltd., Chennai (Model VCT:71) with an overall accuracy 0.0001m-s^{-1}. The densities of the pure (doubled distilled water),binary solution (fertilizer-water) and ternary solution (fertilizer-water-salts) were determined with the help of 10ml capacity specificgravity density bottle with overall accuracy ±2*10^{-2} kg-m^{-3} and digital electronic weighing balance (Contech CA-34) having accuracy ±0.0001g. The temperature of the double walled measuring cell made up of stainless steel was maintained constant by circulating water with the help of an electronically operated automatic thermostatic water bath supplied by Lab-Hosp. Company Mumbai with an accuracy of ±1 K temperature.

Theory : The following listed, acoustic and volumetric parameters were determined from the experimentally measured values of ultrasonic velocity *(U)* and density *(ρ)* using the standard formulae reported in the literature:

- Adiabatic compressibility is a fractional change (decrease) in volume per unit increase of applied pressure when no heat flows in or out of the system. It is one of the important physical parameter which can be used for the interpretation of molecular interactions including ligand binding in complexes, conformational changes, non-covalent interactions and biomedical reactions. This parameter can be calculated from the speed of sound *(U)* and the density of the medium *(ρ)* using the equation of Newton Laplace[10] as

$$(\beta) = \frac{1}{\rho U^2} \tag{1}$$

- Hartmann-Balizar[11] has shown theoretically that the intermolecular potential energy is the dominant factor in determining sound speed, and its derivative in liquids. The expression proposed by Hartmann-Balizar is as follows:

$$(B/A)_1 = \left\{2 + \left[\frac{0.92*10^4}{U}\right]\right\} \tag{2}$$

- According to the empirical rule of Ballou[12], there is a relationship between B/A of liquid and reciprocal of sound velocity as follows:

$$(B/A)_2 = \left\{-0.5 + \left[\frac{1.2*10^4}{U}\right]\right\} \tag{3}$$

- Solubility parameter data are useful in the description and interpretation of different phenomena occurring between solute and solvent such as their miscibility, compatibility or adsorption[13]. The solubility parameter is defined as the square root of the solution[14] and is given by:

$$(\delta) = \sqrt{\pi_i} \tag{4}$$

Where π_i be the internal pressure.

- The expression for McGowan's[15] Isothermal Compressibility is:

$$(k_{T1}) = 1.33*10^{-8} / (6.4*10^{-4} U^{3/2} \rho)^{3/2} \tag{5}$$

- Pandey *et al.*[16] also suggested the relation for

Table 1 – Sample information table

Chemical Name	Molecular weight	CAS number	Source	Mass fraction purity/ Grade
Potassium Sulfate	158.26 (g-mol^{-1})	7783-20-2	Himedia Lab. Pvt. Ltd., Mumbai	>> 99.8% AR
Sodium Chloride	58.44 (g-mol^{-1})	7647-14-5		
Magnesium Chloride	203.30 (g-mol^{-1})	7786-30-3		

calculating the Isothermal Compressibility (k_T) at a certain temperature (T) is:

$$(k_{T2}) = \left[17.1*10^{-4} / (T^{4/9} U 2 \rho^{1/3})\right] \quad (6)$$

- The Pseudo-Grüneisen parameter measures the degree of molecular or ionic association exists in the solution. It can be calculated by the relation:

$$(G) = \left\{\frac{\gamma - 1}{\alpha * T}\right\} \quad (7)$$

Where, γ be the specific heat ratio and α is the thermal expansion coefficient.

Results and Discussion

The outcomes of the density and speed of sound (ultrasonic velocity) for the stock solutions (0.5 mol-kg^{-1} NaCl /$MgCl_2$) and pure distilled water were found to be same as reported in the previous study[17]. From Table 2, it was observed that the values of ultrasonic velocity (U) and density (ρ) of the binary solution (fertilizer-water) and ternary solution (fertilizer-water-salts) increases with varying concentrations (0.02-0.2 mol-kg^{-1}) measured at a constant 288.15 K temperature. The increase in density and ultrasonic velocity is because of disruption of associate structures in water and in salt solutions. Furthermore, the addition of fertilizer in to solvents may be due to the formation of new species because of interactions between voter components of molecules, and hence free volume changes[18].

The adiabatic compressibility shows a contrary behavior as compared to the speed of sound in all the systems. In the present study it is found that the adiabatic compressibility (β) of fertilizer in all the three solvents decreases with increase in weight fraction of fertilizer. Because, as water is polar solvent and when fertilizer mixed, molecule breaks up the molecular clustering of the other releasing several dipoles for interactions. Thus structural rearrangements of the molecules results in increasing adiabatic compressibility thereby well intermolecular interaction occurred, resulting in close packing of molecules. The decreasing values of adiabatic are tabulated in Table 2. Same behavior adiabatic compressibility for some liquid mixtures were also reported by researchers[19,20].

The non-linearity parameter is measure of the non-linearity of the equation of stat of fluid and plays a noteworthy role in acoustics, biology, agriculture and

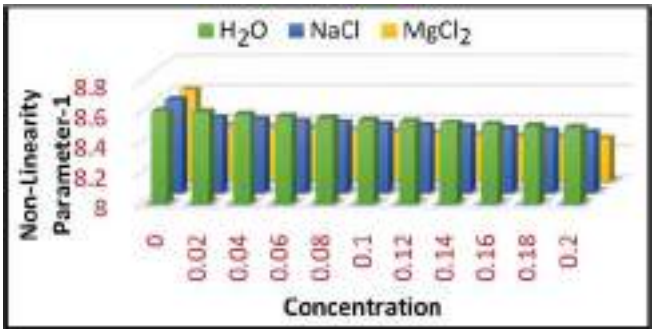

Fig. 2. Variation of non-linearity Parameter by Hartmann-Balizer with concentration.

Table 2 – The values of Ultrasonic velocity, density, adiabatic compressibility, as a function of concentration of System (potassium sulfate + water + 0.5M aq. solution of ($NaCl/MgCl_2$)) at temperature 288.15 respectively.

CONC. (M) (mol/kg)	Ultrasonic Velocity (m-sec^{-1})			Density (Kg-m^{-3})			Adiabatic Compressibility *10^{-10} (m^{2}N^{-1})		
	H_2O	NaCl	$MgCl_2$	H_2O	NaCl	$MgCl_2$	H_2O	NaCl	$MgCl_2$
0.00	1466.032	1466.032	1466.032	0999.103	999.103	999.103	4.66	4.66	4.66
0.02	1469.317	1501.275	1525.827	1006.757	1023.10	1046.81	4.60	4.34	4.10
0.04	1473.719	1504.145	1528.797	1009.328	1025.81	1049.12	4.56	4.31	4.08
0.06	1478.148	1507.604	1532.377	1011.800	1028.63	1052.04	4.52	4.28	4.05
0.08	1481.487	1511.660	1534.773	1014.610	1031.41	1054.92	4.49	4.24	4.02
0.10	1485.403	1514.571	1537.779	1016.803	1034.10	1057.16	4.46	4.22	4.00
0.12	1489.339	1516.908	1538.984	1019.612	1036.43	1059.92	4.42	4.19	3.98
0.14	1492.163	1518.665	1540.796	1022.007	1039.77	1062.51	4.39	4.17	3.96
0.16	1494.431	1521.015	1543.826	1024.750	1042.62	1065.02	4.37	4.15	3.94
0.18	1496.705	1524.553	1545.650	1027.505	1045.01	1067.74	4.34	4.12	3.92
0.20	1498.986	1526.921	1548.088	1029.893	1048.04	1070.36	4.32	4.09	3.90

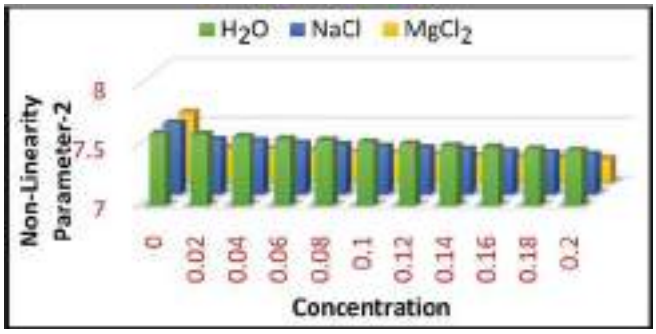

Fig. 3. Variation of non-linearity parameter by Ballou with concentration.

medicine. Non-linear parameter (B/A) obtain from Hartmann-Balizer and Ballou relations are represented in the Figs. 2-3. It is observed that the values of non-linearity parameter for potassium sulfate fertilizer in the case of Hartmann and Ballou are in well asset. Which indicating that clustering of molecules is more and hence less spacing[21].

The solubility parameter *(δ)* have been generally useful only for regular solutions. It is directly related to the internal pressure. The resultant values are tabulated in the Table 3. The outcome of this parameter shows an increasing trends for all the systems of current study. This behavior of the solution indicates the intermolecular space decreases with addition of fertilizer in salt solutions and increase the interaction between the molecules in the system.

We can explored the thermodynamic responses functions of these mixtures by varying the composition and temperature. Isothermal compressibility is one of the thermodynamic response functions which can give

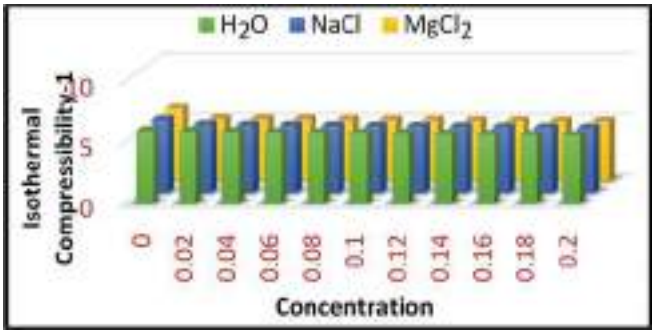

Fig. 4. Variation of isothermal compressibility by McGowan's with concentration.

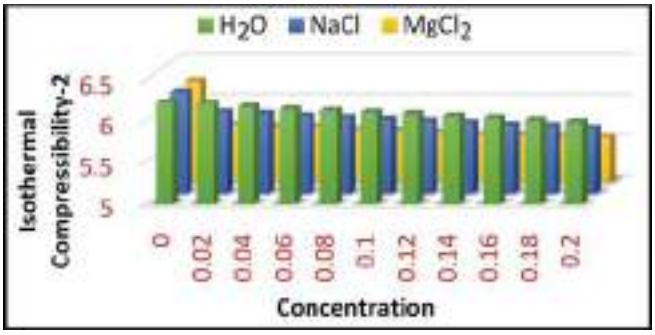

Fig. 5. Variation of isothermal compressibility by Pandey *et al.* with concentration.

Table 3 – The values of non-linearity parameter-1, non-linearity parameter-2 and as a function of concentration of system (potassium sulfate + water + 0.5M aq. solution of ($NaCl/MgCl_2$)) at temperature 288.15 respectively.

Conc. (M) (mol/kg)	Non-linearity parameter-1 ($m^{-1}s$)			Non-linearity parameter-2 ($m^{-1}s$)			Solubility parameter		
	H_2O	NaCl	$MgCl_2$	H_2O	NaCl	$MgCl_2$	H_2O	NaCl	$MgCl_2$
0.00	8.684711	8.684711	8.684711	7.685360	7.685360	7.685360	70020.50	70020.50	70020.50
0.02	8.669766	8.527785	8.422746	7.667060	7.493206	7.364588	70538.21	72703.24	74949.29
0.04	8.649843	8.515329	8.410269	7.642665	7.477954	7.349309	70850.96	72961.58	75194.18
0.06	8.629918	8.500381	8.395293	7.618267	7.459649	7.330971	71160.43	73250.68	75496.67
0.08	8.614975	8.482939	8.385309	7.599970	7.438293	7.318746	71440.77	73563.59	75746.48
0.10	8.597536	8.470479	8.372827	7.578616	7.423036	7.303462	71715.93	73823.60	75990.37
0.12	8.580100	8.460511	8.367836	7.557266	7.410829	7.297352	72022.33	74039.69	76183.09
0.14	8.567647	8.453036	8.360349	7.542017	7.401677	7.288182	72262.05	74281.80	76393.37
0.16	8.557680	8.443066	8.347866	7.529812	7.389468	7.272897	72496.01	74529.27	76653.12
0.18	8.547716	8.428114	8.340375	7.517612	7.371159	7.263724	72730.46	74802.67	76870.91
0.20	8.537753	8.418145	8.330389	7.505412	7.358953	7.251497	72947.54	75058.50	77110.66

Table 4 – The values of isothermal compressibility-1, isothermal compressibility-2 and pseudo-gruneisen parameteras a function of concentration of system (potassium sulfate + water + 0.5M aq. solution of ($NaCl/MgCl_2$)) at temperature 288.15

Conc. (M) (mol/kg)	$(Isothermal\ compressibility)_1*10^{-11}$ (m^2N^{-1})			$(Isothermal\ compressibility)_2*10^{-11}$ (m^2N^{-1})			Pseudo-gruneisen parameter -----		
	H_2O	NaCl	$MgCl_2$	H_2O	NaCl	$MgCl_2$	H_2O	NaCl	$MgCl_2$
0.00	6.19	6.19	6.19	6.42	6.42	6.42	-3.1596	-3.1596	-3.1596
0.02	6.08	5.66	5.27	6.38	6.08	5.84	-3.1658	-3.2067	-3.2414
0.04	6.02	5.61	5.23	6.33	6.05	5.81	-3.1715	-3.2108	-3.2454
0.06	5.96	5.56	5.18	6.29	6.01	5.78	-3.1773	-3.2155	-3.2503
0.08	5.90	5.50	5.14	6.26	5.98	5.75	-3.1819	-3.2209	-3.2539
0.10	5.85	5.46	5.10	6.22	5.95	5.73	-3.1870	-3.2250	-3.2579
0.12	5.79	5.42	5.07	6.18	5.93	5.71	-3.1923	-3.2283	-3.2600
0.14	5.75	5.38	5.04	6.15	5.91	5.70	-3.1962	-3.2313	-3.2628
0.16	5.70	5.34	5.00	6.13	5.88	5.67	-3.1996	-3.2348	-3.2670
0.18	5.66	5.29	4.97	6.10	5.85	5.65	-3.2030	-3.2395	-3.2698
0.20	5.62	5.25	4.93	6.08	5.83	5.63	-3.2063	-3.2430	-3.2733

information about the structural features of binary and ternary mixtures. The overall trends observed in the isothermal compressibility *(k_T)* at 288.15 K temperature are as shown in Figs. 4-5. It has been found that the calculated values of isothermal compressibility's by using both the relations to be decreasing with increase in concentration. The outcomes of *'k_T'* values with increase in concentration of potassium sulfate in all the three solvents seems to be the result of corresponding decrease in free volume and average kinetic energy of the constituent solute-solvent molecules in the saline salts solution[22,23]. Studies have put forward the view of a clustering exists in all the systems while transition from 0.02-0.2 mol-kg^{-1} weight fraction.

Conclusion

Calculated volumetric and acoustical parameters indicates that there exists hydrogen bonding and dipolar interaction in the solutions. it is also concluded that, among all the three solvents, fertilizers develops maximum interactions with $MgCl_2$ solutions due to greater degree of hydrogen bonding and electrostatic interactions molecules in its aqueous soil salt solutions which indicate the prominent effect of nature of fertilizer molecule on its behavior in solutions.

The order followed by the parameters of potassium sulfate (PS) fertilizer in H_2O, NaCl and $MgCl_2$ solutions is:

$$(PS+H_2O+MgCl_2)>(PS+H_2O+NaCl) > (PS+H_2O)$$

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13. Physico-Chemical Studies on Potassium Nitrate in Aqueous Media

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Abstract

The values of viscosity, density, and speed of sound of an aqueous solution of potassium nitrate of different concentrations ranging from 0.02 % to 0.20% have been measured using an ultrasonic interferometer at 2MHz frequency in temperature range 283.15K to 298.15K. Using these values different acoustical parameters like adiabatic compressibility, isothermal compressibility, acoustic impedance, cohesive energy, and classical absorption have been calculated. The results have been interpreted in terms of structure making and structure breaking properties of potassium nitrate in an aqueous solution.

Keywords: Ultrasonic velocity, potassium nitrate, cohesive energy, classical absorption

I. Introduction

The ultrasonic method plays an important role in understanding the thermo-acoustic and physicochemical behaviors of liquids. There has been an increasing interest in the study of intermolecular interactions between components of liquid mixture.[1] Viscometric, volumetric and ultrasonic investigations of the liquid mixture are of considerable importance in understanding the molecular interactions occurring among component molecules and they find application in several technological, agriculture, medicinal and industrial processes.[2]

The thermos-acoustic study provides valuable information about the nature of intermolecular interaction present in solutions and the structure maker or breaker behavior of solute molecules in a solvent.[3] The study of the propagation of ultrasonic waves through a mixture is an effective means of investigating of physical and chemical properties of the medium. Salts have large effects on the structure and properties of proteins. Nitrogen increases the deep green color in plants and cells and makes the cell wall thinner, Nitrogen increases the proportion of water and decreases calcium content in plant tissues. Potassium nitrate is used in diuretic medicine, it is also included as an ingredient in toothpaste and it is also added with drugs for joint and back pain

[4-5] Potassium nitrate contains nitrogen. It is a very important fertilizer in soils that are deficient in elements.

Hence present work mainly provides useful information on the measurement of velocity, density, and viscosity values of KNO_3 solution at different temperatures and concentrations. This information is useful to understand various biochemical reactions occurring in living organisms.

II. Material and Method

AR grade of Potassium Nitrate having a molecular weight of 101.1032g/mol was obtained from HIMEDIA private ltd. The purity of the compound is 99.99%. The various concentrations ranging from 0.01-0.10 mole/Kg were prepared from the standard formula and used on the day were prepared.

In the proposed work we have planned to measure Ultrasonic velocity at different solutions using a digital Ultrasonic interferometer or pulse-echo overlap technique with the function of concentration and temperature. The density measurement of solutions would be carried out using a specific gravity density bottle respectively. The temperature variation of different samples will be maintained constant using a thermostatically controlled digital water bath with a flowing water technique. The viscosity has been calculated with the help of Oswald's Viscometer.

III. Defining Relation

Using measured data, the following volumetric and acoustical parameters have been calculated using the standard relations,

A. Adiabatic Compressibility(βa)

is defined as 'the fractional decrease o volume per unit increase of pressure' and is calculated the using formula

$\beta a = 1/u^2\rho(m^2\backslash N)$ ..... (1)

B. Classical absorption (α/f^2)

The derived empirical relation as

$(\alpha/f^2) = 8\pi^2\eta_s/3\rho u^3$ (m)..... (2)

C. Isothermal Compressibility (βi)

It can be calculated using the relation as given below

$\beta i = \gamma.\beta a$.....(3)

D. Acoustic Impedance (Z)

The specific acoustic impedance is given by

$Z = u\rho$ (Kg\m^{2}s) ..... (4)

E. Cohesive Energy (C.E)

Cohesive Energy is obtained by

(C.E) = $\pi \times Vf$..... (5)

IV. Result and Discussion

Graph: Graphical Representation of Potassium Nitrate at Temperatures 288.15k, 288.15K, 293.15K 298.5K Respectively

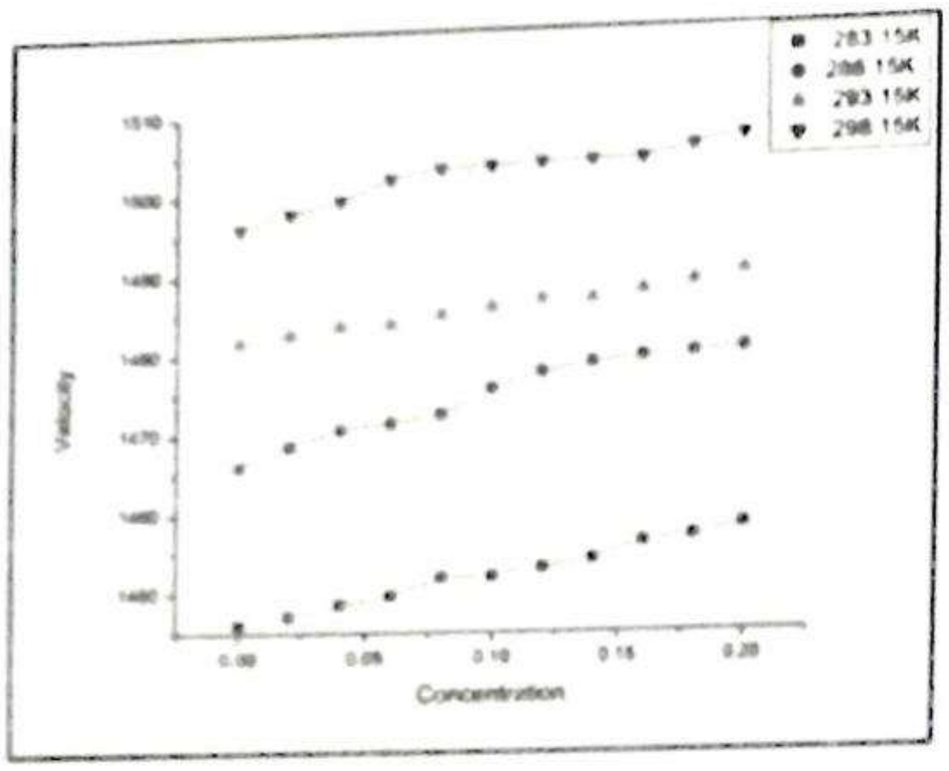

Fig .1. Variation of velocity with concentration

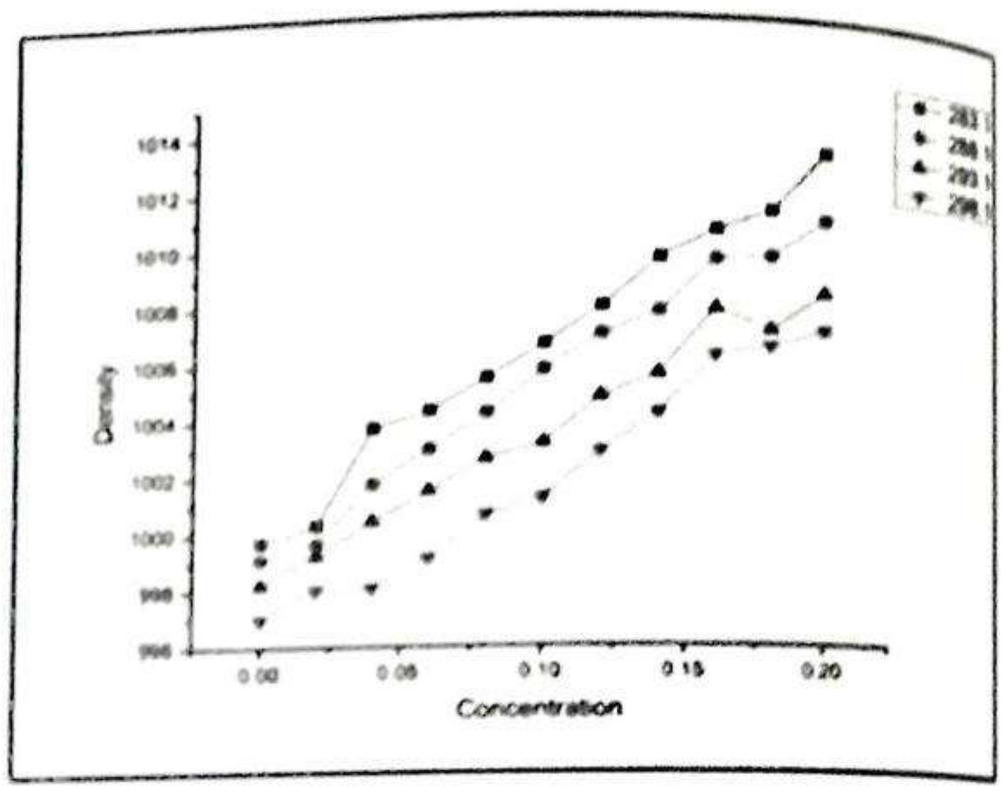

Fig.2. Variation of density with concentration

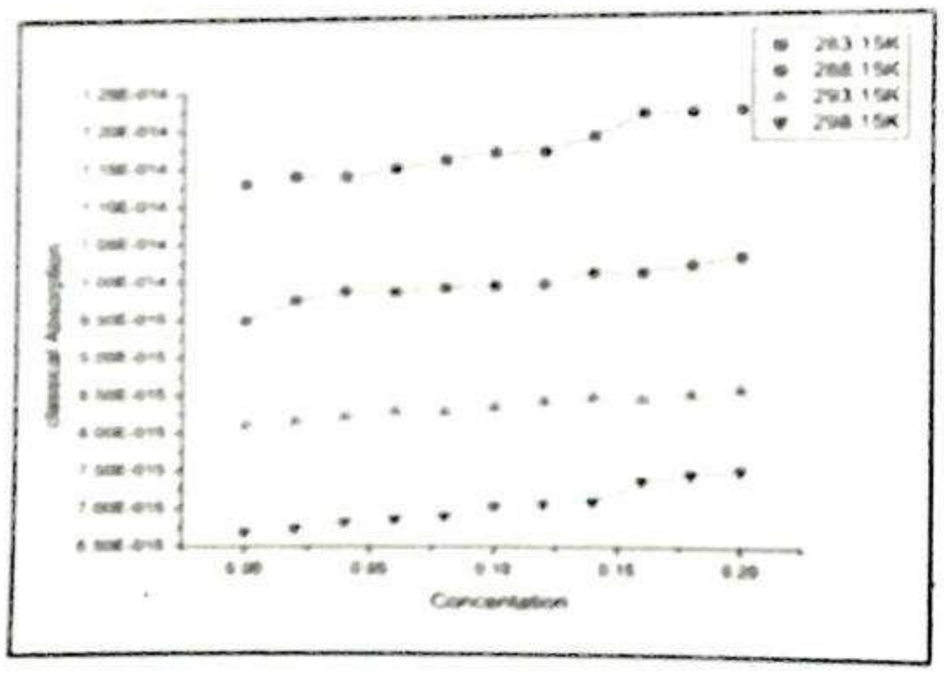

Fig.3. Variation of viscosity with concentration

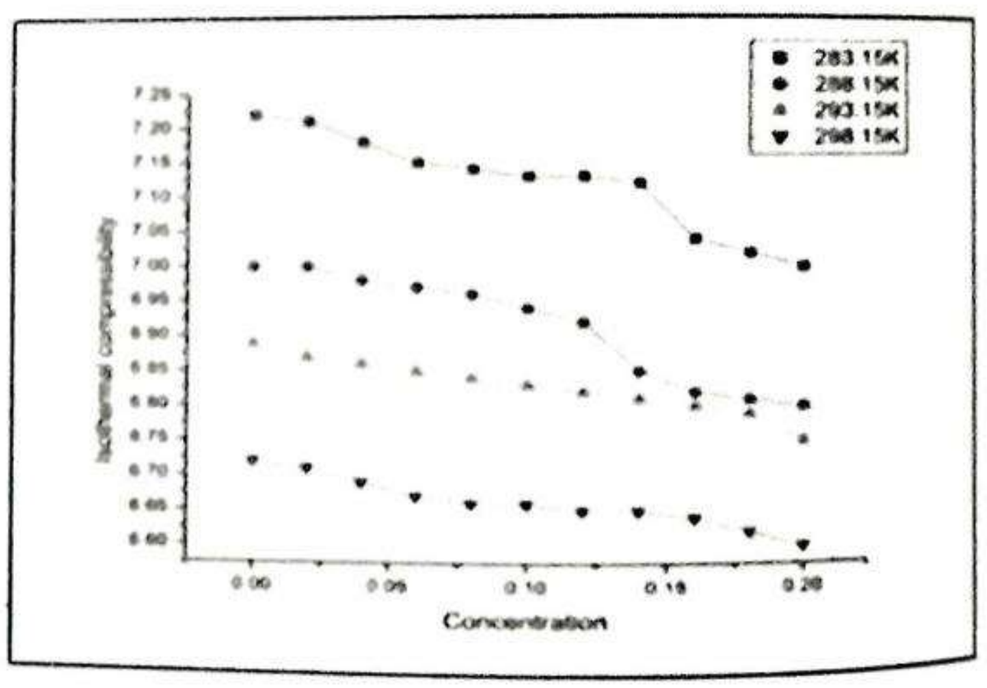

Fig.4. Variation of adiabatic compressibility with concentration

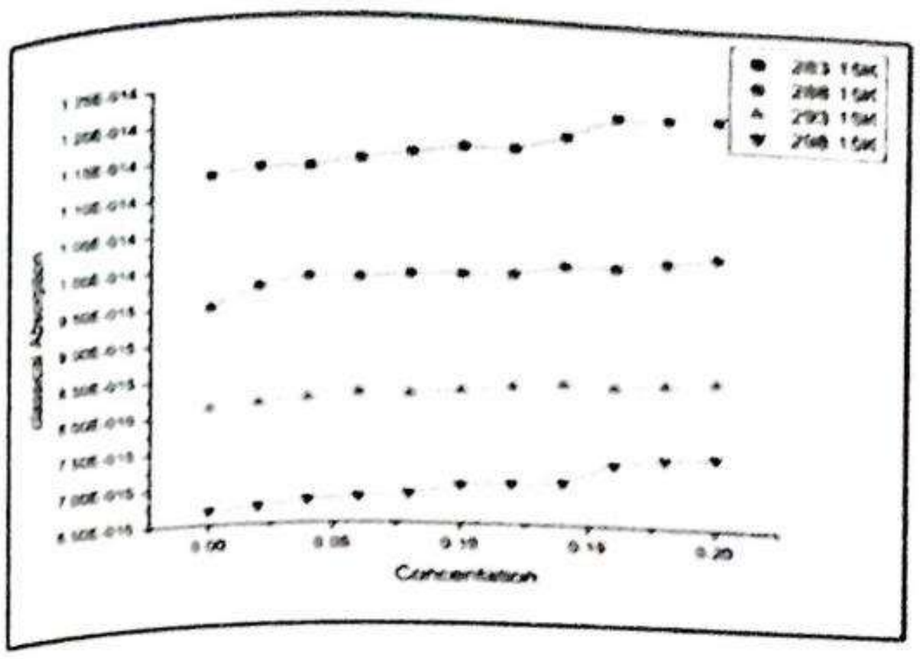

Fig.5. Variation of Classical Absorption with Concentration

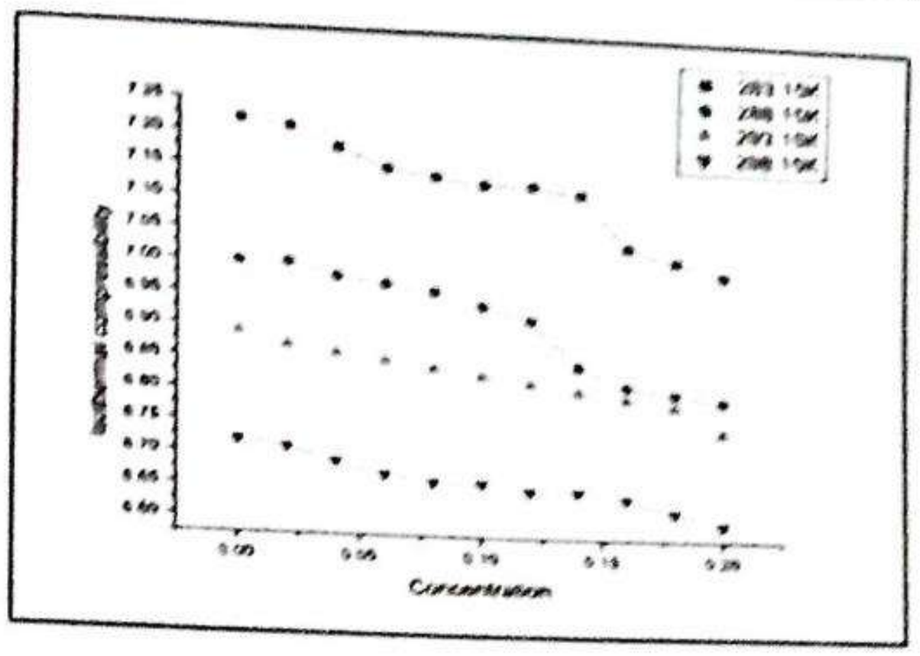

Fig.6. Variation of Isothermal Compressibility with concentration

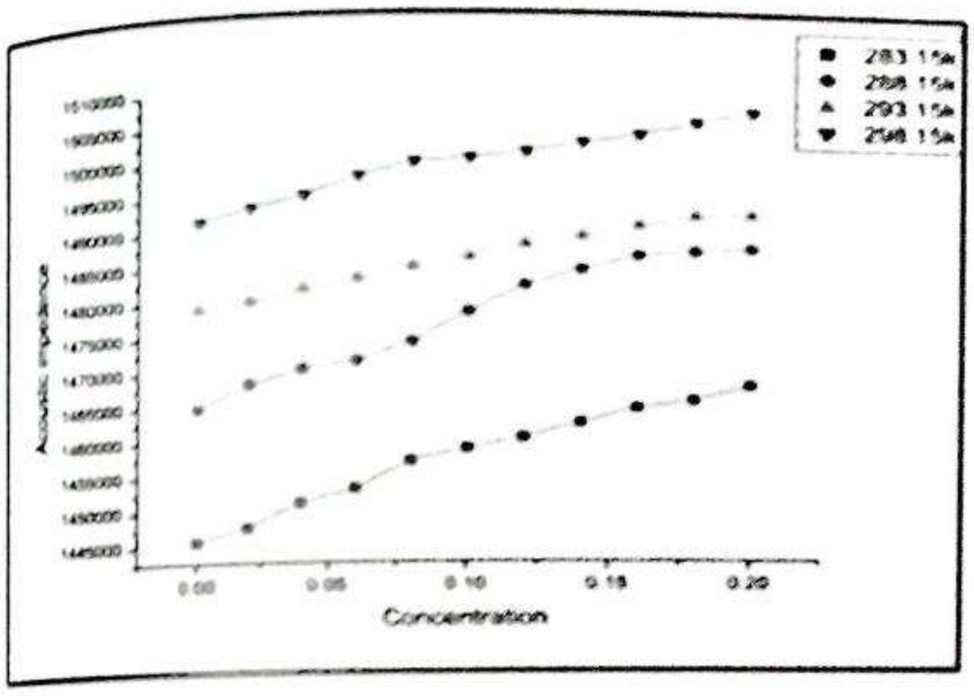

Fig.7 Variation of acoustic impedance with Concentration

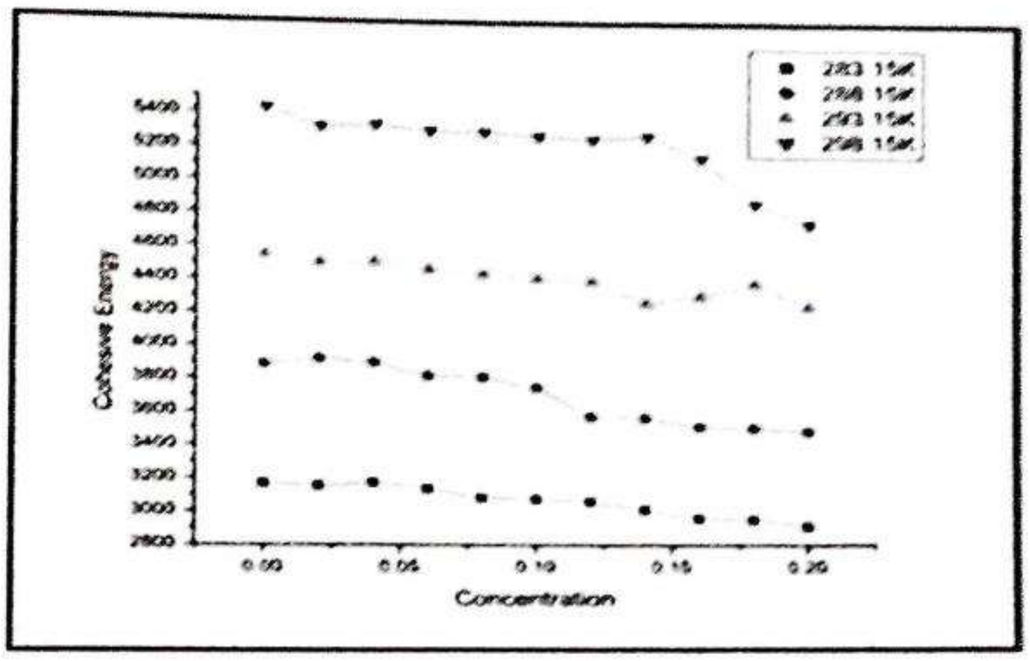

Fig.8.Variation of Cohesive Energy with concentration

In the present work, the ultrasonic velocity of potassium nitrate has been measured at 283.15K, 288.15K, 293.15K, and 298.15K temperatures. The observed data of ultrasonic velocity increases with increased concentration is shown in fig 1. Concentration and temperature affect the ultrasonic wave passing through the solution. This increase in ultrasonic velocity in an aqueous solution of potassium nitrate is attributed to the cohesion brought by ionic hydration.[6]The increase in density with molar concentration suggests a solute-solvent interaction exists between the potassium nitrate and water. [7]

Viscosity is an important parameter in understanding the structure as well as molecular interaction occurring in solution. From (fig.3) values of viscosity increase with concentration but decreases with temperature. These variations attribute to structural changes. [8] Fig.4 shows the graph between the variation of adiabatic compressibility and the mole fraction of potassium nitrate. The adiabatic compressibility decreases with an increase in concentration. These trends suggest the ion-solvent interaction increases at a given composition. This trend supports the

complex formation of the solution. [9] From the fig.5, it is observed that the classical absorption increases with an increase in concentrations and decreases with temperature strongly supports the intermolecular hydrogen bonding and enhances solute-solvent interactions. The closed packed water structure absorbs more sound energy due to intermolecular hydrogen bonding and hence more the classical absorption value. [10] Fig.6 shows that the isothermal compressibility of potassium nitrate solution decreases with an increase in concentration. This may be the influence of the electrostatic field of the solute molecule on the surrounding solvent molecule. A decrease in compressibility indicates that there is enhance of molecular association in this system upon an increment of solute. The compressibility value depends on the speed of sound. Hence compressibility decreased with a rising in temperature.[11] Acoustic impedance depends on the density of the medium and the speed of the sound wave.Fig.7 shows the variation of acoustic impedance with temperature and concentration. The increase in acoustic impedance with the increase in temperature as well as concentration suggests the greater association of solvent and solute through hydrogen bonding. Thus, an increase in acoustic impedance indicates the associative nature of solute and solvent and enhancement in molecular interaction. [12] From fig.7 the values explain the free energy state of the liquid system related to escaping tendency, which is the resultant contribution of all its constituent molecule/ion in whatever state of aggregation, ions, etc. [13]

Conclusion

In common with all these parameters, considering the interaction among various components, we find that the salvation approach is used to interpret ion-solvent interaction. The ultrasonic study of potassium nitrate indicates the process of ion association and complex formation at various concentrations. From the above study, it is concluded that there is an association between potassium nitrate and water, because of interaction between solvent and solute may be responsible for the increase in ultrasonic velocity, and in turns affects other parameters. The result also indicates the existence of positive interaction between potassium nitrate and water.

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16. Study on Thermodynamic and Acoustical Parameter of Potassium Sulphate in Aqueous Media at Various Temperature

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Abstract

This manuscript aims to show the noticeable and remarkable nature of intermolecular interaction that exist in the aqueous solution of potassium sulphate at a frequency of 2 MHz. The major data of velocity, density and viscosity for the said system were used to calculate various acoustical parameters viz. Relaxation Time (r), Classical Absorption Factor (α/f^2), Relative Association (R_A), Internal Pressure (Π_i), Enthalpy (ΔH_i), Surface Tension (σ) and Effective Mass (M_{eff}) which provide valuable information. The results explore the structure making-breaking tendency and confirm the existence of strong solute-solvent interaction.

Keywords: Acoustical and thermodynamic parameters, density, potassium sulphate, ultrasonic velocity & viscosity.

Introduction

In recent year the study of acoustical properties of the aqueous mixed solution have been determined to be useful in specific ion-ion, ion-solvent interaction in solution. The wave propagation of ultrasonic study is very important and effective in the liquid system for determining the certain physical properties of the material. Ultrasonic has become a very important and valuable tool in medical and biological science, engineering, geophysics and so on. Ultrasonic studies in organic/inorganic liquid have been the subject of extensive research recently. The study of the molecular interaction and the variation in this interaction due to structural changes has been carried out by various experimental techniques. The measurement of ultrasonic velocity, density and viscosity of potassium sulphate and water to understand the intra and intermolecular interaction between the molecule of components. There a various practical

applications for ultrasonic i.e., underwater explanation, sanitation of bottles and cans for leak detection, ultrasonic cleaning and medical application (diagnosis, therapy and surgery).

Chemical fertilizers are synthesis substances that provide the necessary nutrients for plant growth and development. Fertilizer is any natural or synthetic origin that is applied to plants or soil to supply more nutrients for the better growth of plants. Potassium sulphate is an inorganic compound with the molecular formula K_2SO_4 and it is white and a water-soluble solid. And it is mainly preferred as a fertilizer providing both sources of potassium and source of Sulphur i.e., K is an excellent source of nutrition for plant and the source of S require enzyme function and protein synthesis. This salt is a powerful oxidant, commonly used to initiate polymerization. Potassium is the third key nutrient of commercial fertilizer; it helps strengthen a plant's abilities to resist disease and plays an important role in increasing crop yield and overall quality. It also protects the plant when the weather is unfavourable.

Material and Method

In the present work, we have used analytical reagent (AR) grade with 99% purity of potassium sulphate {[CAS No – 7778-80-5] [molecular wt. – 174.259 g/mol]} used as solute and fresh distilled water having [molecular wt. 18.01528 g/mol with density – 1000 kg/m3] was used as a pure universal solvent and this work was done at different temperatures (i.e., 288.15, 293.15 & 298.15K) and concentrations.

1. This experiment was carried out at different temperatures (i.e., 288.15, 293.15 & 298.15K) which were maintained by a digital water bath.
2. The measurement of weight was done by using a digital weighing machine having an accuracy of ±0.1mg.
3. Some basic parameters like, Ultrasonic velocity were measured on a digital ultrasonic interferometer with a 2MHz frequency having an accuracy of 0.1%.
4. Ultrasonic viscosity was determined by using Ostwald's viscometer with ±0.001pa-sec accuracy.
5. The ultrasonic density of this solution was accurately determined by using a 10ml density gravity bottle.
6. Using the measured data, some other acoustical parameters have been calculated using standard relation.[1]

Defining Relation

1. Relaxation Time (τ): The relaxation process occurring in viscous liquids may be pictured in the following way. After applied stress, the liquid will tend to rearrange its structure in such a manner as to relieve the stress.
2. $\tau = \frac{4}{3}\eta_s \beta_a$
3. Classical absorption factor (α/f^2): Viscous losses due to friction as molecules collide with each other. This thermal-viscous classical absorption depends on viscosity, density and cube of velocity.
4. $(\alpha/f^2) = 8\pi^2\eta_s/3\rho u^3$
5. Relative association (R_A): The relative association parameter is the relative association between the component's molecules in a liquid mixture and is given by
6. $(R_A) = (\rho/\rho_0)\ (u_0/u)^{\frac{1}{3}}$
7. Internal Pressure (Π_i): The intermolecular forces give a liquid its cohesion and it creates a pressure of thousand to ten thousand atmospheres within a liquid. This pressure is called 'internal pressure'. The internal pressure indicates the results of the three of attraction and the forces of repulsion between the molecules.
8. $\Pi_i = bRT(K\eta/U)^{\frac{1}{2}}.\ \rho^{\frac{2}{3}}/Meff^{\frac{7}{6}}$
9. Enthalpy (ΔHi): Enthalpy is a property of the thermodynamic system, the constant is a state function used in many measurements in chemical, biological and physical systems at constant pressure.
10. $\Delta Hi = \frac{Pi \times Vm}{Meff}$
11. Surface Tension (σ): Surface tension is the tendency of the liquid surface at rest to shrink into the minimum surface area possible. It allows higher density than water.
12. $\sigma = (6.3*10^{-4})\ \rho u^{\frac{3}{2}}$
7. Mass effective (M_{eff}): A particle's effective mass is the mass that it seems to have when responding to force or the mass that it seems to have when interacting with other identical particles in a thermal distribution.
13. $(M_{eff}) = \Sigma X_i m_i$

Results and Discussion

For the systematic study the variation in ultrasonic velocity, density and viscosity of the aqueous potassium sulphate solution under the study at different concentrations and temperatures (288.15, 293.15 & 298.15K) are plotted. These are shown in fig. (1-10).[2]

In the present study one can observe that in given fig. 1 the Potassium sulphate system, the value of ultrasonic velocity is increased with an increase in concentration and Temperature. This increasing trend of ultrasonic velocity in the mixtures suggests a moderate strong electrolytic in which the solute (potassium sulphate) tends to attract solvent (distilled water) molecules [3]. i.e., it shows a greater association between solute and solvent molecules.[4] From fig. 2 it is found that density increases with an increase in the concentration of potassium sulphate solution. Thus, the increase in density with concentration may be due to the closed packing of solute-solvent interaction among the constituent particle of the mixture. [5] It is found that the density decreases as the temperature increases. This is because as the temperature increases, the thermal motion of a particle of the medium also increases. Thus, particles become loosely packed to cause a decrease in density. [6]

Viscosity is an important parameter in understanding the structure as well as molecular interaction occurring in the solution.[6] From fig. 3 it is observed that the viscosity of aqueous potassium sulphate solution is found to increase with the increase in concentration which suggests that a strong association in potassium sulphate solution may be due to intermolecular interaction between solute and solvent molecule. [7] And the value of viscosity decreases with an increase in temperature, this is because as the temperature increases, the kinetic energy of the molecule increases which diminishes the viscosity of the medium. [6]

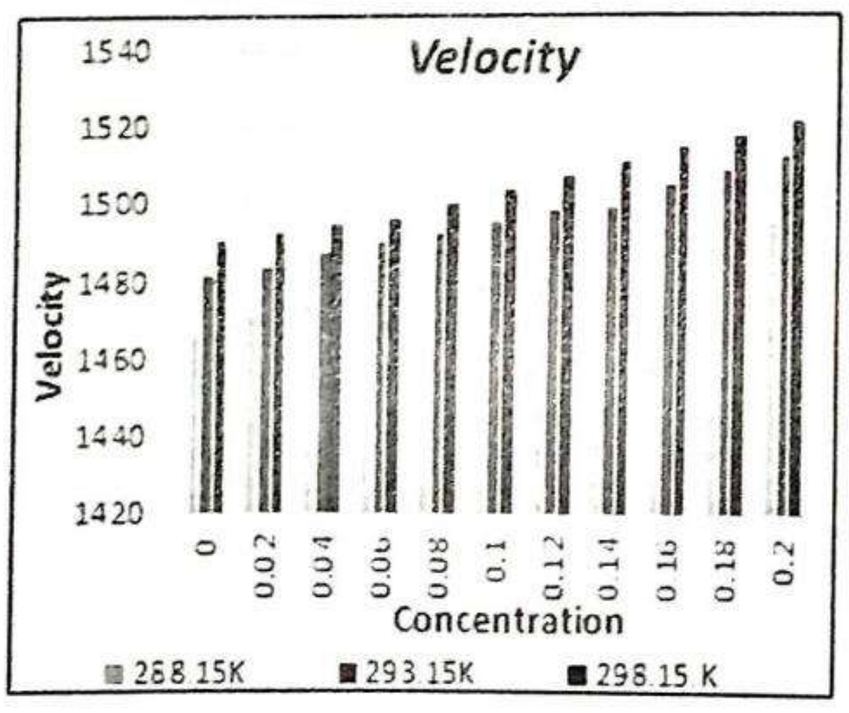

Fig.1 Variation of Velocity with Conc.

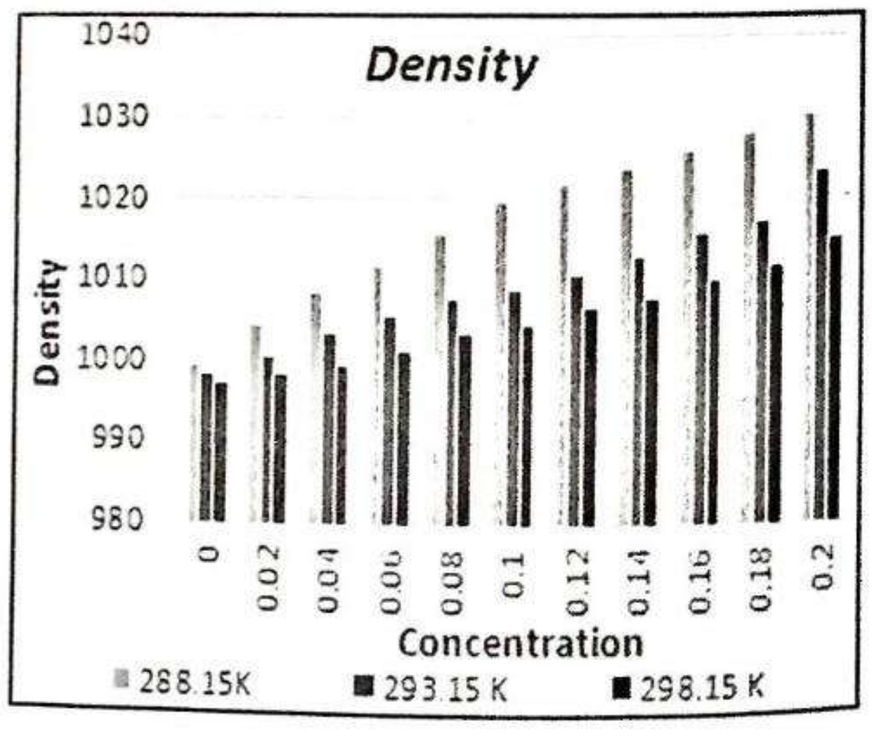

Fig2. Variation of Density with Conc.

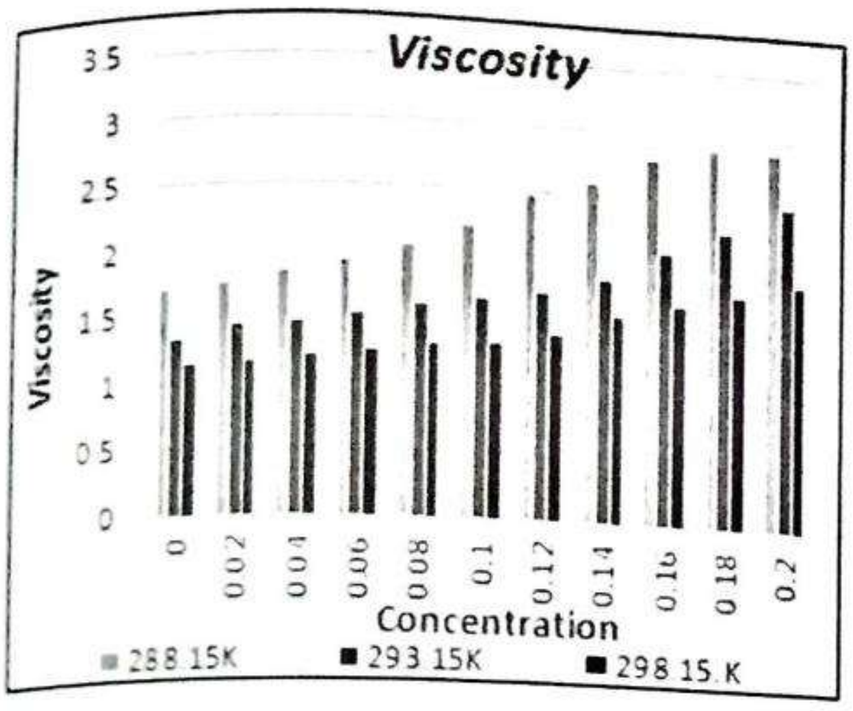

Fig.3 Variation of Viscosity with Conc.

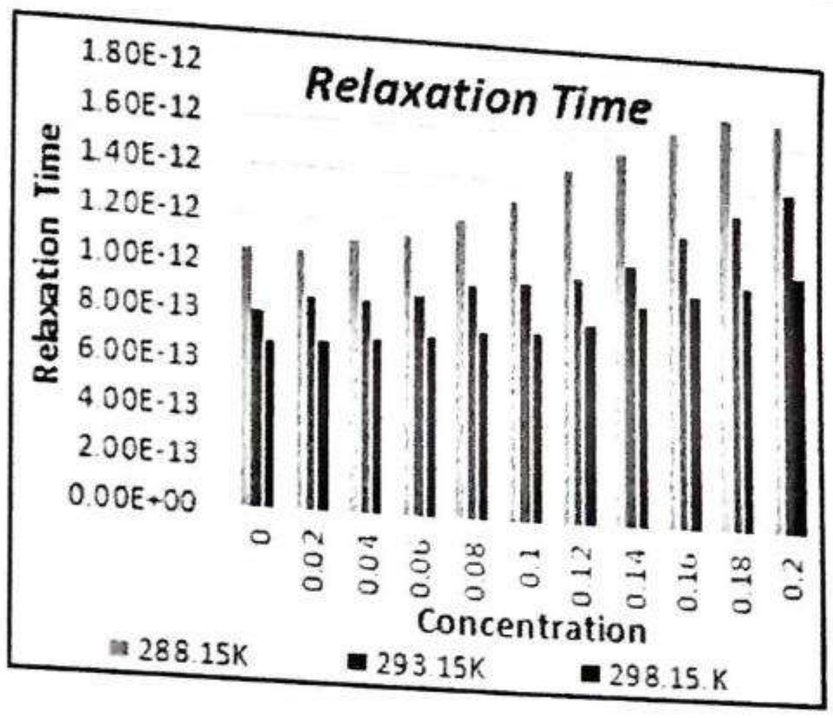

Fig. 4 Variation of R.T. with Conc.

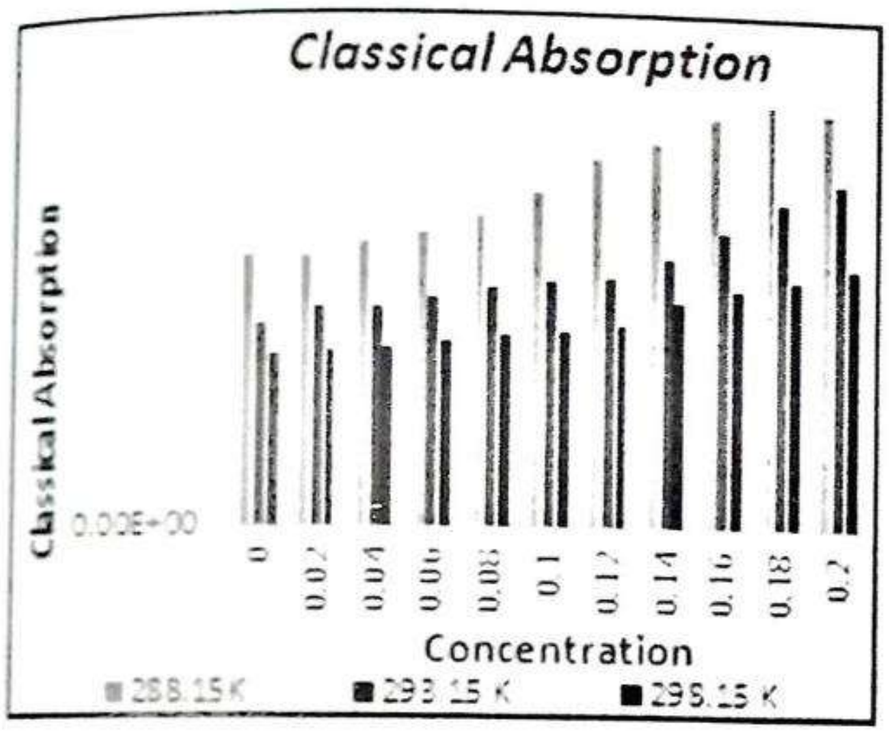

Fig.5 Variation of C. A. with Conc.

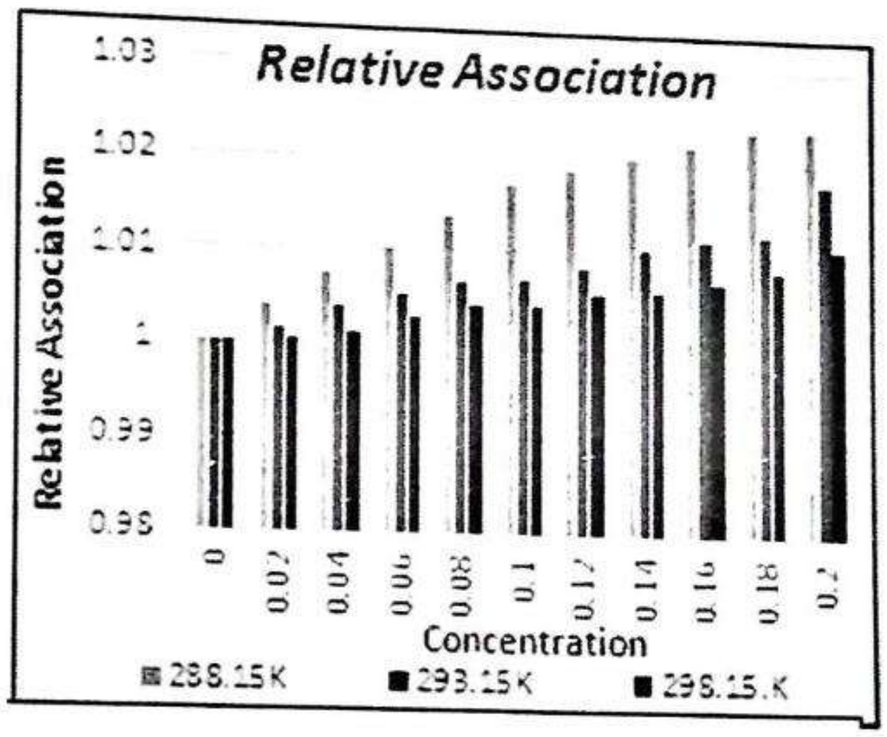

Fig. 6 Variation of R. A. with Conc.

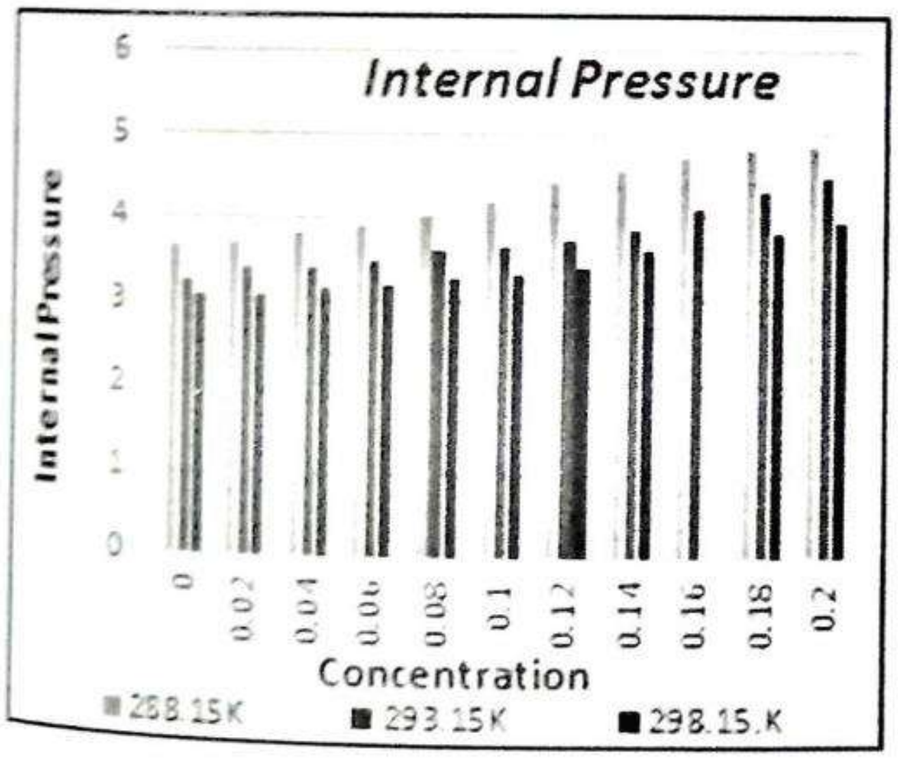

Fig.7 Variation of I. P. with Conc.

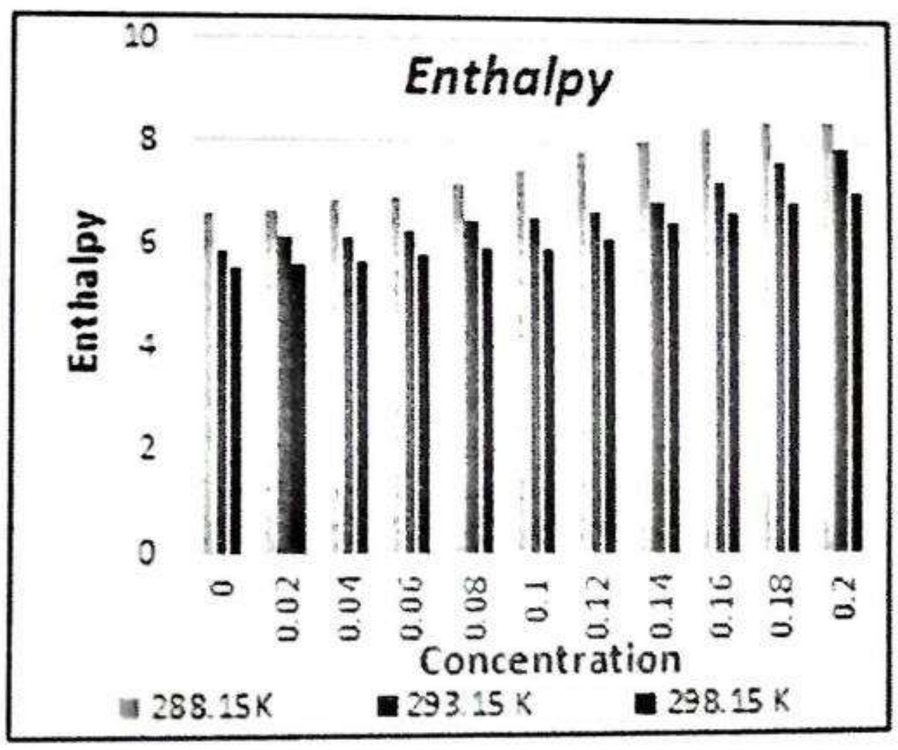

Fig.8 Variation of enthalpy with Conc.

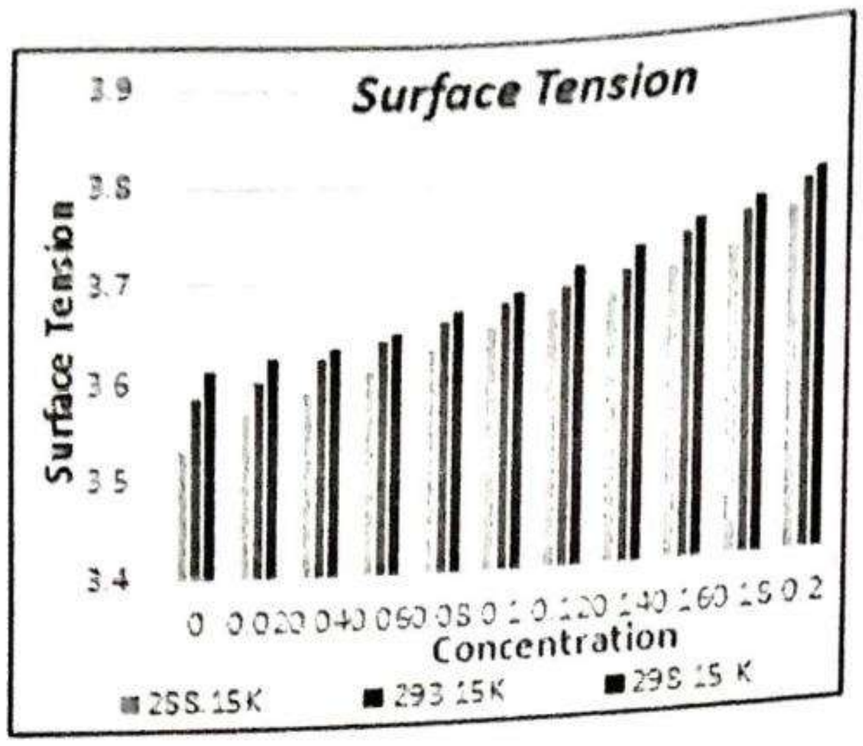

Fig.9 Variation of S. T. with Conc.

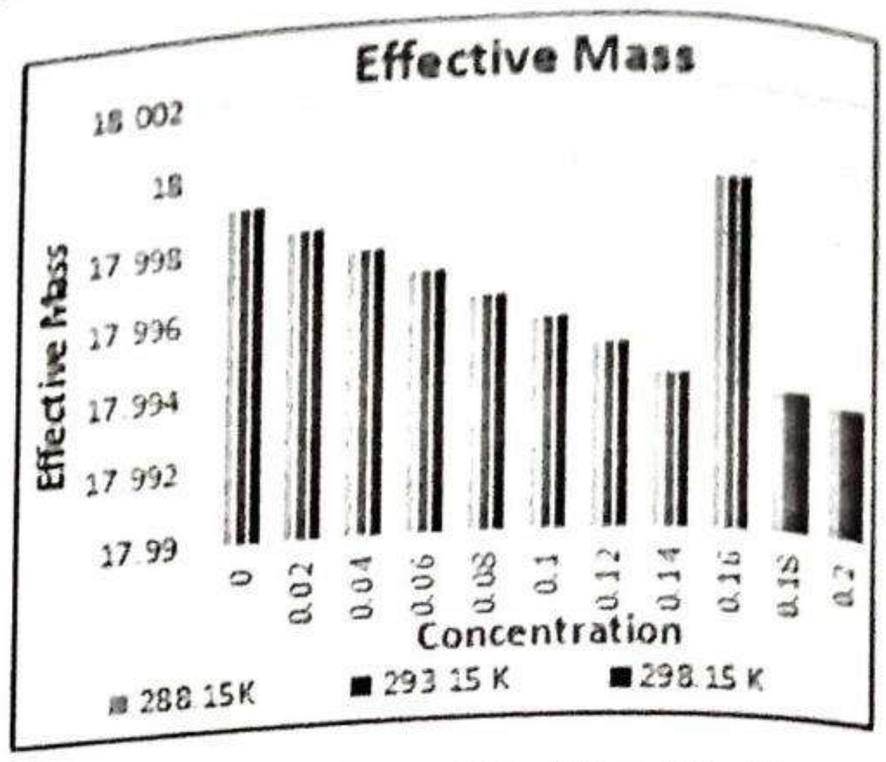

Fig.10 Variation of E. M. with Conc

Relaxation time is the time taken for the excitation energy to appear as translational energy which depends upon the temperature and impurities. At higher temperatures, the relaxation time value decreases in the aqueous solution because hydrogen bonds become weak due to thermal vibrations and the structure breaking effect predominates over the formation of hydrogen bonding. [8] shown in fig. 4 it is also observed that the relaxation time increases with the rising in the concentration of the solution which indicates the structure making effect whereas the adverse effect on relaxation time with a rise in temperature shows structure breaking effect. From fig. 5, is observed that the classical absorption factor (α/f^2) increases with an increase in concentrations and decreases with an increase in temperature. This increasing trend is due to the aggregation of solvent molecules of ions suggesting strong solute-solvent interaction.

The value of density and ultrasonic velocity enables the calculation of the relative association. It is influenced by two important factors:[9] Breaking up of the associated solvent molecules on the addition of solute into it. This leads to a decrease in the relative association with an increase in temperature.[5] Relative association increases with an increase in concentration for an increase in solutes into solvent as observed from graph 6. Fig. 7 shows that internal pressure is the resultant of intermolecular attractive and repulsive forces. [10] Internal pressure decreases with a rise in temperature because of thermal agitation of ions from each other due to increasing thermal energy, which reduces the possibility for interaction and reduces the cohesive forces and ultimately leads to a decrease in internal pressure. [11] The increase in internal pressure with the concentration is due to the increasing strength of molecular association through hydrogen bonding or dipolar association.

Enthalpy is a thermodynamic quantity that measures the total heat content of the system. From fig.8 it is found that as the concentration of solute increases, enthalpy increases.[12] This is because the addition of solute to solvent decreases the available solvent molecules. At high temperatures hydration or salvation rate decreases hence as the temperature of the system increases, the enthalpy of solute solution also decreases. Fig. 9 indicates the behaviour of surface tension with concentration and temperature. It increases as the molar concentration goes on increasing. This shows the association interaction in the solution. And also increases surface tension as the temperature goes on increases because surface tension is the tendency of fluid surface to shrink into the minimum surface area possible.[13] The effective mass of the solution (as shown in fig. 10) decreases with an increase in concentration and remains constant with an increase in temperature because it is independent of temperature.

Conclusion

The variation of ultrasonic measurement was carried out on aqueous potassium sulphate solution at different temperatures and concentrations. It is concluded that the structure making and breaking tendency and strong solute-solvent interaction between potassium sulphate and water.

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Volumetric and Ultrasonic Investigation of Acetamide in Aqueous Sodium Chloride

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ABSTRACT

In present work, the Ultrasonic studies have been discussed for two different systems: 1) Acetamide + H_2O and 2) Acetamide + H_2O + NaCl (0.2 mol/kg) under different physical conditions like, temperature and concentration. Both the systems have been described in three phases of computation and discussion of a) Mechanical properties b) Ultrasonic velocity, density and thermal properties and c) Higher order elastic constants. These properties and constates provide the information about the intrinsic properties of the liquid system, for example information about bonding stability, kind of interaction etc. Therefore, this kind of study is worthwhile and interesting in view from number of aspects.

KEYWORDS: Acetamide, Thermal properties, Ultrasonic, Intermolecular interaction, Mechanical properties.

INTRODUCTION

Ultrasonic techniques are widely used in the field of agricultural, engineering, medical and other industrial areas.[1] In this work, ultrasonic velocity and density was calculated experimentally. With the help of this experimental data, we have calculated some mechanical, thermal and elastic parameters at different concentration and temperature operated at 2MHz frequency. The determination of ultrasonic velocity is important to knowing the physio-chemical and molecular properties of liquids and liquid mixtures of appreciable importance to conclude the inter-molecular interaction between solute and solvent mixture.[2]

Ultrasonic investigation of drugs (Acetamide) in aqueous solution of sodium chloride gives best information for determining the nature of solution. Drugs are commonly used in preparation of medicines like Paracetamol, Penicillin, etc. The simplest amide derived from the acetic acid is acetamide with molecular formula CH_3CONH_2. It is white odorless crystalline solid [3] A work has been taken to explain the molecular interaction in mixture of acetamide and aqueous solution of sodium chloride at various temperature. The physiochemical property of given mixture is observed by linear variation in ultrasonic velocity and other parameters which are studies with their structural changes occurring in a mixture. This kind of information is worth in view to many aspects of medical and pharmaceutical purpose.[4]

MATERIAL AND METHOD

- In present work, acetamide is used as a analytical reagent {[CAS No 60-35-5][molecular wt. 59.07 g/mol]}grade with 99% purity is used as a solute and distilled water [molecular wt. 18.01528 g/mol] and aqueous solution sodium chloride [molecular wt. 58.44 g/mol] with densities -1000 kg/m^3 and 2170 kg/m^3 is used as a solvents .
- This process was takes place at different temperature (283.15K, 288.15K, 293.15K and 298.15K) is maintained constant by digital thermostat.
- The weight of substance was measured by using a digital weighing machine of an accuracy ±0.1mg.
- A digital ultrasonic interferometer is used to measure the ultrasonic velocity with 2MHz frequency and 0.1% accuracy.
- The density of solution was perfectly determined by using a 10 ml gravity density bottle.
- By using these two parameters, we can calculate other different acoustic parameters at various temperatures and concentrations.

DEFINING RELATION

Isothermal Compressibility (k_T): Isothermal compressibility value have been evaluate using the MeGowan's expression [5], the arbitrary constant in the denominator in this expression in terms of temperature. Pandey et al [6] suggested the relation for the determination of isothermal compressibility.

$$k_{T1} = 1.33*10^{-8}/(6.4*10^{-4}C^{3/2}d)^{3/2}$$

$$k_{T2} = 17.1*10^{4}/(T^{4/9}C^{2}d^{1/3})$$

Internal Pressure (π_i): Internal Pressure [7] is a significant parameter which is used to understand structure and nature of intermolecular interaction in the liquid molecule.

$$\Pi_i = \{T*\alpha/k_T\}$$

Surface Tension (σ): Surface tension [8] is the tendency of liquid surface at rest to shrink into the minimum surface area. It is used to study surface composition of mixture.

$$\sigma = (6.3*10^{-4})\, dC^{3/2}$$

Bulk Modulus (K): Bulk modulus [9] is the reciprocal of adiabatic compressibility, it is used to measure the ability of substance.

$$K = C*2d$$

Thermal Conductivity (k): Thermal conductivity [10] is refer to the ability of material or substance to conduct or transfer heat.

$$k = \{3.0*(dN_A/M)^{2/3}k_BC\}$$

RESULT AND DISCUSSION

In the present work, the obtained variation in ultrasonic velocity and density in the system of aqueous sodium chloride and acetamide at different temperature and concentration are plotted is shown in fig. [1-8]

Fig. 1 exhibit the plot between ultrasonic velocity and concentrations at various temperature. It is shows that the ultrasonic velocity increase with increase in concentration of acetamide in aqueous solution of sodium chloride, result indicates association in the molecules of the component. The association in the constituent molecules may involve due to dipole interaction and due to the hydrogen bonding between the constituent molecules. The peak at molar concentration because of containing the strong hydrogen bond. This interaction generates to the complex formation this concentration. [11] The variations of the density with concentration are shown in fig.2 which indicates that the density of mixture of aqueous solution of sodium chloride and acetamide increase with increase in concentration and decrease with increase in temperature.[12]

The Bulk Modulus of acetamide in aqueous solution of sodium chloride increases with increase in concentration and temperature as shown in fig.3 which observed that the hydrogen bonding between the unlike components in the solution increases.[13]

Fig.4 reveals the variation of Internal pressure with different concentration and temperature which suggests that the internal pressure increases with increase in concentration as well as temperature the association takes place through the hydrogen bonding in the molecules, and they are closely packed inside the shielded region. [14]

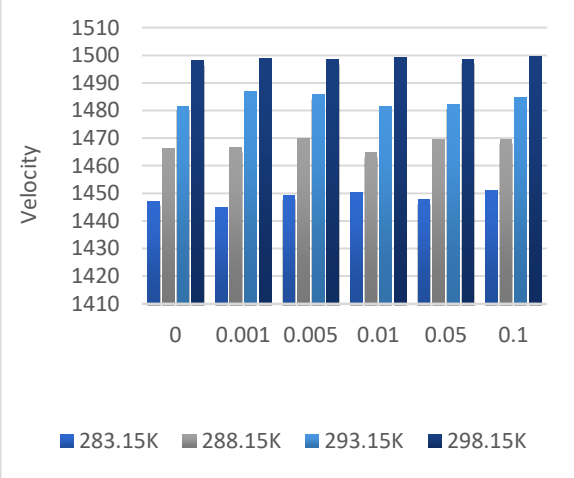

Fig.1 Variation of velocity with conc. and temp.

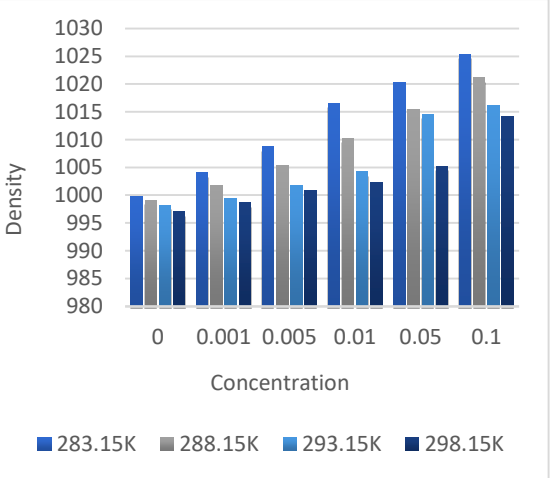

Fig.2 Variation of Density with conc. and temp.

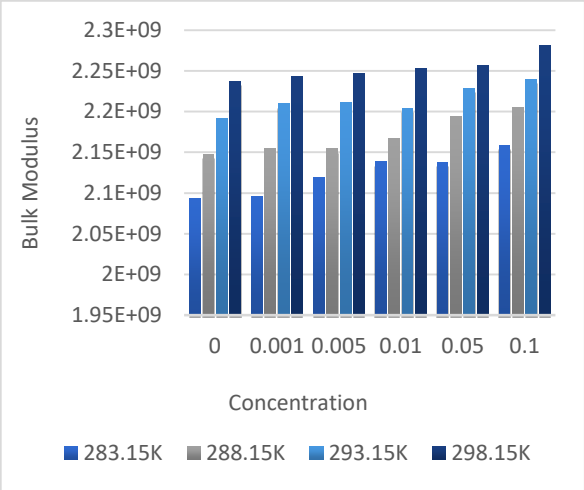

Fig.3 Variation of Bulk modulus with conc. and temp.

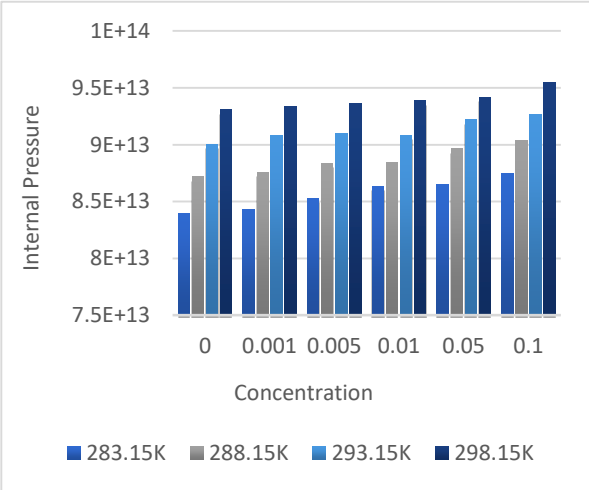

Fig.4 Variation of internal pressure with conc. and temp.

The variation of isothermal compressibility with concentration observed in fig.5 and fig.6 which says that the isothermal compressibility decreases with increase in concentration of solute at different temperature. Because acetamide is dissolved in aqueous solution of NaCl. Some of the surrounding molecules are closely attach to the ions due to the electrostatics field of ions. Since, in the ionic field the solvent molecules are oriented. The solvent molecules are closely packed in the solvation shell as compared in absence of ions.[15] The increase variation of surface tension with different concentration and temperature of solute show in fig.7 which indicates that the significant associative interaction in the solution of acetamide and aqueous sodium chloride.[16

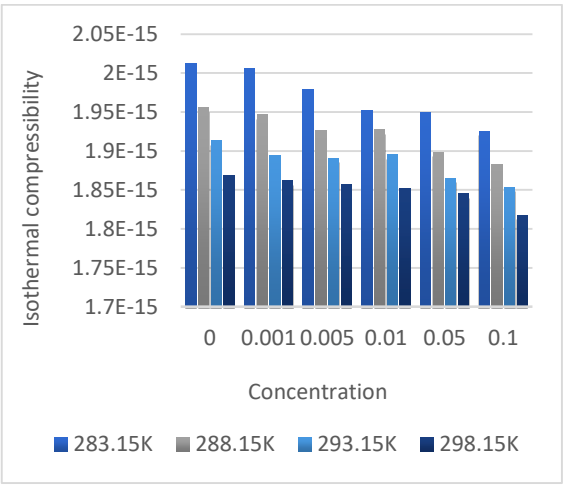

Fig.5 Variation of k_{T1} with conc. and temp.

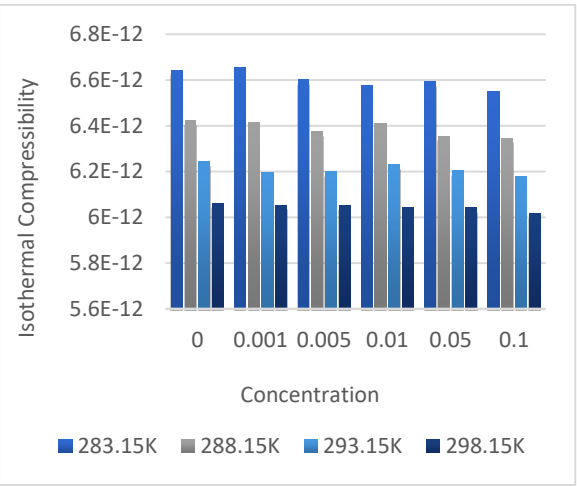

Fig. 6 Variation of k_{T2} with conc. and temp.

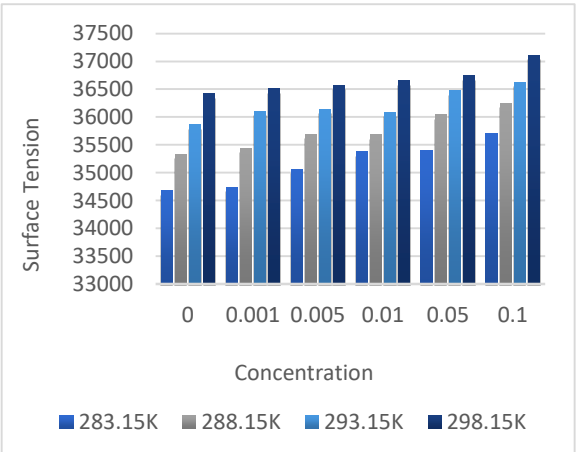

Fig.7 Variation of surface tension with conc. and temp.

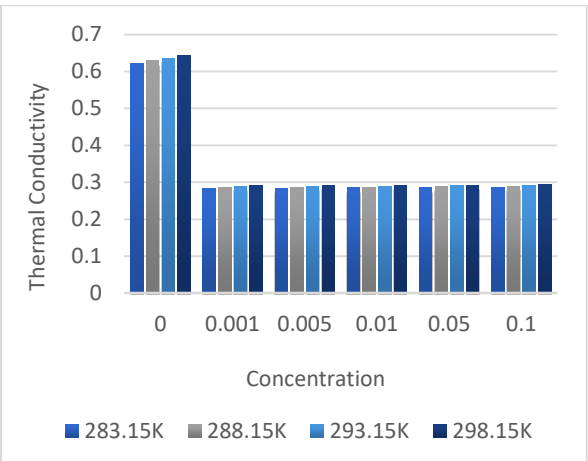

Fig.8 Variation of thermal conductivity with conc. and temp.

Fig.8 exhibit the plot of thermal conductivity and concentration and temperature. It is observed that the thermal conductivity of water is increases with increase in temperature as compared to concentration it is observed that the thermal conductivity slightly increases with increase in concentration and temperature clear that the energy is flow when the molecules are close to each other. This means in the given system intermolecular interaction takes place.[17]

CONCLUSION

The uniqueness is in the fact that mixture of acetamide and aqueous sodium chloride has a characteristic feature, which is observe in all the properties discussed in our study. Our aim is to establish that the various mechanical, elastic and thermal parameters support the experimental finding as solution (CH_3CONH_2 + H_2O + NaCl) has greater interaction as compared to (H2O + NaCl).

This kind of interaction helps to our medical and pharmaceutical industries in view to make more effective drugs related to application.

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Soil Salinity Management with the Help of Ultrasonic Characterization

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Keywords: Fertilizer; Agriculture; Soil salinity; Intermolecular interaction; Ultrasonic characterization

ABSTRACT

The present manuscript reports the ultrasonic characterization of fertilizer at varying concentration in different solvents at a fixed temperature. Sound speed or ultrasonic velocity (U) and density (ρ) measurement were carried out by 2 MHz frequency digital ultrasonic interferometer. With the help of observed experimental values of sound speed and density a number of acoustical and physical parameters have been estimated using the standard relations. The acoustical and physical studies clarify the nature of interaction between binary as well as ternary solutions. The variation in these parameters plays a significant role in understanding the solute-solute and solute-solvent interactions between the constituent molecules. This kind of approach lead to better understand of interactions exists in between the fertilizers and different solvents. Therefore the proposed study is worthwhile, interesting from number of aspects, and has applications in pure and applied research in the field of agriculture in view to increase fertility of soil or to counteract the problem of soil salinity.

INTRODUCTION

Use of fertilizers and manures is a key factor to sustain fertility of the soil. Fertilizers being a costly input, the scientific approach towards the profitable agriculture would imply the supplemental use of plant nutrients according to the actual need of the situation [1]. Numerous factors are involved in plant response to fertilizers under saline, sodic, or waterlogged conditions so a suitable fertilizer should be used for this purpose. Efficiencies of fertilizers applied to salt–affected soils are lower than when applied to non-saline soils. A decrease in the ability of the plants to absorb K or NH_4 usually takes place in saline soils containing excess Na, Mg, or Ca [2]. Also, P absorption may be decreased in presence of excess Cl or SO_4. Application of K, NH_4 or P fertilizers not only corrects their deficiencies but also decreases the adverse effects of Na, Cl, or SO_4 on the plants.

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As ultrasonic speed along with density provides wealth of information regarding nature and strength of molecular interactions [3]. Utilizing density and ultrasonic speed data numerous acoustical parameters such as acoustic impedance, intermolecular free length, adiabatic compressibility, change in adiabatic compressibility, internal pressure, Pseudo-Grunseien Parameter and relative association are computed which delivers evidence about kind of interactions prevailing in the liquid mixtures.

In view of the above fact, an attempt was made to fulfill the mentioned conditions and to carry out such studies on fertilizer: Potassium Sulfate of different concentration change by weight fraction *viz*. 0.02-0.2 mol.kg^{-1} in different solvents like water and aqueous 0.5 mol.kg^{-1} salt solutions namely: Sodium Chloride and Magnesium Chloride at a constant temperature 293.15 K with the help of Ultrasonic (NDT) technique [4]. Such data are expected to throw light on the intermolecular interaction (solute-solute, solute-solvent and ion-solvent) present between molecules of fertilizer-water-saline salts in view to find a way to increase the crop production by counteracting the problem of soil salinity.

MATERIALS AND METHODS

Materials

AR grade chemicals (mass fraction purity 99.9%) as Potassium Sulfate (CAS no: 7778-80-5), Sodium Chloride (CAS no.: 7647-14-5) and Magnesium Chloride (CAS no: 7786-30-3), were supplied from Himedia Lab. Pvt. Ltd., Mumbai. Entire chemicals were used without any further purification. The concentrations (0.02-0.2 mol.kg^{-1}) of Ammonium Sulfate in water and in 0.5 M aqueous saline salt solutions were changed by weight fraction. To maintain the accuracy of experimental data all the glassware's were washed with acetone as well as with double distilled water and well dried before use (Figure 1).

Figure 1. Molecular structure of potassium sulfate.

Method

A digital ultrasonic velocity interferometer was used for measuring the speed of sound passing through experimental liquids, operating at frequency 2 MHz supplied from Vi Microsystems Pvt. Ltd., Chennai (Model VCT:71) with an overall accuracy 0.0001 m/s. The source of ultrasonic waves was a quartz crystal excited by a radio frequency oscillator. The cell was filled with the desired experimental solutions and water at constant temperature was circulated in the outer jacket of the cell. The cell was allowed to equilibrate for 30min. prior to making the measurements. The densities of the solutions were determined accurately and properly with the help of 10ml specific gravity density bottle having accuracy of ± 2*10^{-2} kg/m^3 and digital electronic balance (Contech CA-34) having accuracy ± 0.0001 gm for the measurement of weight. An average of triple measurements were taken into account for better accuracy. The experimental temperature was maintained constant by circulating water with the help of an automatic thermostatic water bath supplied by Lab-Hosp. Company Mumbai having an accuracy of ± 1 K temperature.

Table 1. Density and ultrasonic velocity of water at 293.15 K temperature.

Current work data		Literature data	
U. Vel. (U)	Density (ρ)	U. Vel. (U)	Density (ρ)
m/sec	kg/m^3	m/sec	kg/m^3
1481.496	998.2	1482.940	0998.202

Defining relations

For the derivation of several acoustical and physico-chemical parameters the following standard defining relations reported in the literature are used:

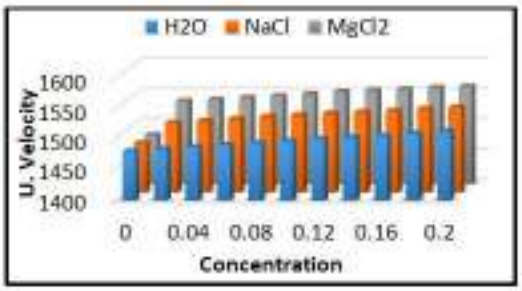
- Adiabatic Compressibility (β)=$1/(U^2\rho)$
- Change in Adiabatic Compressibility ($\Delta\beta$)={β-β_0}
  Here, β is the adiabatic compressibility of solute and β_0 is the adiabatic compressibility of solution.
- Intermolecular Free Length (L_f) = $K(\beta)^{1/2}$
  Where, K be the Jacobson temperature dependent constant.
- Acoustic Impedance (Z)=U_ρ
- Pseudo-Grunseien Parameter (r) = {(γ-1)/(αT)}
  Here, γ be the specific heat ratio and α is the thermal expansion coefficient.
- Internal Pressure (πi) = {(Tα)/kT}
  Here, T, α and k_T are the abbreviations used for temperature, isobaric thermal expansion coefficient and isothermal compressibility.
- Relative Association (R_A) = {(ρ/ρ_0) (U_0/U)$^{1/3}$}
  Here, ρ and ρ_0 is the density of the solute and solution at any temperature. Also, U and U_0 be the ultrasonic velocity of the solute and solution at any temperature.

RESULTS AND DISCUSSION

Ultrasonic velocity

The measured value of ultrasonic velocity for pure water 293.15 K temperature and the observed data tabulated. Comparison of observed data with literature data reported for water indicated that our results are in assent with the literature data. The ultrasonic velocity (U) of fertilizer of varying concentrations (0.02-0.2 mol.kg^{-1}) in 0.5 M solution of both the saline salts solvents: NaCl and $MgCl_2$ measured at 293.15 K temperature. The ultrasonic velocity versus concentration graph and it is observed that the value of ultrasonic velocity increases with increase in concentration of fertilizer. As concentration of liquid affects the propagation of ultrasonic wave through solution. The increase in sound speed is accredited due to the strong interaction between the fertilizer (Potassium Sulfate)-water and fertilizer (Potassium Sulfate)–aqueous saline salt solutions (Figure 2).

Figure 2. Ultrasonic velocity versus concentration at 293.15 K temperature.



Density

The measured density of pure water and the literature data of density at 293.15 K temperature have been tabulated. After Comparison of observed data with literature data reported for water indicated that our results are shows well agreement with the literature data [5]. The density of all the systems increases with rise in concentration. This indicates, there was improve in compactness of solvent by the addition of solute molecules. This indicates a good association between solute and solvent molecules [6]. The increase in density results increase in the molar volume and ultrasonic velocity, indicating the association in the components of the constituent molecules and confirms the structural rearrangement in the liquid solutions.

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Adiabatic compressibility

Physico-chemical properties of liquid can be understood by the adiabatic compressibility (β) parameter. In the present study it was found that the adiabatic compressibility values falls with increase in concentration of Potassium sulfate fertilizer [7]. The decreases values of adiabatic compressibility listed and indicate the strong association of fertilize and saline salts molecules. The compressibility of the solvent is higher than that of solution and decreases with increase in concentration of the solution [8]. Because, as water is polar solvent and when salts and fertilizer mixed, the well intermolecular interaction occurred, resulting in close packing of molecules (Table 2 and Figures 3, 4).

Table 2. The values of ultrasonic velocity, density, adiabatic compressibility, as a function of concentration of system.

Conc. (M) (mol/kg)	Ultrasonic velocity (m/sec)			Density (Kg/m³)			A compressibility 10^{-10} (m^2N^{-1})		
	H_2O	NaCl	$MgCl_2$	H_2O	NaCl	$MgCl_2$	H_2O	NaCl	$MgCl_2$
0	1481.49	1481.49	1481.49	998.2	998.2	998.2	4.56	4.56	4.56
0.02	1485.41	1515.04	1537.76	1004.92	1021.13	1044.31	4.51	4.27	4.05
0.04	1488.79	1517.91	1540.17	1007.38	1023.7	1046.91	4.48	4.24	4.03
0.06	1492.18	1521.37	1543.20	1010.05	1026.67	1049.41	4.45	4.21	4
0.08	1495.02	1525.43	1546.24	1012.71	1029.64	1053.12	4.42	4.17	3.97
0.1	1498.45	1528.34	1549.29	1015.22	1032.22	1054.85	4.39	4.15	3.95
0.12	1501.88	1530.67	1552.97	1017.67	1035	1057.62	4.36	4.12	3.92
0.14	1504.76	1532.43	1555.43	1020.31	1037.12	1060.88	4.33	4.11	3.9
0.16	1507.65	1534.78	1557.28	1022.47	1040.52	1062.24	4.3	4.08	3.88
0.18	1511.13	1538.32	1559.76	1025.40	1043.5	1065.61	4.27	4.05	3.86
0.2	1515.21	1540.69	1561.62	1028.01	1046.08	1068.27	4.24	4.03	3.84

Figure 3. Density versus concentration at 293.15 K temperature.

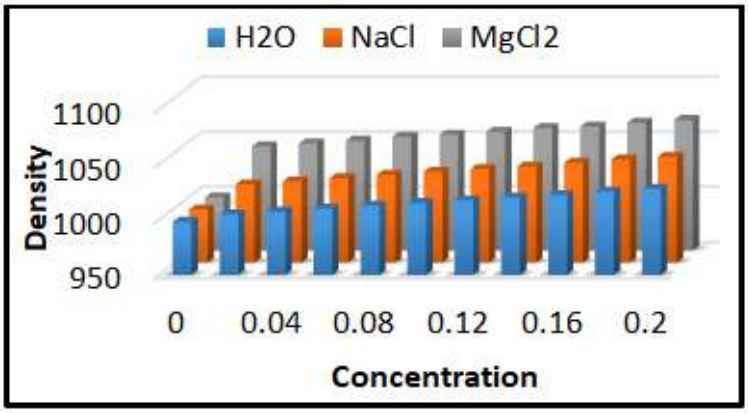

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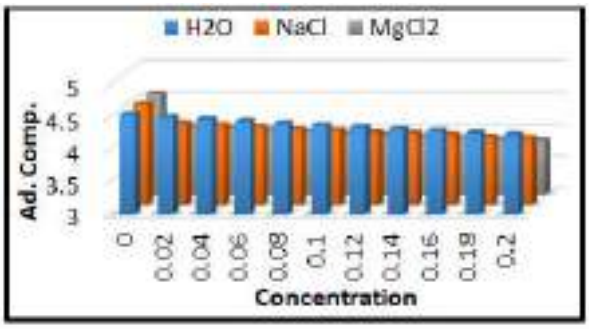
Figure 4. Adiabatic compressibility versus concentration at 293.15 K temperature.



Change in adiabatic compressibility

The change in adiabatic compressibility's was calculated with the help of adiabatic compressibility values for solute and solvent. It is found that the negative values of 'Δβ' are due to the solute-solvent interaction [9]. Such an increase in 'Δβ' with increase in concentration of solute (Potassium Sulfate) in water as well as in both the salt solutions may be attributed to an increase in the cohesive forces in solutions [10]. The negatively increase in change in adiabatic compressibility values with rise in concentration confirms the increase of bulk modulus [11]. This increase in bulk modulus indicates that the hydrogen bonding between the unlike components in the solution increases.

Intermolecular free length

Intermolecular free length is one of the important parameter that helps in determining the mobility and understanding the nature as well as strength of interaction between the solute and solvent [12]. The average distance between the surfaces of two head-to-head molecules, this is termed as the intermolecular free length. Variation of free length is set down [13]. It is observed that the values of intermolecular free length decreases with increase in concentration of Potassium Sulfate fertilizer in all the three solvents (Table 3 and Figure 5, 6).

Table 3. The values of change in adiabatic compressibility, intermolecular free length and acoustic impedance as a function of concentration of system (Potassium Sulfate+0.5 M aq. Solution of (NaCl/ $MgCl_2$)) at temperature.

Conc. (M) (mol/kg)	Change in adiabatic compressibility 10^{-11}			Intermolecular free length 10^{-11}			Acoustic impedance		
	(m^2N^{-1})			(m)			(kgm^2s^{-1})		
	H_2O	NaCl	$MgCl_2$	H_2O	NaCl	$MgCl_2$	H_2O	NaCl	$MgCl_2$
0	0	0	0	4.35	4.35	4.35	1478829	1478829	1478829
0.02	-0.5	-3	-5.1	4.33	4.21	4.1	1492729	1547059	1605904
0.04	-0.9	-3.2	-5.4	4.31	4.2	4.09	1499782	1553891	1612428
0.06	-1.2	-3.6	-5.6	4.3	4.18	4.08	1507184	1561950	1619458
0.08	-1.5	-3.9	-5.9	4.28	4.16	4.06	1514033	1570648	1628380
0.1	-1.8	-4.2	-6.1	4.27	4.15	4.05	1521256	1577585	1634275
0.12	-2.1	-4.4	-6.4	4.25	4.14	4.04	1528426	1584253	1642455
0.14	-2.4	-4.6	-6.7	4.24	4.13	4.02	1535327	1589320	1650130
0.16	-2.6	-4.8	-6.8	4.23	4.12	4.02	1541541	1596945	1654211
0.18	-2.9	-5.1	-7.1	4.21	4.1	4	1549517	1605241	1662097
0.2	-3.3	-5.4	-7.3	4.2	4.09	3.99	1557658	1611686	1668228

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This indicates that there exists a significant interaction between the fertilizer and water also fertilizer and saline salt solution [14]. Among all the three solutions (H_2O, NaCl and $MgCl_2$) intermolecular free length values are found low in magnesium chloride solution, specifying strong intermolecular interaction of fertilizer with $MgCl_2$. This gives a passage for water to uptake by the plants. The observed order of variation of intermolecular free length in all the three solvents is: $MgCl_2$<NaCl<H_2O.

Figure 5. Change in adiabatic compressibility versus concentration at 293.15 K temperature.

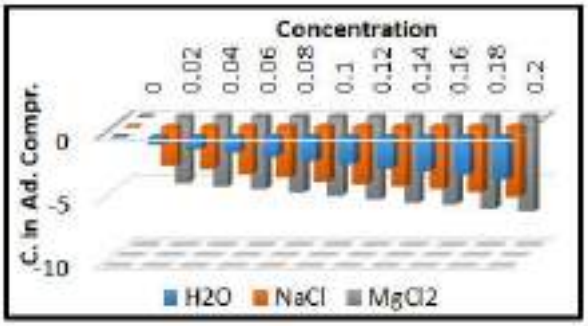
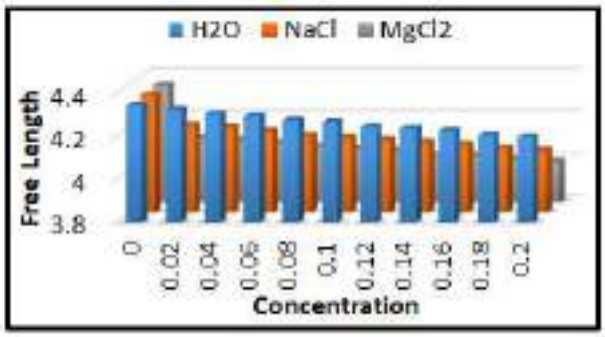


Figure 6. Intermolecular free length versus concentration at 293.15 K temperature.



Acoustic impedance

The values of acoustic impedance for fertilizer: Potassium Sulfate of varying concentrations *viz*. 0.02-0.2 mol.kg^{-1} in water and in 0.5 M mol.kg^{-1} aqueous salt solutions of NaCl and $MgCl_2$ were calculated with the help of speed of sound and density of experimental solutions and lay [15]. It was observed that the acoustic impedance (Z) values of Potassium Sulfate fertilizer increases with addition of fertilizer in water and also in both the saline salt solutions. The increase in acoustic impedance with the increase in concentration indicates the superior association among the solute and solvent through hydrogen bonding [16]. Thus increase in acoustic impedance indicates associative nature of solute and solvent and enhancement in molecular interaction with less resistance and more viscous force. The order of variation of acoustic impedance (Z) in water as well as in salt solution is: $MgCl_2$>NaCl>H_2O.

Psuedo-Gruensien parameter

The Pseudo-Grunseien parameter (r) measures the degree of molecular or ionic association. The calculated values of Pseudo-Grunseien parameter have been listed and a graph is plotted against the fertilizer concentration at a constant 293.15 K temperature shown. It was observed that the values of Pseudo-Grunseien parameter are negative and shows a decreasing trend of variation with the addition of fertilizer in the solvent [17]. The negative values of Pseudo-Grunseien parameter suggests the probable formation of intermolecular complex in the system and strong intermolecular interaction between the solute and solvent (Table 4 and Figures 7, 8).

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Table 4. The values Pseudo-Grunseien parameter, internal pressure and relative association of system.

Conc. (M) (mol/kg)	Pseudo-Grunseien parameter			Internal pressure 10^9			Relative association		
	-			(Nm^{-2})			$(Nm^{-2})^{1/2}$		
	H_2O	NaCl	$MgCl_2$	H_2O	NaCl	$MgCl_2$	H_2O	NaCl	$MgCl_2$
0	-3.12742	-3.1274	-3.1274	5.06	5.06	5.06	1	1	1
0.02	-3.13388	-3.1714	-3.2034	5.14	5.44	5.76	1.00584	1.01536	1.03327
0.04	-3.13837	-3.1754	-3.2068	5.17	5.48	5.8	1.00754	1.01727	1.03500
0.06	-3.14295	-3.1801	-3.2109	5.21	5.52	5.84	1.00944	1.01945	1.0371
0.08	-3.1469	-3.1854	-3.2153	5.25	5.57	5.89	1.01146	1.02149	1.04008
0.1	-3.15145	-3.1894	-3.2191	5.29	5.61	5.92	1.0132	1.02340	1.04110
0.12	-3.15599	-3.1928	-3.2240	5.33	5.64	5.97	1.01487	1.02564	1.04301
0.14	-3.15997	-3.1954	-3.2276	5.37	5.67	6.01	1.01685	1.02734	1.04567
0.16	-3.16381	-3.1990	-3.2300	5.4	5.71	6.04	1.01836	1.03017	1.04660
0.18	-3.16853	-3.2037	-3.2337	5.45	5.76	6.08	1.02048	1.03234	1.04936
0.2	-3.17381	-3.2071	-3.2366	5.49	5.8	6.11	1.02216	1.03436	1.05156

Figure 7. Acoustic impedance versus concentration at 293.15 K temperature.

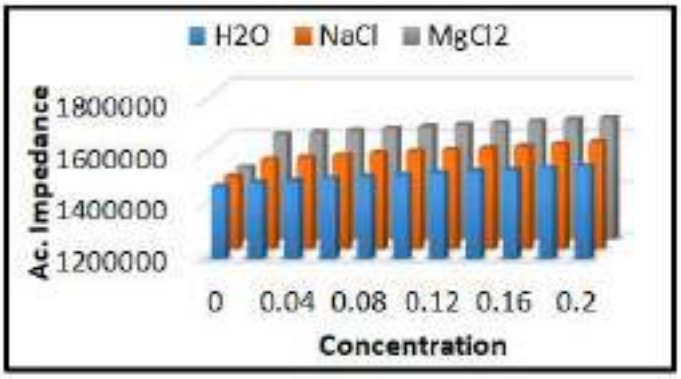
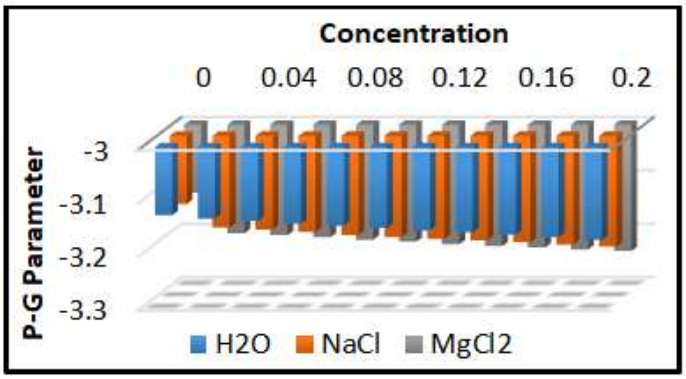


Figure 8. Psuedo-Gruensien parameter versus concentration at 293.15 K temperature.



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Internal pressure

Acoustical parameters have potential to illuminate the ilk and strength of the interaction taking place in solutions [18]. In the present work the internal pressure (πi) increases with increase in concentration of fertilizer: Potassium Sulfate in all the three solvents is shown. This increasing behavior of the internal pressure in all the three solutions indicates the more intermolecular interactions between the fertilizer and soil salt solutions as compared to fertilizer and water [19]. The order of variation found to be: $MgCl_2$>NaCl>H_2O.

Relative association

The trends of relative association of the system. The increase of 'RA' with concentrations is due to increase in solvation of ions of solute and there exist intermolecular interactions (Figures 9 and 10).

Figure 9. Internal pressure versus concentration at 293.15 K temperature.

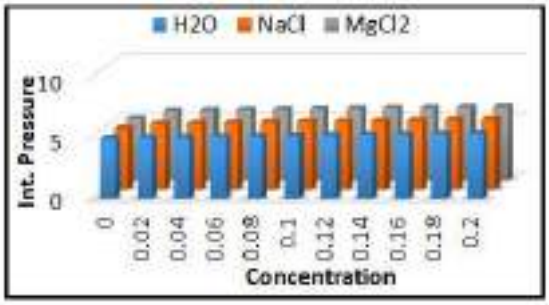
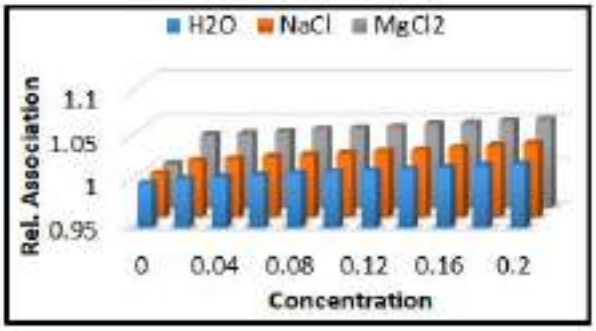


Figure 10. Relative association versus concentration at 293.15 K temperature.



CONCLUSION

The various acoustical and physico-chemical parameters determined by using the measured values of density and speed of sound for PS fertilizer in all the solvents (H_2O, NaCl and $MgCl_2$) at 293.15 K temperature. All parameters confirm that the intermolecular interactions are present between the molecules of Potassium Sulfate fertilizer and solvents. The impact of concentration on these parameters were observed and explained with the help of physico-chemical study. In the light of obtained results and discussions, it was concluded that: the variation in concentration, nature of solute, nature of solvent and its position plays a major role in determining the kind of interactions occurring in the solution. Also it is concluded that H-bonding is strong at higher concentration. Moreover, all the parameters exhibits the maximum values for Potassium Sulfate fertilizer mixed in $MgCl_2$ solution, coz it has weak interaction with water molecules among the electrolyte solution and ergo can bind with saline salt molecules more effectively. The overall intermolecular interaction order of variation for Potassium Sulfate fertilizer in different solvents are found to be: $MgCl_2$>NaCl>H_2O.

FUTURE SCOPE

This kind of information can be useful in improving fertilizer activity according to soil salinity treatment and in other application by changing the ilk of its molecule. Physico-chemical studies could also be used successfully and well supported in this regard. In view of the above interpretation, this kind of study has a bright future scope in the field of agriculture in order to feed the peoples and increase the economy of farmers with the help of proper fertilizer selection for specific kind of soil.

CONFLICTS OF INTEREST

The authors declare no conflict of interest in the present research work.

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Ultrasonics : A Future Scope For Human Being

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Absract:

Ultrasonic testing techniques are widely accepted for quality control and materials testing in many industries. Ultrasonic technique provides the interaction of high frequency sound wave with matter ensuing to generation of information about physical and chemical properties. Ultrasonic testing is essential in constructing and operating modern engineering technology. Non-destructive testing (NDT) method is ultrasonic technique use for the characterization of matter in a wide sense. Safety requirements and the costs of component failure are powerful incentives to apply ultrasonics more widely and to improve its reliability and efficiency. Ultrasonics is needed to detect planar defects and to measure the defect dimensions which fracture mechanics shows to be structurally significant. The future of ultrasonics will be linked closely with the growing use of fracture mechanics to assess defects. Some techniques look like to be the case of pertinent sectors such as environment, food industry, pharmaceuticals, machinery mining, chemicals manufacture etc.

The aim of this study is the investigation of the capability of ultrasonic technique in assessment of the wide scope in modern era. Thus; Ultrasonic Technique is effective quality control tool which can be used for different characterization of materials.

Keywords: Ultrasonic, Ultrasonic testing, Advantages of ultrasonic, New trends, Utility, Future.

INTRADUCTION

Ultrasonics means the vibrations of frequencies greater than the upper limit of the audible range for humans i.e. greater than about 20 kilohertz. The term *sonic* is applied to ultrasound waves of very high amplitudes. Modern ultrasonic devices can produce frequencies in a high range of several gigahertz by transforming alternating electric current into mechanical vibrations and researchers have produced ultrasound with frequencies up to about 10 GHz. Ultrasonics was very useful and powerful tool for research areas in the field of physics. Variety of methods to evaluate materials or components and non-destructive methods are an important category of them with many applications. The field of Non-Destructive Evaluation (NDE) or Non-Destructive Testing (NDT) involves the identification and characterization of damages on the surface and interior of materials without changing their morphology. In other words, NDT refers to the evaluation and inspection process of materials or components for characterization or finding defects and flaws in comparison with some standards without altering the original attributes or harming the object being tested. Ultrasound was being using for the study of inspection and characterization of different materials. Ultrasonic technique can not applied only to inspect bulk and surface flaws but also finding the information on material microstructures. Ultrasonic technique provides the interaction of high frequency sound wave with matter resulting to generation of information about physico-chemical properties. Ultrasound is a very useful and flexible modality in medical imaging that uses high-frequency sound waves to characterize tissue.

Ultrasonic technology developed new techniques to represent a clean and effective tool to refine classical existing techniques. Many investigations carried out the wide application of ultrasonic waves in different areas like medicines, oceanography, aerospace, navy and material science. Nowadays Ultrasonics became a multidimensional area of study due to its different industrial and medical field.

PRESENT STATUS OF ULTRASONICS

Ultrasonic technology has increased in different applications of medical & sciences and work ongoing in these fields. Industrial competitiveness of ultrasonic based technologies are non-destructive testing and better known in its more common applications for flaw detection, thickness gauging and acoustic imaging. The advantages expected from using ultrasonic for separation processes include higher liquid removal rate, higher dry matter content in product, lower processing temperature, maintenance of product integrity, more selective product, and higher product recovery. In general, the passing of ultrasonic waves using suitable high intensity through air or liquid is accomplished by primary phenomena such as cavitation, radiation pressure, and secondary phenomena of a physicochemical nature such as dispersion, coagulation, and change in liquid properties. Ultrasonic testing conducted in three modes, transmission, reflection, and back scattering Each of which uses a range of transducers, coupling agents, and frequencies. Pulse echo ultrasonic method can readily locate defects in homogeneous materials. Frequencies of 20 KHz to 100 MHz utilize for ultrasonic testing but effective work performed between 500 KHz to 20 MHz frequency range. For the system of laser-based maintenance, laser ultrasonic testing includes a technology the same sense of non-destructive testing technique. It is a technique that uses laser beam to generate and detect ultrasonic waves in substances under the surface of the materials. Present applications for laser ultrasonics is water inspection, wall thickness measurement of seamless steel tubes and inspection of composite components in aircraft. Advance ultrasonic technology continues to offer advances in the medical field. In a present day ultrasound imaging is one of the most valuable tools for development of medical ultrasound. It has been executed in both diagnostic and therapeutic course of actions. In ultrasonic imaging; elastography, super resolution imaging, ultrasound contrast agent imaging and 2D array transducer are remarkable. Due to the improvement of this image-quality, ultrasound is now used to procedures by magnetic resonance imaging (MRI) and computed tomography (CT). Ultrasonic biomicroscopy (UBM) is one of the most significant advances of present development of ultrasound. A new progress in ultrasound technology involves three-dimensional ultrasound that formats the data of sound wave into three-dimensional (3D). A study of Doppler ultrasound can be a part of ultrasound examination it is known as Color Doppler Ultrasonography, which is a unique ultrasound technique that permits the doctor to see and analyze blood flow through arteries and veins in various body organs. Present, ultrasound technology is being developed very rapidly for the use of surgery. With the help of transducer, ultrasonic surgical instruments (USTs) transforms an ultrasonic signal into mechanical vibration, a waveguide then propagates the vibration and amplifies. Ultrasonic surgical instruments are extremely helpful in various medical procedures. This normally decreases the average length of surgery.

ULTRASONIC UTILITY FOR HUMAN BEING

Ultrasonics is wider so it improves its reliability and efficiency that's the way Ultrasound is a versatile technique that has many advantages for human beings. Ultrasonics is briefly analyzed by the principle of the generation, propagation and detection. Ultrasonics is effective tool for many areas likes in flaw detection and navigation processes – for control system in industrial purpose; in medical diagnosis – for the treatment of certain diseases; for cleaning – in the operation of cavitation effect; for chemical effects – in alloying certain metals and various working methods. Even in nature, bats and porpoises use this particular technique for the location of prey and obstacles .Important scientific applications of ultrasonics are evolving for new results in physical, chemical and biological processes. The most useful and important applications are briefly discussed below

1. *Cleaning* - Ultrasonic cleaning method is one of the effective ways to removal of dirt, grease, rust and paint from metal ceramics glass and crystal surface of parts which are used in the electronics, aircraft, automotive and precision instruments industries. In objects with parts that are difficult to reach, for example, spiral tubes and electronic components, the process of ultrasonic cleaning is used.

Here, the object is dipped in a solution of suitable cleaning material and ultrasonic waves are passed into it. As a result of this, high-frequency waves are generated that cause the dirt and grease to detach from the surface.

2. *Detection of cracks* - Ultrasound is used to detect cracks in the metallic components that are used in the construction of high rise structures such as buildings and bridges. They generate and display an ultrasonic waveform that is interpreted and analysis by the software, to locate and categorize flaws in test pieces. High-frequency sound waves reflect from flaws in predictable ways, producing distinctive echo patterns that can be displayed and recorded by instruments. It identifies specific echo patterns corresponding to the echo response from good parts and from representative flaws. The echo pattern from a test piece may then be compared to the patterns from these calibration standards to determine its condition.

3. *Ultrasonic Welding* - Ultrasonic sound waves are also used for the purpose of welding plastic. High frequency ultrasonic vibrations are used to weld couple of parts of the plastic. However, this welding process is very well programmed and has time and frequency already programmed into the welding machine and computer carry out each and every step of the welding process. Ultrasonic welding method is to be used the thermoplastics; it is used high frequency ultrasonic vibrations to create friction the materials, which are being held together under the pressure to generate the solid-state weld. This is one of the fastest welding method is used today.

4. *Non-destructive testing* – Non-destructive testing has been utilized to examine both their surface and interiors. Ultrasonic testing uses pulse-echo technique to detect the imperfections in substances and to measure the properties. In this process the sound wave propagates through solid materials have been examined to detect flaws, cracks and other internal discontinuity in metals. Normally, for NDT purpose the range of frequency is used 1 MHz to 15 MHz.

5. *Electronics* - Ultrasonics is extensively used in the electronics industries, Ultrasonic technology is used to cleaning, testing and soldering of electronic component. The surface acoustic wave (SAW) device is an electronic component, which is using ultrasonic frequencies indifferent medium such as cellular phone, machinery and high performance TV receiver etc. electronics are everywhere.

6. *Agriculture* – In agriculture, ultrasonic method has been applied to germination of seeds, growth rates and yields of crops and use in destroying viruses, bacteria and fungi. It can also be used to improve the quality of homogenized and is used for pest control and for killing the germs and insects.

7. *Oceanography* – Ultrasonic devices are generally used in oceanography application to investigate the ocean and tracking of submarines.

8. *Sonochemistry* – Sonochemistry is the process, which is used to explain a subject that uses sound energy to affect chemical changes. In the sonochemistry, very high intensity ultrasound can be used to cause chemical and physical changes in substances.

9. *SONAR* – SONAR, Sound Navigation, and Ranging is a technique in which sound waves are used to navigate, detect and communicate under the surface of the water.

10. *Material Science* – Ultrasonic waves can be practiced for multiple purposes; one of them would be synthesis of material science for determination of such properties of the solids as compressibility, elasticity and specific heat ratios. Ultrasonics has also been used for the determination of fundamental microstructure characteristic such as grain, size and texture.

11. *Medical Ultrasonics* – Ultrasound finds has so many useful applications in medical field. Medical technology has made a great contribution in imaging continues to propose amazing advances in various specialties such as cardiology, obstetrics and other internal medicines In the process of electrocardiography, the ultrasonic waves are used to form an image of the heart using reflection and detection of these waves from various parts. Ultrasonography: Medical ultrasound is a diagnostic imaging technique based on it. It is used for the imaging of internal body structures such as muscles, joints and internal organs. Ultrasonic images are known as sonograms. Lithotripsy: Ultrasonic waves

are used to break stones in the kidney. High energy sound waves are passed through the body without injuring it and break the stone into small pieces. These small pieces move through the urinary tract and out of the body more easily than a large stone.

FUTURE SCOPE OF ULTRASONICS

The future scope of this technology is very auspicious in the field of NDT technique. This non-destructive testing has played an essential role in the field of defense, military and nuclear power industries. Non-destructive testing technique includes visual inspection testing, eddy current testing, ultrasonic testing, liquid penetrate testing, magnetic particle testing and radiography. NDT technique are increasingly utilized by varied industries such as defense, aerospace, nuclear power, oil and gas, automotive and construction among others. NDT testing leads to aging infrastructure, from roads to buildings and aircraft, present a new set of measurement and monitoring. Advanced simulation tools that are designed for inspect ability and their integration into quantitative strategies for life management will contribute to increase the number and types of engineering applications of NDE. In the area of NDE, this trend will drive the emphasis on standards, enhanced educational offerings and simulations that can be communicated electronically. This technology has improved significantly and continually over this time and remains in use due to its numerous advantages.

1) Speed 2) Ease of Use 3) Depth 4) Accuracy and Sensitivity 5) Portability 6) Imaging Power 7) Versatility 8) Software 9) Durability 10) High-Resolution Touch screen 11) Safe and Clean

Ultrasonic sensor market survey major consideration after performing numerous different sensible and extensive analyses on ultrasonic sensor industry. Looking to the future, the primary purpose of contact ultrasonic sensors report is to discriminate, explicate and forecast the global market based on various aspects such as service, application, solution, method, region and vertical. Ultrasound market is forecast to continue to grow relatively strongly in the coming years, with the following trends driving growth.

Trend 1- New Users of Ultrasound, Trend 2- New Uses of Ultrasound, Trend 3- Emerging Markets, Trend 4- Handheld Ultrasound, Trend 5-Artificial intelligence.

Innovations and research have been increasing in non-thermal technologies, particularly ultrasonication, for multi-functionalities in food processing. There are several areas of food technology such as crystallization, freezing, bleaching, degassing, extraction, drying, filtration, emulsification, sterilization, cutting, etc. The future possibility and the need for studying the ocean on a global scale also provide a major impetus for new partnerships in oceanography. Some important technologies namely high frequency radars, sea glinders, drifters, underwater hydrophone, sonar these are used to study and understand ocean around the world. commercial use of power ultrasound in industries such as pharmaceutical, petrochemistry, petroleum, minerals, plastics, water and waste effluent, acoustic microscopy, piezoelectric sensor, cosmetics, civil engineering etc. There will be broad variety techniques of possible applications for the use of high power ultrasound in all industries. The use of ultrasound for a cleaning industry is expected to promptly escalate in significance throughout the world. Ultrasonic cleaning uses ultrasound and an appropriate cleaning solvent to clean items and this industry is delineate it as a key technology for the future prospects. The widespread trends and future opportunities are also taken into medical ultrasound. The best known approaches in ultrasound imaging such as magnetic resonance imaging (MRI), Doppler ultrasonic imaging, computes tomography (CT), and others, of providing real-time imaging of anatomical structures .The global ultrasonic imaging market published the latest research report of medical imaging likely cardiology, urology, gynecology, and vascular clinical applications. There are several important technologies such as 2D imaging, 3D imaging, 4D imaging, Doppler imaging and others, which are used for medical imaging. Ultrasonic imaging is a fledged industry. Future trends that have a direct impact on the dynamics of the ultrasonic imaging industry incorporate technological

modernization and advancement, diagnostic Ultrasound in the field of guided therapy and surgery and commercial application of hand-held devices

The application of high-intensity ultrasonic waves is based on the potential effects of power ultrasound mainly including mechanical and thermal effects in a medium and cavitation in liquids. These special effects of power ultrasound can be employed to produce or to enhance a wide range of processes that largely depend on the specific irradiated medium, i.e., solid medium, liquid medium and gas medium. There has been a renewed interest in the industrial applications of power ultrasound including dehydrating, welding, de-icing and wire bonding in solids, and chemical reactions, atomization, cleaning, extraction, oil recovery and heat transfer enhancement in liquids, as well as drying, fine particle removal and defoaming in gas. Overall, the power ultrasound offers considerable potential for green and sustainable chemical processing. Ultrasonic heat transfer enhancement is a well-known and highly effective approach of heat transfer enhancement and can be potentially applied to various industrial fields.

CONCLUSION

This paper highlights that ultrasonics technology gives a new set of opportunities in different areas such as industry, medicine, aerospace, material science, food processing, pharmaceutical, microbiology, minerals, agriculture, chemical, biotechnology, underwater application, optical data processing, engineering, forensic science, etc .The scope of modern ultrasonics industries will produce good opportunity to create new possibilities in ultrasonic invention in the field of material science. The recent states and future trends of ultrasonics extend an unlimited area of research and development activity and it opens up great opportunities for their applications.

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Exploration of Thermo-acoustical Conduct of Dichlofenac sodium Drug in Butanol at Different Temperature

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Abstract:
The approach of this study to estimate the various physico-chemical mechanism of liquid drug system with respect to temperature and the outcome indicates the structural sense and interactions in the drug mixture. Physico-chemical examinations play a vital role to understand the nature and strength of molecular aggregation that exist in binary liquid drug system and their sensitivities to variations in composition and the molecular structure of pure components. The drug-solvent molecular interactions play an important role in the understanding of drug action. In the present investigation we tried to study of various molecular interactions in alcohol solution of dichlofenac sodium by measuring ultrasonic velocity, density, viscosity and thermodynamic parameters at 2 MHz at different temperature with different concentrations.
These parameters have been thoroughly analysed and eventually interpreted at the possible molecular interactions such as structure making and structure breaking effect and also solute-solvent, ionic interaction, H-bonding effect in the alcoholic diclofenac sodium drug solution.

Keywords: Ultrasonic velocity, density and Acoustical parameters, Dichlofenac sodium, Butanol

I) Introduction :
Viscometric, Refractrometric and Interferometric measurement methods are very useful to sort out suitable interactions in the drug solution. Drug activity and drug effect can be explained by knowing suitable types of interactions [1-3]. Drug action, although complex result from various kinds of physico-chemical interactions, e.g. Ion-dipole, ionic or covalent, hydrogen bonding, charge transfer interactions, hydrophilic interactions etc.[4,5]. Formokinetic processes involve transport of drug across biological membranes, which can be understood by transport property measurements such as ultrasonic velocity, viscosity, thermal conductivity and diffusion. Diclofenac sodium is a nonsteroidal anti-inflammatory drug (NSAID) with analgesic and antipyretic properties. It has been found to relieve pain, reduce fever, swelling and tenderness, and increase mobility in patients with rheumatic disorders. Diclofenac sodium is rapidly and almost completely absorbed and distributed to blood, liver, and kidney. When drug is absorbed and transmitted in blood; the drug metabolism starts and at last there occurs excretion of bye product, if formed. All systems in the body directly or indirectly take part in this process. Each step in the pharmacokinetics and pharmacodynamics depends on solute-solvent, solute-solute-solvent and solute-solvent solvent interactions [6-7]. The wide ultrasonic sense has been adequately employed in understanding the nature of molecular interactions in pure liquids and liquid mixtures. The ultrasonic characterizations are highly sensitive to molecular interactions and used to demonstrate qualitative nature and strength of molecular interaction in the drug solution [8]. The characterization of mixtures through their thermodynamic and transport properties is important from the fundamental viewpoint of understand their mixing behavior [9-13]. A thorough knowledge of transport properties of non-aqueous solutions is essential in many chemical and industrial applications [14]. Alcohols serve as simple examples of biological and industrially important amphiphilic materials that exist in the liquid state which may be due to hydrogen bonding of their O–H group. The dipolar association of alcohols decreases when they are mixed with aromatic hydrocarbons due to some specific intermolecular interactions between the alcohol and an aromatic hydrocarbon [15-17].
The present paper deals with the measurement of density, viscosity, speed of sound, internal pressure, surface tension etc.in the liquid mixture of diclofenac sodium and butanol at different temperatures. The investigation of physicochemical activities of drug can be the great attention from academic as well as physiological intellect

Ultrasonic technique investigation is to study molecular interaction, drug absorption, transmission activity of alcoholic drug solution [18-20].

II) Materials and Methods:

The Butanol alcohol and analgesic Diclofenac sodium drug were used AR grade (E-Merck chemicals, Germany) with pure form. The purity of chemicals has been confirmed out by comparing the ultrasonic data with standard literature value [21]. The observation of ultrasonic velocity of the solution by using ultrasonic interferometer supplied by Vi-Micro system, Chennai (Model VCT: 71) having frequency at 2 MHz with an accuracy of 0.0001 m/s. The densities are found out using 10 ml specific gravity bottle. Specific gravity bottle having accuracy of ± 2 $X10^{-2}$ kg/m^3.Automatic temperature controller water bath supplied by Lab-Hosp Company Mumbai having an accuracy ±1K temperature. Viscosities were calculated at particular temperature by using Oswald's viscometer; the calibration of viscometer by using doubled distilled water with literature data. The time rate of doubled distilled water and experimental mixture are considered with digital stop clock having accuracy of 0.01 sec (Model: RACER- 10W).Weights were measured with an electronic digital balance (Contech CA-34) having accuracy 0.0001gm. Such a set up make use of to determine the ultrasonic and thermo-acoustic evaluation in butanol and tramadol at temperature T=278.15K-293.15K at various molar concentration.

III) Ultrasonic and thermo-acoustic parameters are formulizing as follows:

Adiabatic Compressibility $(\beta) = 1 / U^2\rho$ ..... (1)

Specific Acoustic Impedance $(Z) = U\rho$ ..... (2)

Intermolecular Free Length $(L_f) = K_T \beta^{1/2}$ ..... (3)

Relaxation Time $(\tau) = (4/3)^*\beta^*\eta$ ..... (4)

Relative association $(Ra) = (\rho/\rho_0)(U_0/U)^{1/3}$ ..... (5)

Classical Absorption $(\alpha/f^2) = (8\pi^2\eta)/(3U\rho)$ ..... (6)

Internal Pressure $(P) = bRT(K\eta/U)^{1/2}x(\rho^{2/3}/M^{7/6}eff)$ (7)

Free Volume $(V_f) = (M_{eff} U/\eta K)^{3/2}$ .....(8)

Molar volume $(Vm) = Meff/\rho$ ..... (9)

Molar Sound Velocity or Rao Constant $(R) = Meff/\rho (U)^{1/3}$ (10)

Molar compressibility or Wada constant $(W) = V\beta^{-1/7}$ ..... (11)

Isothermal Compressibility $(\beta i) = \gamma\beta$ ..... (12)

Surface Tension $(\sigma) = (6.3 \times 10^{-4})\rho U^{3/2}$ ..... (13)

IV) Data interpretation by graphical tactic as follows:

Following figures are of thermo-acoustic parameters V/S molar concentration

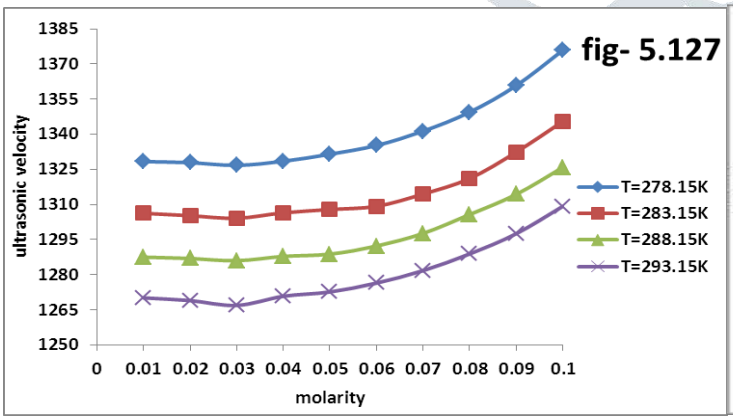

Fig.1 Ultrasonic velocity

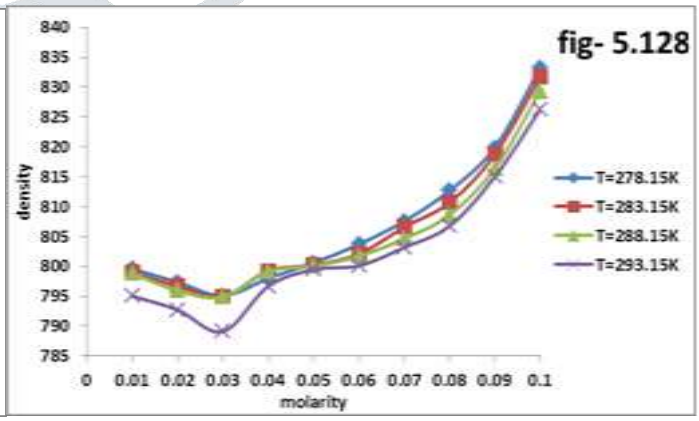

Fig.2 Density

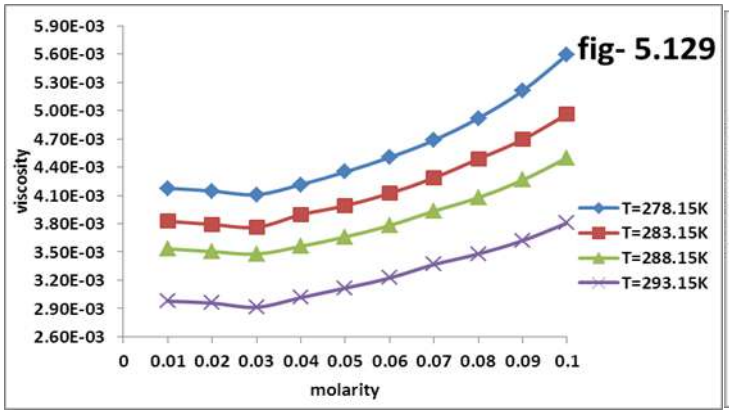

Fig.3 Viscosity

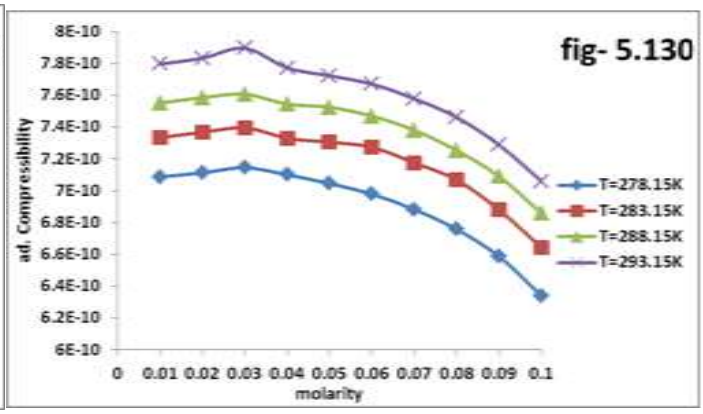

Fig.4 Ad. Compressibility

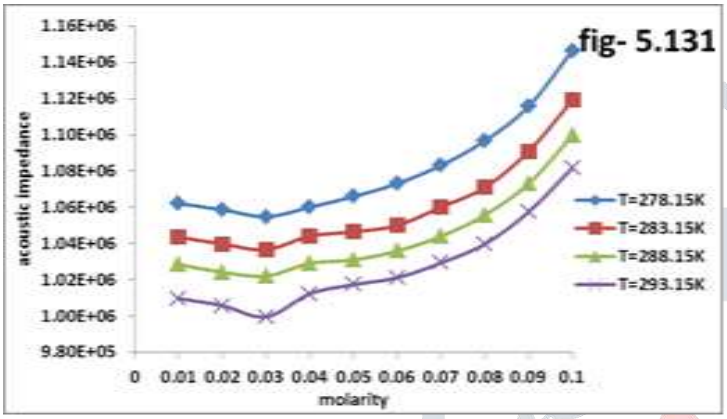

Fig.5 Acoustic Impedence

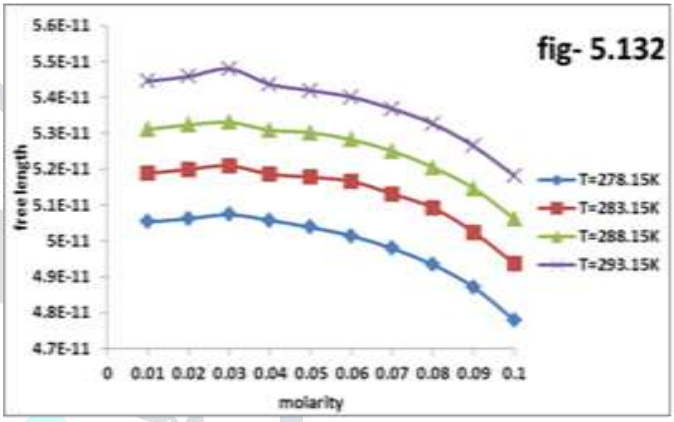

Fig.6 Free length

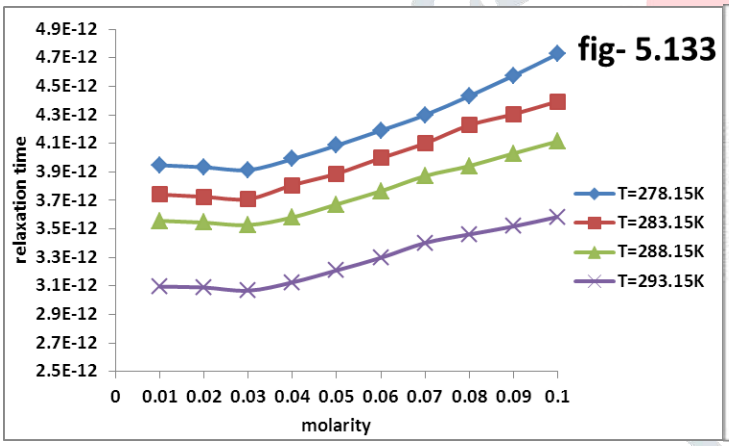

Fig.7 Relaxation Time

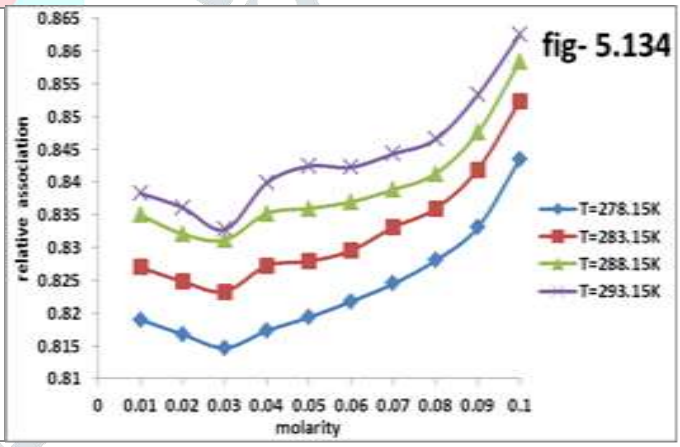

Fig.8 Relative Association

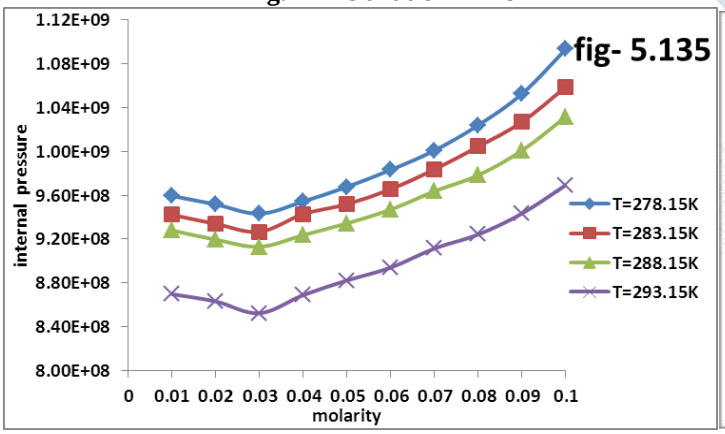

Fig.9 Internal Pressure

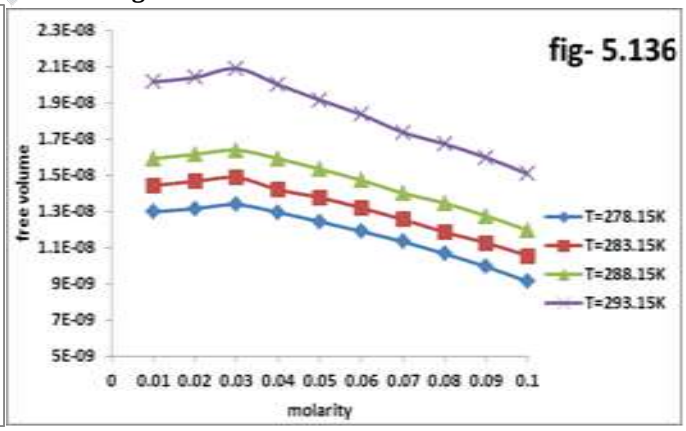

Fig.10 Free Volume

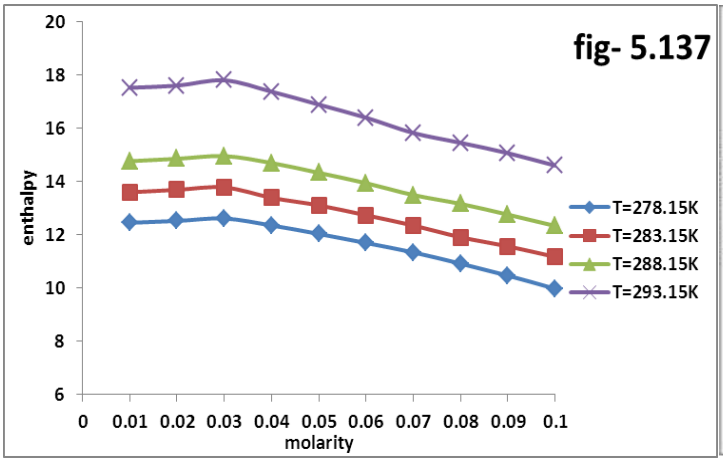

Fig.11 Enthalpy

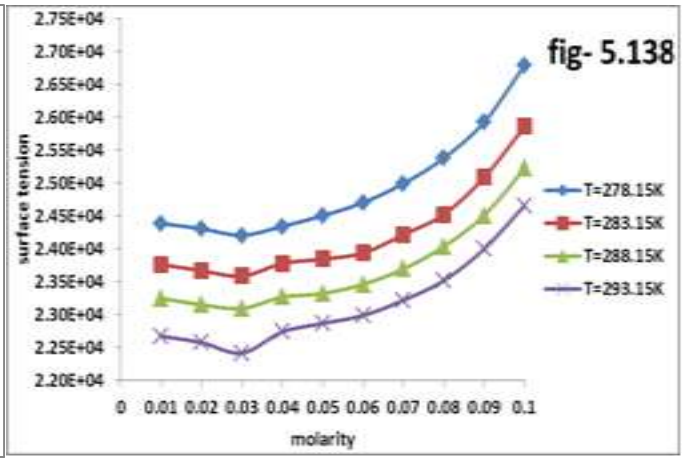

Fig.12 Surface Tension

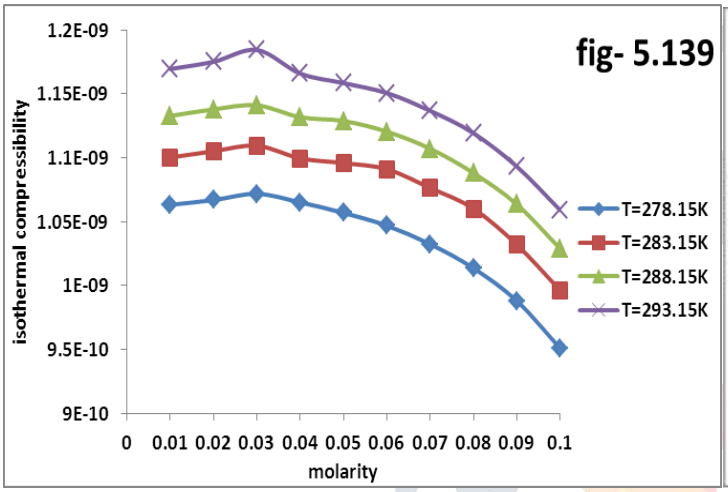

Fig.13 Isothermal Compressibility

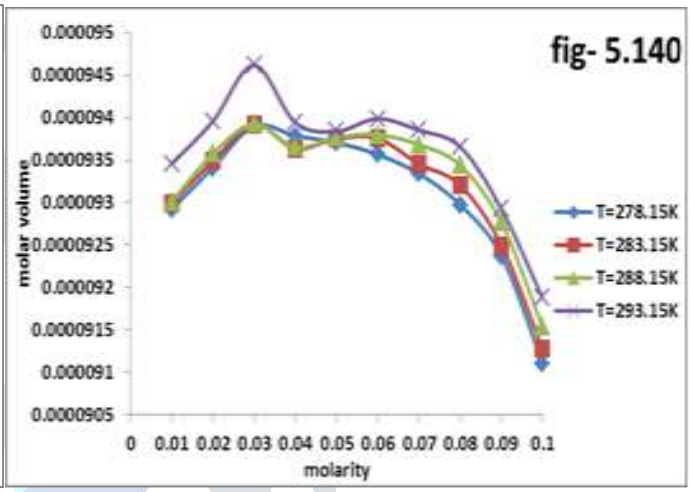

Fig.14 Molar Volume

V) Results and Discussion:

Resulting the experimental data and it has going to assess in terms of Ultrasonic and allied parameters with increase in concentration of Diclofenac sodium with Butanol at temperature T=278.15K-293.15K it has been revealed graphically. Nonlinear variation of ultrasonic velocity with increase in mole fraction of diclofenac sodium gives the dipole-dipole interaction or hydrogen bonded complex structure between unlike molecules which leads to increase in sound velocity and decrease in compressibility. At lower concentration, the number of hydrogen bonds formed may less and at higher concentration it may more because of solute-solute interactions and it forms a tightly bounded system. Adiabatic compressibility is a wide measure of intermolecular association or dissociation or repulsion. Free length decreases as the mole concentration increases; these considerable interactions between solute and solvent molecules. Ultrasonic velocity increases on decrease in free length and vice-versa. An abrupt decrease in molecular free length exhibits a tightly packing molecules or strong interaction in the liquid system. Increase of acoustic impedance with mole concentration may give the strength of inter molecular interaction so it reveal on the basis of the interaction between solute and solvent molecules. Relative association varies linearly which deals with the particular interaction exists in the mixture and relatively it is strong. Internal pressure suggests an outstanding assessment of the solution phenomenon and evaluating various properties of the liquid state. The variation in the internal energy of liquid mixtures, it seems to undergo a much quit isothermal change. So it is a measure of cohesive or binding forces between solute and solvent molecules. The internal pressure may provide information regarding the nature and strength of forces exist between the molecules. The variation of surface tension also supports the significant associative nature in the solution.

Loss of di-polar associating nature and difference in size and shape of the molecules, which provide to decrease in velocity and increase in compressibility. Increase in the compressibility value indicates the weakening of molecular interactions. The positive value of entropy change indicates the reaction must be spontaneous process of flipping of molecule over each other. Increase in temperature of drug solution increases the disorder of the molecules in the mixture; hence there is a reduction in molecular interaction and cohesive forces between the

molecules. Effect of temperature produced destruction in hydrogen bonding between the molecules and hence weakens the molecular interaction. As the result of this drug solution behaves dissociative nature.

VI) Conclusion:

The inference drawn of the alcoholic diclofenac sodium mixture, it has pointing out in this research, the strong intermolecular interaction that exposed the structure making property in the drug mixture. Solute-solvent interaction interpreted in terms of structural re-arrangement due to hydrogen bond interaction between constituent of liquid system. These kinds of sense of interactions directly suggest the wide utility of drugs in various applications.The results obtained from these studies can thus be helpful for pharmacological application of drugs.

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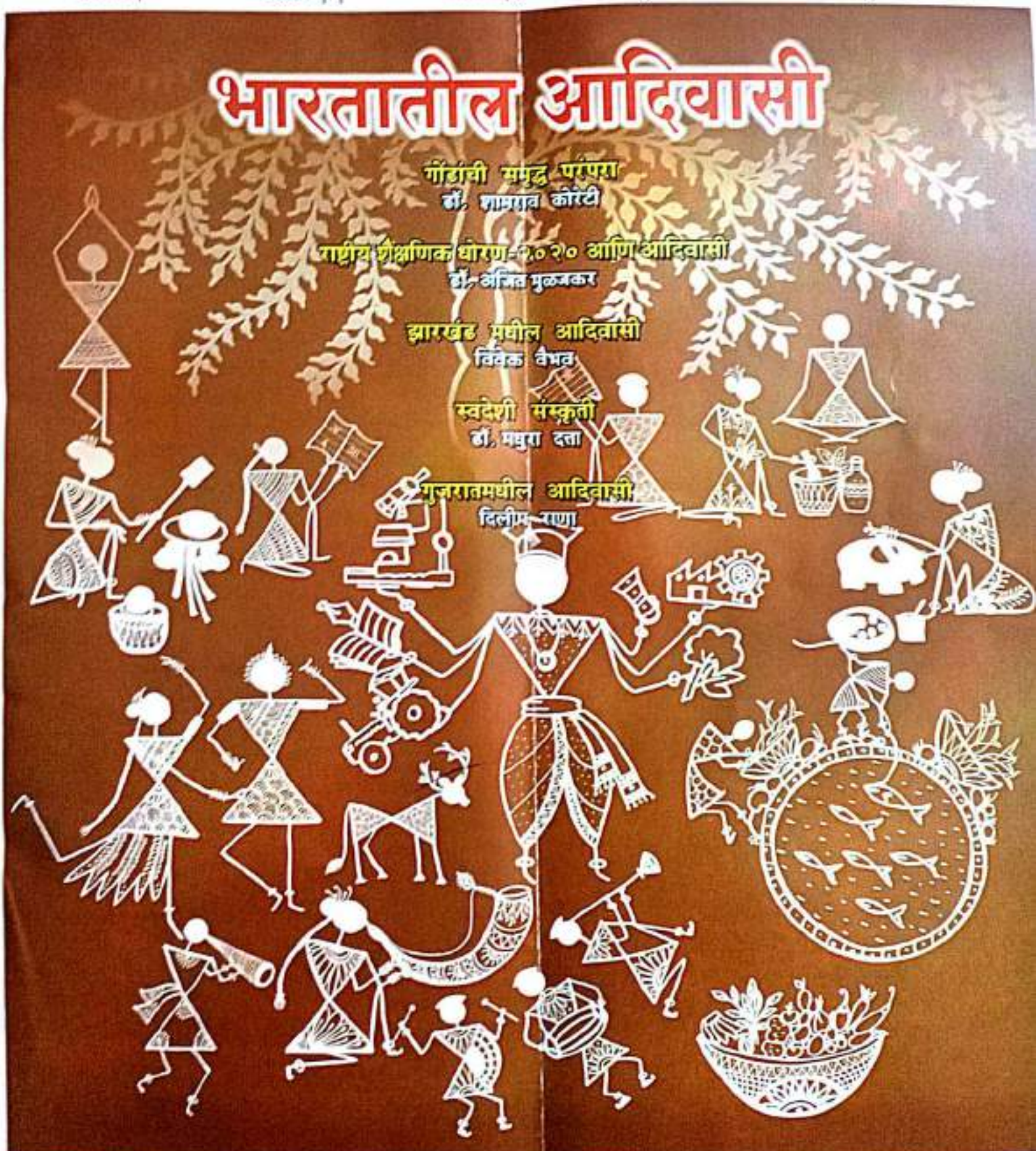
विकास समर्पित मासिक

योजना

वर्ष ४९ अंक ११ पाने ५४ जुलै २०२२ मूल्य २२ रु.

भारतातील आदिवासी



सामाजिक, आर्थिक दुष्टचक्रात अडकलेला आदिवासी

– प्रा.डॉ. रमेश ल. बिडवाई, डॉ. शरयू मनिष पोतनुरवार

देशातील तळागाळातील आदिवासी समाजाचा मागसलेपणा कमी होऊ शकला नाही. निकृष्ट राहणीमान, खालावलेली आर्थिक परिस्थिती, दारिद्रय, वेदना, व्यथा, छळ, अन्याय, अत्याचार, शोषण, भूक, अमानुषता, उपेक्षीत आणि वंचित जिणे, सामाजिक प्रतिष्ठेचा अभाव इत्यादींना बळी पडलेला आदिवासी समाज आहे. हे कोणीही अमान्य करू शकत नाही. अनेक कारणांचा तो संयुक्त प्रभावच म्हणावा लागेल. आदिवासींसाठी अनेक विकास योजना येतात आणि त्या कुठे जातात ? त्यांच्या पदरात किती पडत असतील ? त्याचे सखोल अध्ययन करण्याची आवश्यकता आहे.

भारत देशात अनेकविध वंश, जाती, धर्म आणि संस्कृतीची वस्ती आहे. विविध भाषिक आणि बोली भाषिक भारतात एकसंघ राहतात. विविधता हेच तर भारतीयांचे एक खास वैशिष्ट्य आहे. देशभरात सहा हजार पेक्षा अधिक जाती-जमातींचा समावेश आहे. भारताच्या एकूण जनसंख्येत २०११च्या जणगणनेनुसार एक चर्तुतौंश आदिवासी बांधवांचा समावेश आहे. १९५० मध्ये २१० तर २००१ मध्ये ५५० आदिवासी जाती-जमातींचा समावेश आढळतो (डॉ. प्रदीप आगलावे, आदिवासी साहित्याचे लेखक)

डॉ. प्रदीप आगलावे पुढे म्हणतात, मानव समाजातील आर्थिक क्रियांचा ऐतिहासिक दृष्टीकोनातून विचार केल्यास त्यात सातत्याने परिवर्तन घडून आलेले दिसते. आद्यपाषाण युग, नवपाषाण युग, विविध धातू युग इत्यादी. आदिवासी समाजाची अर्थव्यवस्था ही प्रामुख्याने पाषाण युगाप्रमाणे म्हणजे खाद्यसकंलन, शिकार, मासेमारी आणि पुढे पशुपालन, शेतीलागवड व छोटे-छोटे उद्योग अशी आहे. ग्रोस या अभ्यासकाने मानवी समाजाच्या आर्थिक विकास क्रियांच्या पाच प्रमुख अवस्थांचा उल्लेख केला आह.

आदिवासी

अर्थ आणि व्याख्या नागरी संस्कृती पासून दूर व अलिप्त राहिलेले मुळचे भारतातील रहिवासी म्हणजे आदिवासी (विश्वकोष)

डॉर्विनच्या उत्क्रांतीवादी सिध्दांतानुसार शारिरीक दृष्ट्या मानव जातीपर्यंत विकसित झालेले, उत्क्रांत पावलेले परंतु मनाने, बुध्दिमत्तेने इतर माणसाच्या तुलनेत अविकसित राहिलेले लोक म्हणजे आदिवासी असे म्हणता येईल. इ.स. १९६२ च्या शिलाँग येथील आदिवासी समितीच्या परिषदेने केलेली समर्पक व्याख्या - एका समान भाषाबोलीचा वापर करणाऱ्या एकाच पूर्वजापासून उत्पत्ती सांगणारा, एका विशिष्ट भूप्रदेशात वास्तव्य करणाऱ्या तंत्रशास्त्रीय ज्ञानाच्या दृष्टीकोनातून मागासलेला, अक्षर ओळखही नसलेल्या आणि रक्तसंबंधावर आधारित, सामाजिक तसेच राजकीय रितीरिवाजांचे अधिक प्रामाणिकपणे पालन करणाऱ्या एकजिनसी गटसमूहाला आदिवासी समाज म्हणतात.

आदिवासींचा वार्षिक इतिहास

इ.स. पूर्व १४०० मध्ये आर्यांनी (वैदिक ब्राम्हण) गुरे चारण्याच्या निमित्ताने खैबर खिंडीतून भारतात प्रवेश केला. आर्य हे मूळचे भारतीय नव्हते लोकमान्य टिळकांनी ब्राम्हणाचे उगमस्थान उत्तरध्रुव असल्याचे सांगितले आहे. क्षत्रिय, वैश्य आणि शुद्र या हिंदू बहुजनांचे मूळ आदिवासी जमातीत आहे. आदिवासी जमात ही स्वाभिमानी होती. त्यांनी छळवणूक करणाऱ्या ब्राम्हण वर्गापासून अलिप्त आणि दूर रानावनात, डोंगर दऱ्यात राहणे पसंत केले, परंतु ब्राम्हणांची शरणागती मात्र त्यांनी कदापीही स्वीकारली नाही. कंद-मुळे, रानमेवा खाऊन आणि नदी-नाल्यांचे पाणी पिऊन राहणे पसंत केल. आदिवासी हे मूळ रहिवासी, आद्य वसाहतकार आहेत. त्यांच्यात एक फार मोठा दोष होता, तो म्हणजे ते आत्मसंरक्षणास समर्थ नव्हते. त्यामुळे देशात पश्चिम, वायव्य व ईशान्य दिशाकडून (आलेल्या) घुसलेल्या द्रविड, इंडोआर्यन आणि मोंगल लोकापुढे त्यांना टिकाव लागू शकला नाही. (भारतीय संस्कृतिकोश खंड १, संपादक प. महादेवशास्त्री जोशी) आधी वसलेले म्हणून ते आदिवासी. इतर समाजापासुन भयाने दूर रानावनातून, डोंगर दऱ्यातून भटकंती करणारे आणि तिथेच वास्तव्य करणाऱ्यांनी आपले आचार-विचार मौखिक स्वरूपात जतन करून खडतर जीवन जगले आहेत.

आदिवासी जमातीचे लोकसंख्यात्मक विश्लेषण

१९५१ च्या जनगणनेनुसार भारतात सुमारे २ कोटी आदिवासी होते. (५.६ प्रतिशत) २०११ मध्ये ३० कोटी (२५.३ प्रतिशत) आणि २०२१ मध्ये सुमोर ३४ कोटी (२५.५ प्रतिशत) आदिवासी आहेत. महाराष्ट्र राज्यात भारताच्या एकुण लोकसंख्येत ७-८ टक्के आदिवासीची संख्या आहे. (२०११) महाराष्ट्रात २००१ मध्ये एकुण लोकसंख्या ९-६९ कोटी असुन ८-५८ लक्ष (८.८५ प्रतिशत) आदिवासी लोक आहेत. २०११ महाराष्ट्राच्या ११-२४ कोटी लोकसंख्येपैकी २१ प्रतिशत (२.३८ कोटी) आदिवासी लोकांची संख्या आहे. आदिवासी मध्ये अनुसूचित जमाती आणि अनुसूचित जातीचा प्रमुख गट समूहाचा समावेश आहे. महाराष्ट्राच्या एकूण

लोकसंख्येत जनगणनेनुसार एसी. एसटीचे १९६०-६१ ते २०१८-१९ चे प्रमाण तक्ता क्र. १ मध्ये दिले आहे.

२००१-२०११ या दशकातील एस.सी व एस.टी. संयुक्त लोकसंख्या वार्षिक वाढ २-१२ आहे. ती भारत व महाराष्ट्राच्या वाढीच्या तुलनेत अधिक आहे. परंतु एस.सी. व एस.टी.च्या स्वतंत्र वाढीचा विचार केल्यास त्याची वाढ भारत व महाराष्ट्रापेक्षा अल्प आहे.

भारताच्या सर्व राज्यांचा सर्वांगीण विकास साध्य करण्यासाठी प्रत्येक प्रदेश व त्यातील प्रत्येक गट, जाती-जमातीचे लोक, तळागाळातील लोक आणि लिंगनिहाय विकास करावा लागेल. स्वातंत्र्य सूर्याचा उगम होऊनही थोडी थोडकी वर्षे झाली नाहीत तर अमृत महोत्सवी पर्व साकारले आहे. परंतु देशातील तळागाळातील आदिवासी समाजाचा मागासलेपणा कमी होऊ शकला नाही. निकृष्ट राहणीमान, खालावलेली आर्थिक परिस्थिती, दारिद्र्य, वेदना, व्यथा, छळ, अन्याय, अत्याचार, शोषण, भूक, असुरक्षितता, उपेक्षित आणि वंचित जिणे, सामाजिक प्रतिष्ठेचा अभाव इत्यादींना बळी पडलेला आदिवासी समाज आहे. हे कोणीही अमान्य करू शकत नाही. अनेक कारणांचा तो संयुक्त प्रभावच म्हणावा लागेल. आदिवासींसाठी अनेक विकास योजना येतात आणि त्या कुठे जातात? त्यांच्या पदरात किती पडत असतील? त्याचे सखोल अध्ययन करण्याची आवश्यकता आहे.

आदिवासी समाजाच्या विकासाचा प्रयत्न

आदिवासी समाजाचा जलद गतीने विकास घडून यावा, त्यांना मानवी दृष्टीकोनातून जीवन जगता यावे या उदात्त उद्देशाने प्रेरित होऊन राज्य आणि केंद्र शासन प्रयत्नशील आहेत. इ.स. १९८३ मध्ये म्हणजे आजपासून ३९ वर्षांपूर्वी एक स्वतंत्र आदिवासी विभाग निर्मित करण्यात आला. परंतु परिणामकारक अंमलबजावणी अभावी उद्दिष्टे साध्य होऊ शकली नाहीत. म्हणून १९९२ मध्ये या विभागाची पुनर्रचना करण्यात आली. शासनाच्या वतीने अनेक प्रकारांच्या सामाजिक व शैक्षणिक विकास योजना राबविल्या जातात.

आदिवासी समाजाचा जलद गतीने विकास घडून यावा, त्यांना मानवी दृष्टीकोनातून जीवन जगता यावे या उदात्त उद्देशाने प्रेरित होऊन राज्य आणि केंद्र शासन प्रयत्नशील आहेत. इ.स. १९८३ मध्ये म्हणजे आजपासून ३९ वर्षांपूर्वी एक स्वतंत्र आदिवासी विभाग निर्मित करण्यात आला. परंतु परिणामकारक अंमलबजावणी अभावी उद्दिष्टे साध्य होऊ शकली नाहीत. म्हणून १९९२ मध्ये या विभागाची पुनर्रचना करण्यात आली. शासनाच्या वतीने अनेक प्रकारांच्या सामाजिक व शैक्षणिक विकास योजना राबविल्या जातात.

प्रमुख आदिवासी विकास योजना

महाराष्ट्र शासनाने डॉ. द.ना. धुळेकर या राज्य नियोजन मंडळाचे अनुभवी सदस्य व माजी सचिव यांच्या अध्यक्षतेखाली एका समितीचे गठन केले. त्यांनी चौकशी करून ज्या शिफारशी सादर केल्या त्यांचा स्वीकार करण्यात आलेला आहे. २००५-०६ पासून केंद्र शासनाने महाराष्ट्राला ९ प्रतिशत इतका निधी देण्याचे मंजूर केला आहे. त्यापैकी ४० प्रतिशत राज्यस्तरावर आणि ६० प्रतिशत जिल्हास्तरावर वापरला जाया असी तरतूद करण्यात आली. या आर्थिक निधीतून पुढील अनेक विकास प्रकल्पावर खर्च केला जातो.

अ) आदिवासी सामाजिक विकास योजना

डोंगर दऱ्यांमधून जीवन जगणाऱ्या तसेच समाज प्रवाहापासून अलिप्त असलेला व उपेक्षित आदिवासी जनसमुदायात आमुलाग्र परिवर्तन होण्यासाठी, त्यांना मुख्य प्रवाहात आणण्यासाठी विविध प्रकारचे प्रयत्न केले जातात. त्यापैकी प्रमुख सामाजिक योजना पुढीलप्रमाणे आहेत. १) आदिवासी कन्यादान योजना २) ठक्कर बाप्पा आदिवासी वस्तीविकास कार्यक्रम इत्यादी.

ब) शैक्षणिक विकास योजना आदिवासी बांधव मुख्यत अतिदुर्गम स्थळी वास्तव्यास असतात. आदिवासी भागात प्रामुख्याने कन्यांची निरक्षरता, दैववादी आचरण, जुन्या परंपरा व चालीरीती यांनी पछाडलेला असतो. आणि विशेषत: त्यामधून शिक्षण घ्यावे अशी त्यांची मानसिकता नसते. शिक्षणाशिवाय त्यांच्या वृत्तीत आणि कृतीत बदल होऊ शकणार नाही याची पूर्णपणे जाणीव ठेवून पुढची पिढी शिक्षित झालीच पाहिजे म्हणून संबंधित विभाग आटोकाट प्रयत्न करतात. त्या दृष्टीने १) शासकीय आश्रम शाळा २) अनुदानित आश्रम विद्यालय ३) कनिष्ठ महाविद्यालय ४) मुले व मुली यांच्यासाठी स्वतंत्र शासकीय वसतिगृहे ५) व्यावसायिक प्रशिक्षण केंद्र ६) एकलव्य निवासी शाळा इत्यादी. शिक्षणाच्या सोयी व सवलती निर्माण करण्याबरोबरच शैक्षणिक गुणवत्तेवर भर देण्यात येते. त्यासाठी अनेकानेक प्रकारच्या शिष्यवृत्तीच्या भरपूर सुविधा दिल्या जातात. उदाहरणार्थ १) शालान्त परीक्षेत्तर शिष्यवृत्ती योजना २) विद्यार्थ्यांना निर्वाह भत्ता. शिवाय प्रसंगी वाढ भत्ता देण्याची व्यवस्था केली जाते. विशेषत: व्यावसायिक शिक्षण घेऊन त्यांच्या विद्यार्थ्यांच्या प्रगतीला आळा बसावा यासाठी काळजी घेण्यात येते. ३) विदेशातील शिक्षणासाठी शिष्यवृत्ती योजना ४) विशेष गुणवंतांना प्राविण्य बक्षिसे ५) अपंगांना शिष्यवृत्ती व वाहतूक भत्ता देण्यात येतो. तसेच ६) प्रोत्साहनपर बक्षिस देण्याची योजना ही राबविली जाते सुमारे ५०० पेक्षाही अधिक वसतिगृहातून ६० हजार आदिवासी विद्यार्थ्यांना अनेक प्रकारच्या सोयी सवलतींचा लाभ होतो. ५५६ शासकीय आश्रम शाळा कार्यरत आहेत. इ.स. २०१६-१७ मध्ये एकूण १,८७,३१२ विद्यार्थ्यांमध्ये ५०-४८ प्रतिशत विद्यार्थी आणि ४८-५२ प्रतिशत विद्यार्थिनींना आश्रम शाळेतून शिक्षणाची संधी मिळू शकली. शिवाय याशिवाय व्यतिरिक्त केंद्र शासन विशेष केंद्रीय सहाय्य निधीची व्यवस्था करते. (डॉ. एम.जी. देवगावकर, आदिवासी विकास प्रशासन विभाग)

२००१च्या जनगणनेनुसार पंजाब, हरियाणा या राज्यात व पॉंडेचेरी, दिल्ली, चंदीगड या केंद्रशासित प्रदेशात आदिवासी लोकांचे अस्तित्व आढळले नाही. परंतु नेपाळ (८९ प्रतिशत), मिझोराम (९५ प्रतिशत), नागालँड (९० प्रतिशत), लक्षद्वीप (९५ प्रतिशत) मध्ये बहुतांश लोक आदिवासी असल्याचे आढळले. (डॉ. प्रदीप आगलावे) भारतात ब्रिटिश शासनाच्या कूट नितीचा आदिवासींवर प्रतिकूल

तक्ता क्र.१

महाराष्ट्राच्या लोकसंख्येत आदिवासींचे प्रमाण			१९६०-६१ च्या तुलनेतील वाढ	
वर्ष	एस.सी प्रतिशत	एस.टी. प्रतिशत	एस.सी	एस.टी.
१९६०-६१	५-६३	६-०६	१००	१००
१९७०-७१	६-३०	७-६२	१४२-६६	१६०-२४
१९८०-८१	७-१४	९-१६	२०१-१७	२४०-८०
१९९०-९१	११-०९	९-२७	३९३-२६	३०४-३०
२०००-०१	१४-१४	१२-२७	४४३-७४	३५७-८२
२०१०-११	११-८१	९-३४	५९६-१४	४३८-४७
२०१८-१९	११-८१	९-३४	५९६-१४	४३८-४७

आधार - *Economic survey of maharashtra 2019&20 (P.3)*

तक्ता क्र.२

एस्सी व एस.टी ची संख्या एकत्र करून त्यांचे महाराष्ट्रातील लोकसंख्येचे प्रमाण

वर्ष	आदिवासीचे प्रमाण (दशवार्शिक) प्रतिषत	वार्शिक वाढ प्रतिषत
१९६०-६१	११-६९	१-१७
१९७०-७१	१३-९२	१-३९
१९८०-८१	१६-३३	१-६३
१९९०-९१	२०-३७	२-०४
२०००-०१	१९-०५	१-९१
२०१०-११	२१-०५	२-१२
२०१८-१९	२१-०५	२-१२

आधार - *अभ्यासाचा वरीलील तक्त्याच्या आधारे तयार केलेली माहिती.*

तक्ता क्र.३

महाराष्ट्राच्या लोकसंख्येतील एस्सी. एस.टी. च्या वाढीचे प्रमाण प्रतिशत

वर्ष	एस.सी.	एस.टी.	स्थिती
१९६०.६१	०.५६	०.६१	एस. सी. पेक्षा
१९७०.७१	०.६३	०.७६	एस.टी. मधील
१९८०.८१	०.७१	०.८२	वाढीचा दर अधिक
१९९०.९१	१.११	०.९३	एस.सी. पेक्षा एस.टी.
२०००.०१	१.४१	१.२३	मधील वाढीचा
२०१०.११	१.१८	०.९४	दर कमी
२०१८.१९	१.१८	०.९४	

आधार - *अभ्यासाचा तक्त्यावरून तयार केलेला तक्ता*

२००१ ते २०११ या काळातील भारतातील व महाराष्ट्रातील लोकसंख्येतील दशवार्षिक वाढ व वार्षिक वाढ

	दशवार्षिक वाढ प्रतिशत	वार्षिक वाढ प्रतिशत
भारत	१७-७	१-७७
महाराष्ट्र	१६-०	१-६०

प्रभाव पडला होता. तरीही त्यांच्या शोषणाला स्थानिक जमीनदार वर्ग आणि सावकार हे अधिक प्रमाणात जबाबदार होते असे अभ्यासकांचे मत आहे. पूर्वी आदिवासी हे जंगलाचे मालक होते- राजे होते. कर्तेसवते होते. परंतु इंग्रजांच्या कुट धोरणामुळे आणि वन कायद्यातील तरतुदींमुळे आदिवासी समाजावर अनेक प्रकारचे निर्बंध लादले गेले. ब्रिटीश आमदानीमध्ये हिंदुस्थानात ख्रिश्चन धर्माचा फार मोठया प्रमाणावर प्रसार व प्रचार झाला. त्याला आदिवासी बळी पडत गेले, असे दिसते. (अभ्यासक) ब्रिटीशांच्या वसाहतवादी नीती-धोरणामुळे आदिवासींचे जगप्रसिध्द हस्तकला कौशल्य नष्ट झाले. हस्त व्यवसाय बंद पडले. आदिवासींच्या ललीत कला कुशलतेचा मोठया प्रमाणावर ऱ्हास झाला. विदेशी सत्तेच्या घातक कृत्यांचा-धोरणांचा प्रतिकार करण्यासाठी आदिवासींना लढे उभारावे लागले. बिरसा मुंडा यांच्या नेतृत्वात ब्रिटीश शासन तसेच देशी जमीनदार वर्ग व सावकारांचा प्रतिकार करण्यासाठी आदिवासींना लढे उभारावे लागले- झगडावे लागले.

स्वातंत्र्योत्तर स्थित्यंतर :-

शैक्षणिक सोयी - सवलतीची खैरात व विविध माध्यमातून आर्थिक सढळ सहाय्य आणि विषेशत: आदिवासी विद्यार्थ्यांना महाविद्यालयात ७-५ प्रतिशत राखीव प्रवेश, तसेच भारतीय संविधान कलम ३३५ नुसार राज्य व केंद्रीय लोकसेवा आयोग व निवड मंडळातर्फे आदिवासींना ७-५ टक्के राखीव जागांची तरतूद. राजकीय क्षेत्रात देखील ७-५ टक्याचे आरक्षण देण्याची व्यवस्था झाली. देशाच्या लोकसभेत ४१ आणि विधान सभेत ५२७ जागा आदिवासी लोकासाठी आरक्षीत झाल्या आहेत. आदिवासींच्या सांस्कृतीक भिन्नतेची जोपासना व त्यासाठी प्रोत्साहनाला प्राधान्य दिले जाते. निसर्गाच्या सहवासात राहणारे व खरे निसर्ग प्रेमी आदिवासी लोक फळ-फुले, कंदमुळे वापरून पशुपक्षी आणि वनराईच्या सानिध्यात रममाण होणारे, अत्यंत समाधानपूर्वक जीवनाचा आस्वाद घेणारे व पाखरा प्रमाणे स्वच्छंदीपणे जीवन जगणारे आहेत. लोकगीते, लोकनृत्ये, कथाकथन यांच्या आस्वाद घेत आनंदोत्सवात तसेच आपल्या

विविध माध्यमातून आर्थिक सढळ सहाय्य आणि विशेशत: आदिवासी विद्यार्थ्यांना महाविद्यालयात ७-५ प्रतिशत राखीव प्रवेश, तसेच भारतीय संविधान कलम ३३५ नुसार राज्य व केंद्रीय लोकसेवा आयोग व निवड मंडळातर्फे आदिवासींना ७-५ टक्के राखीव जागांची तरतूद. राजकीय क्षेत्रात देखील ७-५ टक्याचे आरक्षण देण्याची व्यवस्था झाली. देशाच्या लोकसभेत ४१ आणि विधान सभेत ५२७ जागा आदिवासी लोकासाठी आरक्षीत झाल्या आहेत.

जबाबदारीचा विसर न पडू देता जीवन यज्ञात रममाण होणारे आदिवसी बांधव आहेत. हे त्यांचे मोलाचे वैशिष्टय आहे. (डॉ.सुदाम जाधव) असाध्य रोगावर झाडा-झुडपापासून प्रभावी औषधी तयार करण्याची कला व ज्ञान त्यांना प्राप्त झाले आहे. शासनाच्या शिक्षणाच्या प्रसारामुळे त्यांच्यात पुष्कळ परिवर्तन घडून येत आहेत. तव्दतच क्रियाशील कार्यात आणि विशेषत: राजकारणात त्यांचा सहभाग वाढू लागला आहे. पुढची पिढी तर अधिक महत्वाकांक्षी, उत्साही, धडपडणारी आणि सळसळणाऱ्या उष्ण रक्ताची बनत आहे. हेच तर खरे यश आहे. स्वातंत्र्य प्राप्तीसाठी सुध्दा अनेक आदिवासी बांधवांनी मोलाचा सहभाग दिला आहे.

आदिवासी लोक गरीब व दुर्बल असले तरी तो कधीही भीक मागतांना दिसणार नाही अथवा ऋणभारामुळे आत्महत्येस बळी पडतो असे दिसणार नाही. भविष्य म्हणजे काय ते त्यांना अजिबात उमगलेले नाही. भविष्याची ते काळजीही करत नाहीत. म्हणून ते आनंदी आहेत. (श्री. शेषराव मडावी)

समारोप

आदिवासींच्या संस्कृतीची जोपासना करणे, त्यांची जीवनमूल्य जोपासणे आवश्यक आहे. आदिवासींना जीवनातून उध्वस्त न होऊ देता सर्वांगीण प्रगतीवर भर दिला जावा, विकासाचा पुरेपूर लाभ त्यांना मिळायलाच हवा. (डॉ. गोविंद गोरे यांच्या भाषणातून) आदिवासी समाजाला अनेक सोयी सवलती उपलब्ध करून देण्यात आल्या आहेत. परंतु त्याविषयी ते जागृक नाहीत. ते त्या विषयी अज्ञानी आहेत. तसेच विकास प्रकल्पाची अंमलबजावणी बाबतही उदासिनता आढळते. पुरेशा जागृतीची आवश्यकता आहे. एक संशोधक श्री. देवा कुळकर्णी आपल्या दारिद्रयाची यशोगाथा मधून म्हणतात महाराष्ट्रातील सर्वात मागे पडलेला आणि दीन वर्ग म्हणजे भटके विमुक्त समाजातील लोक. त्यांच्यापर्यंत अद्यापही विकासाची झुळूक पोहचलेली नाही. तळातील लोकांची अवस्था खूपच बिकट आहे. अशांना विकास होणार तरी कसा! असे ते संशोधक व्यथा व्यक्त करतात. बऱ्याचदा आदिवासींच्या वास्तविक अडचणी आणि गरजा जाणून न घेता विकास योजना तयार केल्या जातात. म्हणून त्या योजना राबविताना बहुविध अडचणी व मर्यादा उद्भवतात. विकास योजना अंमलबजावणीमध्ये पुरेशी निष्ठा नसते, की आत्मीयताही आढळून येत नाही. सर्वात महत्वाची गोष्ट म्हणजे मुळात लाभार्थ्यांच्या जागृतीची कमतरता आहे. शासकीय प्रयत्नापासून आदिवासींमध्ये मंदगतीने का होईना बदल घडून येतो आहे. एक संशोधिका मनश्री धनंजय आंबेकर (पुणे विद्यापीठ), म्हणतात, बुजरी आदिवासी व्यक्ती अलीकडे सर्वसामान्यांमध्ये मिसळत आहे, सहभाग घेत आहे. असे असले तरी विकास योजनांची सफलता आणि त्यांचा वेग पुरेसा उंचावणे क्रमप्राप्त आहे.

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लेखक रमेश बिडवाई कृषी व रोजगार अर्थ तज्ञ आहेत तर पोतनुरवार या चंद्रपूर येथील सरदार पटेल महाविद्यालयात सहयोगी प्राध्यापिका आहेत.

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EVALUATION OF ENVIRONMENTAL AWARENESS AND PARTICIPATION AMONG MORWA VILLAGERS, CHANDRAPUR DISTRICT, CENTRAL INDIA*

BY

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ABSTRACT
Nowadays we are facing many problems due to greedy human behavior such as environmental destruction, pollution, overpopulation, degradation of resources, etc which are the most vital troubles for us. Environmental education can lead to generating a positive awareness and attitudes about environmental anxiety, at the same time limits the negative role of human actions on the environment. Education which is determined by the objectives of the learners who often contribute willingly is referred to as non-formal education. For attaining environmental sustainability it becomes important to protect and conserve the environment through awareness as well as encourage public participation in conservation activities. This paper presents the scenario of environmental awareness and participation among rural peoples based on gender and occupation in Morwa Village, Chandrapur District, Maharashtra. The data was gathered from a selected population sample size of 325 respondents through a survey using a questionnaire as a methodological tool. The results obtained from the research revealed that respondents had more level of environmental awareness i.e. 72.05% as compared to participation level for environmental protection i.e. 55.88%. The regression results also showed that environmental awareness and participation level of respondents is influenced by gender and occupation to less extent.

KEYWORDS: Non-Formal Environmental Education, Awareness, Participation, Rural Population

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I Introduction:
In years back, the natural system works very well where the mutual concessions maintain between humans and the environment, and the resources of the earth seem to be unlimited. In the preceding several years, the environment was an encounter with the hasty rate of decline which led to the natural imbalance in most of the countries, some developed while some progressing. However, these resources

seem to be demanding to the extent attributable to the swift rise in the population of human species, man not just used but exploited the available natural resources without replacing them. The summed up of different issues like ozone layer depletion, increasing sea level, various types of pollution, and also global warming are results in environmental degradation (Ali et al., 2017). For achieving the Sustainable Development Goals it is vital and urgent to take necessary action in a contest to climate change with its impacts (Hoffmann and Muttarak, 2020). It should be known by the people that, what would be the consequences of our action in course of developmental activities and also there is need to preserve and protect the environment in which we live, through creating awareness about the importance of environment among them (Abbas and Singh, 2014). To create positive awareness and an environmentally friendly attitude among people one can help is environmental education, even at the same time it also limits the negative role of human actions on the environment.

According to Tbilisi Declaration 1977, environmental education is defined as " a learning process that increases people's knowledge and awareness about the environment and associated challenges develops the necessary skills and expertise to address the challenges and fosters attitudes, motivations, and commitments to make informed decisions and take responsible action" (UNESCO 1978). Knowledge, Awareness, Attitudes, Skills, and most importantly participation are the components of environmental education (EPA, 2020). To comprehend the natural systems and their interaction with the human social system is expound by environmental awareness, which also accelerates knowledge. (Bozoglu et al., 2016).To develop responsible behavior in public, an important role is played by awareness and knowledge regarding environmental issues (Awan and Abbasi, 2013). As we defined participation as the process throughout which individuals, groups, and organizations have the opportunity to become actively involved in an activity (Definations, 2012). The participation and role of the 'community' have been the main stakeholder in both whether in the supervisory processes or for the community building an enabling environment to have a say over aspects that affect their lives, these processes have become an important component of all environmental programs and projects (Sahai, 2015). Public participation in environmental problems was directly connected with civil society progress (Furman et al., 2002). There is a hypothesis that "if people become more knowledgeable about the environment and its associated issues, they will, in turn, become more aware of the environment and its problems and, thus, be more motivated to act toward the environment in more responsible ways" (Aminrad et al., 2013). The effect of socioeconomic factors played an important role in a person's behavior (Awan and Abbasi, 2013). A study of environmental concern researchers showed that a variety of hypotheses in which females had diffidently stronger pro-environmental values, beliefs, and attitudes than males (Xiao and McCright, 2015). While environmentalism correlated positively to some social factors, as income level, education qualification, and occupation (Awan and Abbasi, 2013). According to a research study by Herrera 1992, high-income earners maintain to be more tending to hold pro-environmental beliefs and also positive relationship exists between educational qualification and environmentalism (Ogubode and Arnold, 2012). As per Charles and Kate, 2012 research, it was found that the occupation had an important effect on environmental knowledge and attitude (Awan and Abbasi, 2013). Considering the

whole scenario an attempt has been made to study the environmental awareness and participation based on gender and occupation among Morwa villagers of Chandrapur district, Maharashtra.

II Objectives:

1. To study the environmental awareness among Morwa rural population.
2. To study the participation in environmental conservation among the Morwa population.
3. To study environmental awareness and participation based on gender.
4. To study environmental awareness and participation based on occupational background.

III Methodology

Study Area

Morwa is a large village having a total geographical area of about 1233.56 hectares; belongs to the Vidarbha region, located in Chandrapur Tehsil of Chandrapur district in Maharashtra, India. It is situated 10km away from sub-district headquarter Chandrapur and 10km away from district headquarter Chandrapur. As compared to Maharashtra (82.34%), Morwa village (83.83%) has a higher literacy rate. In Morwa male literacy stands at 87.81 % while the female literacy rate was 79.19 %. As per 2019 statistics, a Morwa village comes under the Chandrapur assembly & parliamentary constituency and also a gram panchayat. The Morwa village has a population of 2055 and the number of houses is 520 of which 1104 are males while 951 are females as per the 2011 report of population Census. From the total population of Morwa village, 921 were affianced in occupational activities. The workers included in the Main work means earning period is more than semiannually were 93.27 % while Marginal activities involving workers were 6.73 % having a source of revenue of fewer than 6 months. As of 921 main workers, the cultivators were 148 (owner or co-owner) while 204 were included in Agricultural laborers.

Sampling method

For the present study, the population sample size (n) was calculated based on the following formula:

$n=N*X/(X+N-1)$----------(1)

$X=Z_{\alpha/2}{}^2 *p*(1-p)/MOE^2$-------- (2)

Where,

n: Population Sample Size

N: Population Size (801)

MOE: margin of error (5%)

p: Sample proportion (50%)

$Z_{\alpha/2}{}^2$ (1.96) is the critical value of the Normal distribution at α/2 (Confidence level of 95%, α is 0.05) (Population proportion-Sample size, 2020).

The sample size was selected based on systematic random sampling from the study area i.e. total individuals (n= 325).

The sample size was selected based on systematic random sampling from the study area i.e. total individuals (n= 325).

Gender:

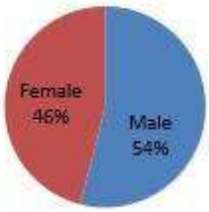

Figure 1: Gender distribution of respondents

Occupation Background:

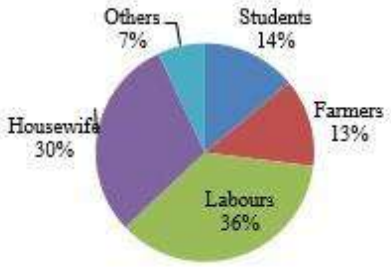

Figure2: Occupational distribution of respondents

Data collection

For conducting this study, a research tool name interview schedule was used for collecting data. The interview schedule consists of a series of questions to gather information from the respondent. The instrument schedule has the self-efficiency to evaluate the environmental knowledge, attitude, and action among the rural population. The data collected from the population sample was analyzed based on a comparison of the response of the selected population. For statistical analysis, coefficient of correlation was conducted to determine the effect of variables like gender, age, and education qualification on achieving environmental education objectives.

IV Results and Discussion:

Table 1: Percentage of Awareness and Participation Level in Morwa village

Factor	Division	Awareness %	Participation %
Gender	Male	75.14	57.94
	Female	68.36	53.42
Occupation	Students	69.6	55.96
	Farmers	74.56	57.7
	Labors	67.51	56.41
	Housewife	76.13	55.42
	Others	77.44	51.63

Table 2: Coefficient of Multiple Correlations

Factor	Awareness	Participation

Gender	0.45	0.47
Occupation	0.08	0.02

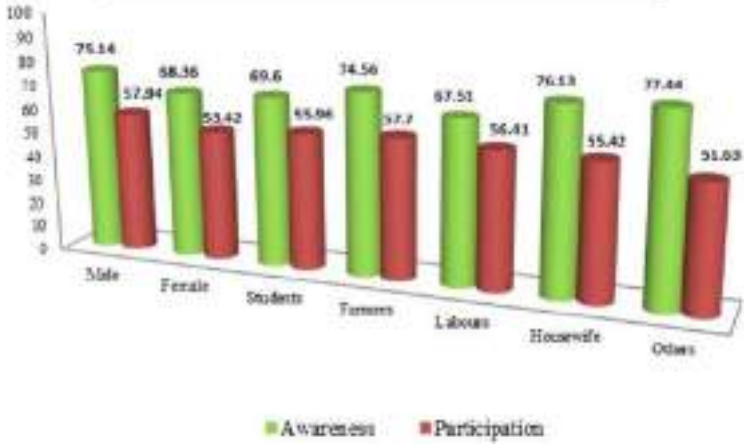

Figure 3: Awareness and Participation level of Morwa Villagers

Awareness

During this research assessment of environmental awareness was done among the rural population, the obtained results are shown in Table 1. The male population had a higher level of environmental awareness i.e. 75.14% than the female population (68.36%), as according to Census 2011, the literacy rate of male (87.81%) is higher than female (79.19%) in Morwa Village. McEvoy (1972) found that men are more concerned about the environment than females, similarly, Ahmed et al (2010) research shows the supporting results to the current study. While some of past studies, Daviden & Frendenberg (1996), Tindall, Davies & Mub. (1996), Mc Staly & Duvly (1983), Nelkin (1981) showed opposite results that females are generally more aware than males about the environment and environmental issues. Environmental awareness based on the different occupational backgrounds of the sample population revealed that laborers (67.51%) had lower environmental awareness than students (69.6%), farmers (74.56%), housewives (76.13%), and others occupation (77.44%). The correlation coefficient endows information about the influence of the linear relationship between different variables taken in the study such as gender and occupational background with environmental awareness and participation, the observations were in between 0 to 1, if values closer to 1 indicate the positive relationship whereas a zero value represents no relationship at all. The coefficient of multiple correlation analysis is given in table 2 which shows the minimum correlation for gender with environmental awareness (r=0.45) however Hassan et al (2011) reported the significant relationship between gender in terms of knowledge, awareness, and participation. The occupational background of the selected sample population with awareness shows a correlation to a very less extent (r=0.08). In the study by Mihanpour et al (2018), the occupation was an effective factor in environmental awareness level and a significant relationship was found between awareness and occupation

background. This contradicts the study of Herrera 1992 argued that there is no significant association between the attainment of a professional occupation with environmental awareness and knowledge.

Participation

The accomplishment of participation for environmental conservation activities among the Morwa rural population was carried out and on basis of gender, it was found that the male population (57.94%) had a higher participation level than the female population (53.42%). It was somewhat supported by with study of Aoyogp-Usui et al (2003), females are less likely to participate in environmental behavior than males. Occupational base background data revealed that farmers (57.7%) showed higher participation levels than students (55.96%), laborers (56.41%), housewives (55.42%), and other occupation backgrounds (51.63%). Analysis for participation level correlation with gender and occupation revealed that for gender had r=0.47 whereas opposite analysis revealed by Tarant and Cordell (1997) found no moderating effect of gender on environmental concern. The occupation correlation with participation in environmental protection activities had very less that is r=0.02. Xiao and Dunalap (2007) research revealed that occupations are positively correlated with environmentalism. While according to Ogunbode and Kate (2012) research study occupation background had a more limited independent impact on determining environmental knowledge and environmental behavior.

V Conclusions:

- As concluded remark by the present study, it revealed that there was a difference in environmental awareness and participation among the rural population of Morwa villagers on comparison with variables like gender and occupational background of the population sample.
- According to gender-wise comparison for environmental awareness and participation, it was observed that males had more environmental awareness (75.14%) and participation (57.49%) than female environmental awareness (68.36%) and participation level (53.42%).
- Occupational background data showed that farmers had a higher level of participation; according to Wu and Mweeba (2010) the environmental self-efficiency of farmers plays an important role and their encouraging and considerable environmental action improves the environment with greater perception.
- The statistical analysis of data revealed that environmental awareness and participation concerning variables gender and occupational background showed a significant association with a minimum coefficient.
- On an average, it was observed that the level of environmental awareness (72.05%) among the rural population was high as compared with environmental activities participation (55.88%).

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ENHANCEMENT OF SHELF LIFE AND QUALITY MAINTENANCE OF FRUIT AND VEGETABLE USING HERBAL PRODUCTS BASED ON ANTIMICROBIAL COATING

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ABSTRACT:
As per consumer demand enhancement of shelf life and quality maintenance of fruits and vegetables. Many natural and artificial preservatives are available in this market but many preservative shows harmful effect to the body that's why used some natural preservatives like aloe vera gel and Neem oil and Neem leaf extracts. Thus Aloe vera gel and neem oil, neem leaf extracts based antimicrobial edible coatings has been identified as a suitable method to extend the shelf life of fruits and vegetables. Treatment has given satisfactory result was recorded until three months in intervals of one week and two week. Combination of aloe vera and neem oil, neem leaf extract edible coating was proved to be efficient as preservative and nutritive value of fruits and vegetables.
Key words: - Herbal edible coatings, Shelf life, Antimicrobial coatings, Neem oil, Aloe vera gel

INTRODUCTION:

Fruits are important sources of many nutrients, they are really essential to the body and also everybody to eat fruit and vegetables. Fruits and green vegetables are little in calories and fat and are a basis of sugars, fiber, and vitamins, which are vital for our health. Fruits present in soluble nutritional fiber, which help to region low cholesterol and low fats from the body. Fruits compose of many antioxidants such as polyphenolic flavonoids, vitamin-C and anthocyanin but fruits and vegetables are a serious problem because of rapid deterioration during handling, transport and storage, that's why use of same herbal coatings like Aloe Vera gel, Neem extract, Neem oil, To improve their quality and self-life enhancemement of shelf life and quality maintenance fruits and vegetable.

Herbal edible coatings:

Herbal coating is a new method for food manufacturing. It is completed from herbs or mixture of herbs, most general herbs used in edible coatings like Aloe Vera gel, Neem, Lemon grass, Marigold leaf, and Cluster beans, Tulsi and Turmeric. Herbs have antimicrobial property, it consists vitamins, antioxidants and essential minerals (M. Douglas, J. Heys & B. Smallfield, 2005). Beneficial for health act as a nutraceutical and medicines.

Aloe Vera

Aloe vera gel is use in herbal edible coating of food industries because of its antimicrobial properties. Aloe Vera is semi-tropical plant with some medicinal properties. "Aloin and Aloe-emodin" are the major components of aloe vera extract. This extract has antifungal, anti-bacterial, anti-inflammatory properties. It also consists of components like glycoproteins, polysaccharides, salicylic acids, phenolic compounds, lignins, amino acids, vitamins and enzymes. It can suppress respiration and can reduce microbial growth, thus can improve the shelf life of fruits and vegetables. Aloe vera is a tropical and subtropical plant. Aloe vera contains medicinal and therapeutic properties and has been used for centuries (Eshun 2004). Aloe vera gel is used as edible coating for fruit and vegetables. It has antifungal properties (Saks 1995). Aloe vera gel based edible coatings prevent moisture loss and retains firmness, decreases respiration rate,

delays oxidative browning and reduces the growth of microorganisms in table grapes (Valverde 2005).

Neem

Neem is considered as the holiest, therapeutic and a non-lethal plant, which has antifungal, antimicrobial properties. Neem extracts act against pathogens like Salmonella, Staphylococcus, E. coli, Vibrio and other microorganisms. Nimbidin are the major components of neem extract. These components can act as an antimicrobial property.They improve the external and internal quality characteristics of diverse commodities. Coatings can reduce dehydration and oxidation as well as the resulting undesirable changes in color, flavor, and texture. Waxes and other coatings delay ripening and senescence of fresh produce and can increase the microbial stability of lightly processed fruits, vegetables, and some processed products. Coatings show promise as environment friendly treatments. Most coating materials are produced from renewable, edible resources and can even be manufactured from waste products that represent disposal problems for other industries. According to this review, Edible Coatings extends shelf life, reduce water and moisture loss, delayed ripening process and also prevent microbial growth specifically in fresh fruits and vegetables (Akilandeswari, P., & Pradeep, B.V. (2016).

Edible coating characteristics

Edible coating should not contain any toxic, allergic substance and should be digestible liable to mechanical damage during handling, display and transportation have good adhesion property have good water barrier properties provide semi permeability to maintain internal equilibrium of gases which is involved during anaerobic and aerobic respiration, thus retarding senescence not affect the nutritional and organoleptic properties of fruit and vegetable be capable of being used as a carrier for desirable additives such as flavor, nutrients, coloring and vitamin have antimicrobial and antibacterial properties be easily manufactured and economically viable.

MATERIALS AND METHOD:

Preparation of Aloe Vera gel

Matured leaves of Aloe Vera plant were harvested from a nearby botanical garden. The leaves were then wash with a gentle chlorine solution of 25% or distilled water. The leaves skins were peeled and the outer cortex. The colorless hydroparenchyma removed in leaves and was blended. The liquid obtain constitute fresh Aloe Vera gel. It was stored in glass bottle.

Preparation of Neem leaf extract

The extract of Neem leaf, was prepared by drying of under shade till they are completely dried with no moisture content. A fine powder by blender. Solution was prepared by different concentration of gel.

Neem oil

Neem oil bottle was purchased from a local medical shop. The solution of neem oil was prepared by mixing of oil with distilled water, with leaf extract on a percentage wise.

Collection of fruits

Fresh fruits were purchased from local market of chandrapur and transferred to laboratory in sterile conditions. Fruits were washed with sterile distilled water and alcohol to remove the dirt followed by air dried. On the basis of size, shape, colour and absence of any external injuries.

The fruits used in this experiment were divided into groups. Control, Only aloe vera, only neem oil extracts and combination with Aloe vera and neem extracts. The fruit were stored in box and basket.

APPLYING METHOD:

Herbal coatings can be applied fruits by the methods of dipping, spreading, and spraying. Dipping is one of the most frequently used methods for applying the herble coating in fruits and vegetables. Optimization was carried out by storage temperature and pH and observes different time intervals. Comparative study of different types of fruits, vegetables and different herbal coatings.

EXPERIMENT AND RESULT:

In the present study was different type of fruits were collected from market such as Apple, Chikoo, Guava, Grapes, Banana. Fruits were further processed for experiment in microbiology laboratory. It was observed that the fruits coated with sample. Control fruits were spoiled within one week. Some edible coated fruits good after three months but some fruits were spoiling within 30 days.

DISCUSSION :

In present study, was carried out by enhancement of shelf life and quality maintenance of fruit and vegetable using herbal products based on antimicrobial coating. Decay is one of the most important postharvest factors in reducing quality fruits and vegetables of horticultural crops. The present study was given by different type of fruit were collected from market such as Apple, Banana, Chikoo, Guava, Grapes etc. The fruits were processed for experimentation in labortary. It was divided into some categories Contol, Aloe vera, Aloe vera and neem leaf extract and neem oil.

It was observed that the experimental fruit like Apple, Chikoo etc. After that colour was observe in long duration. It was not change in any quality of fruit. The fruit become shriveled and wrinkled. This gel treatment was effective as a physical barrier.

The control fruit was observed in short time period was decay as compare to coated fruits. Coating had shown the maximum effect of self life and maintaining the quality of the fruit.

The results revealed that the changes in colour and physical changes of control showed within some fruit 20 to 25 days but Apple and pears was observe in best for the 3 month, No colour change and outer surface or no external injury . It can be observed that coating had shown the maximum effect of self life and maintaining the quality of the fruits.

CONCLUSION

The result have proved the ability of the various coatings used in the present study to enhancement of shelf life and quality maintenance of fruit and vegetable using herbal products based on antimicrobial coating of different type of fruit such as Apple, Guava, Banana, Chikoo, Grapes etc.

It can be observed that Neem leaf extracts and Aloe vera was found to be best as the decay was too less on comparing with the other treatment in different samples. Coating with Aloe vera and neem oil or in combination of both had a positive impact increasing the shelf life of fruit and maintaining the quality of fruit. In future, these treatments may also be applied in other fruit and vegetables to prevent post harvest losses.

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Fig. 1: Experimental Apple for (After 3 Month)

Fig.2:experimental Banana after 1 week

Fig. 3: Experimental Chikoo for After 30 day

Fig. 4: Experimental Pear for (After 3 Month)

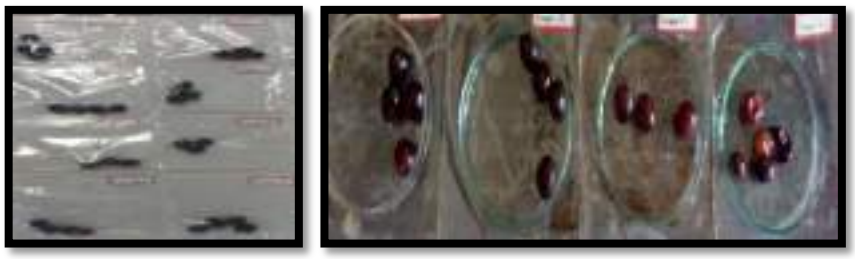

Fig. 5: Experimental Grapes for two weeks

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SEASONAL VARIATION STUDY OF PARASITIC INFECTION IN FRESH WATER FISHES FROM CHANDRAPUR DISTRICT (M.S), INDIA

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ABSTRACT: Like Plants, Humans and other animals, fish agonize from diseases and parasites. Fish defenses towards disease may specific and non-specific. Non-specific resistances include skin, scales and mucus layer secreted by the epidermis that catches microorganisms and inhibits their growth. This study analyses the effects of parasites of fresh water fishes. Fish harbor parasites either external or internal which cause pathological strengths in them. The collective parasites of fishes include the microparasites (viruses, bacteria, fungi and protozoans). Fish harbor a variety of parasites viz. protozoan's, cestode, trematode and nematode. In the present study, collected freshwater fishes of species, Clariusbatrachus Channamarulius and Channapunctatus, from different reservoirs of Chandrapur District during summer, monsoon and winter season respectively. During the Jun 2018 to May 2019 we observed high parasitic infection in the fishes during summer season as compared to the winter and monsoon season.

Key words: - Seasonal Variation, Parasites, Clarusbatrachus and channamarulius.

INTRODUCTION:

Parasites have a varied range of distribution in all groups of animals. India is one of the mega biodiversity countries in the world of freshwater biodiversity (Mittermerier RA, Mitemeir CG 1997). For the last few decades, fishes have been extensively used as food for human consumption in the Indian subcontinent and thus contribute substantially to its economy. These edible fishes are known to harbour a number of parasites which cause deterioration in their health, hence their market and nutritious value is affected. Parasite can have wide range of influence on the ecology of their hosts in terms of health (Atme and Owen, 1967) behavior (Milinski 1984, Moore 1984) sexual selection (Howard and Minchella, 1990 Watve and Sukmar, 1977) and regulation of the host population (Freeland, 1983). Parasites of fish found one of the major problems to fish health. Besides the direct losses caused by mortality, parasites have considerable impact on growth, resistances to other stressing factors, susceptibility to predation, marketability and pave way for secondary infection. Many authors have carried out studies on the helminthes parasites and population dynamics of those occurring in Piscean hosts and work on different aspects of parasites.

Thestudy of population dynamics can be used as the biological method to regulate population of parasite. Fishes are important components of ecosystem from ecological, medicinal, nutritional and economical point of view. Study of population dynamics can be used as the biological basis of method to regulate population of parasite. Keeping in view, importance of helminthes parasitic infection to freshwater fishes, seasonal prevalence of helminthes parasitizing freshwater fishes for parasites are common and hazardous among fishes living in confined space such as aquarium, hatcheries, stocking ponds and tanks (Ali, 1990). Fishes usually have mixed infections of parasites. The amount of damage by infection is influenced to a large extent by the type and the number of parasites presents (Bauer, 1941).Parasites can affect fish population by affecting mortality, reduction in growth, weight loss and suppression of reproductive activity

(Bauer, 1961). Keeping in view the severity of the damages due to parasites in the fisheries sector, different researchers in different parts of the world have conducted studies for the assessment of parasitic population by applying various epidemiological techniques (Wilson, 1926; Jain, 1957;Wilmer, 1967; Ahmed, 1976; Sinhgal et al., 1986; Oldewage and Van As, 1988). In Pakistan research on fish disease is at its early stage except taxonomic studies on fish parasites. The parasitic studies are on Crustaceans, Protozoans, Helminthes and Nematodes (Zaidi et al., 1976 and 77; Bilqees, 1975 and 76; Muzamil, 1983; Jafri, 1993).

Present study was designed to make a survey for the parasitic infections, including their identification, their prevalent frequencies and host specificity in the Wardha River in Chandrapur district region.

MATERIALS AND METHODS :

Fishes are collected from the fresh water fishes, Clariusbatrachus, Channamarulius and Channapunctatus, were collected from different water bodies of Wardha and Wainganga river from Chandrapur Dist. During the early hours of morning, Jun 2018 to May 2019. They were carried in to the laboratory and dissected out. The helminthes parasites were collected and then they were preserved in 4% formaline. Then they were stained with borax carmine for the permanent slide preparation. These slides were observed and identified under microscope. Their identification was done with the 1934help of "SystemaHelminthum" Vol II "Helminths of Vertebrates" (Yamaguti S. 1934). Population dynamics of helminthes parasites were determined by following formula.

$$\text{Incidence of Infection} = \frac{\text{Infected host}}{\text{Total number of host}} \text{ X } 100$$

$$\text{Intensity of Infection} = \frac{\text{No.of paracites collected in sample}}{\text{No.of Infected host}}$$

$$\text{Density of Infection} = \frac{\text{No.of paracites collected in sample}}{\text{Total host examine}}$$

RESULT :

Table no. 1 and graph no. 1 shows that incidence, intensity and density parasites during Jun 2018 and May 2019. The maximum parasitic infection was observed in summer season (Feb 2019 – April 2019). During summer season maximum numbers of parasites (Trematode, Cestode and nematode) were collected from freshwater fishes. From the above results it is clear that a considerable difference was found in the occurrence of parasitic infections among different season. The highest Cestode prevalence (50%), Trematode prevalence (20%) and Nematode prevalence (70%) recorded during summer season where as lowest Trematode prevalence (30%), Cestode prevalence (10%) and Nematode prevalence (400%) in monsoon season. These finding of high occurrence during summer season was due tovariants in temperature and other weather condition that influences the occurrences of parasitic infection in fishes.

DISCUSSION :

The present study, analysis of data shows that the occurrence of parasites varies according to seasons. The incidences, intensity and density of all the parasites were found to be high in summer, medium in winter whereas lower in rainy season. Parasite and host species, host size and feeding habitats, seasons and locality were also effect the intensity. The similar trend was also observed for incidence, density and index of infection in Piscean nematode of genus Camallanussp. and Spinitectussp (Bhure, Nanware 2016). Similar type of results were also observed in case of Sengasp, Gangesiasp., Proteocephalussp. infected to Channasp. in summer, winter and monsoon (Bhure,Nanware

2016). The seasonal variation study of Caryophyllidean tapeworms show infection trend as, rainy < winter < summer season (SunitaBorde, SushilJawale 2012). Seasonal environmental changes of water such as temperature, pH and conductivity effect on the occurrences of parasites from aquatic host (Kennedy CR 1976). High temperature, low rainfall and sufficient moisture were necessary for development of parasite (Jadhav BV. Bhure2006). Increase in parasitic influx occurs due to elevated temperature, agriculture runoff, organic enrichment of the water bodies caused by pollution, indiscriminate use of antibiotics and this also causes increase in density of intermediate hosts. Lessermeatoblicacticity along with suppression of natural immune system makes them more susceptible to a wide range of parasites and diseases. Thus aquatic organisms respond directly to environmental changes due to influence of pH, temperature, and dissolved O2 levels on the metabolic processes.

CONCLUSION :

In this study, after the analysis of data, can be concluded that the high infections of parasite (incidence, intensity and density) were occurred in summer season. Then it was followed by summerwhereas very low in monsoon and winter season. This type of results indicated that theenvironmental factors and feeding habitat are influencing the seasonality of parasitic infection either directly or indirectly way.

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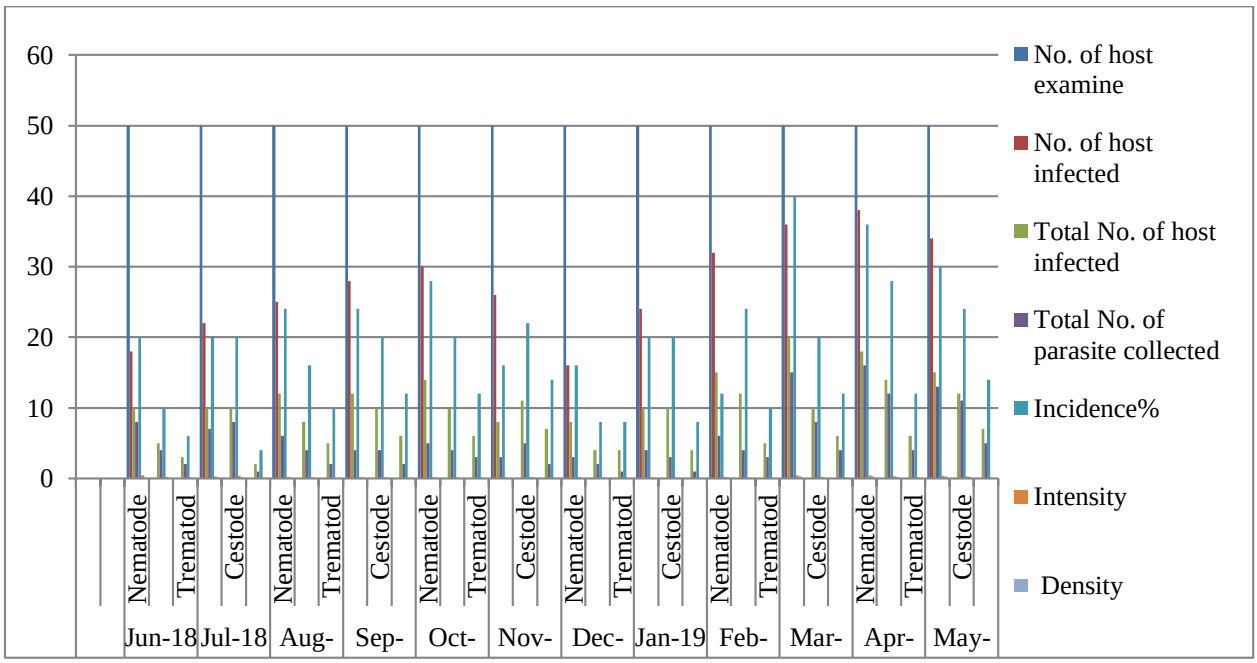
Table 1: Seasonal variation study of parasitic infection in freshwater fishes from ChandrapurDistrict (M.S), India, during the year Jun 2018 to May 2019.

Month	Name of paracites	No. of host examine	No. of host infected	Total No. of host infected	Total No. of parasite collected	Incidence %	Intensity	Density	Habitat
Jun-18	Nematode	50	18	10	8	20	0.44	0.16	NAKODA
	Cestode			5	4	10	0.22	0.08	
	Trematod			3	2	6	0.11	0.001	
Jul-18	Nematode	50	22	10	7	20	0.31	0.14	GHUGUS
	Cestode			10	8	20	0.36	0.16	
	Trematod			2	1	4	0.04	0.02	
Aug-18	Nematode	50	25	12	6	24	0.24	0.12	VADHA
	Cestode			8	4	16	0.16	0.08	
	Trematod			5	2	10	0.08	0.04	
Sep-18	Nematode	50	28	12	4	24	0.14	0.08	USEGAON
	Cestode			10	4	20	0.14	0.08	
	Trematod			6	2	12	0.07	0.04	
Oct-18	Nematode	50	30	14	5	28	0.16	0.1	BHADRAVATI
	Cestode			10	4	20	0.13	0.08	
	Trematod			6	3	12	0.1	0.06	
Nov-18	Nematode	50	26	8	3	16	0.11	0.06	CHANDRAPUR
	Cestode			11	5	22	0.19	0.1	
	Trematod			7	2	14	0.07	0.04	
Dec-18	Nematode	50	16	8	3	16	0.18	0.06	VISAPUR
	Cestode			4	2	8	0.12	0.04	
	Trematod			4	1	8	0.06	0.02	
Jan-19	Nematode	50	24	10	4	20	0.16	0.08	RAJURA
	Cestode			10	3	20	0.12	0.06	
	Trematod			4	1	8	0.04	0.02	
Feb-19	Nematode	50	32	15	6	12	0.18	0.12	BHADRAVATI
	Cestode			12	4	24	0.12	0.08	
	Trematod			5	3	10	0.09	0.06	
Mar-19	Nematode	50	36	20	15	40	0.41	0.3	SASTI
	Cestode			10	8	20	0.22	0.16	
	Trematod			6	4	12	0.11	0.08	
Apr-19	Nematode	50	38	18	16	36	0.42	0.32	VIRUR
	Cestode			14	12	28	0.31	0.24	
	Trematod			6	4	12	0.1	0.08	
May-19	Nematode	50	34	15	13	30	0.38	0.26	GADCHANDUR
	Cestode			12	11	24	0.32	0.22	
	Trematod			7	5	14	0.1	0.08	

Graph 1: Seasonal variation study of parasitic infection in freshwater fishes from Chandrapur District (M.S), India, during the year Jun 2018 to May 2019.



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Review Article

GREENING OF AMALNALA LAKE, GADCHANDUR, CHANDRAPUR DISTRICT (M. S.) - PROBABLE REASONS

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ABSTRACT

Amalnala dam is located at the foothills of Manikgarh hillock in Gadchandur town of Chandrapur district in Maharashtra state. The medium-scale irrigation dam is a main source of water for surrounding villages and local industries. It is also a well-known tourist spot. From last couple of years, water of the dam is turning dark green, especially, in the month of August resulting in the increased viscosity and stinking of water. This increased our curiosity to test the water sample for any biological origins. Preliminary microscopic examination showed the presence of *Microcystis*, a neurotoxic cyanobacteria which is green in colour and probably imparts green colour to water. The excessive growth of single cell cyanobacteria or the algal bloom can be due to rise in nitrates and phosphate levels in water. Thus, it becomes necessary to study the source of nitrates and phosphates and its possible bioremediation with the help of microbes and effect of neurotoxin produced by cyanobacteria on animal and human health. This review discusses various factors such as turbidity, light, temperature, pesticides, fertilizers etc. for the greening of the Amalnala dam.

Keywords: Amalnala; pesticides, turbidity, algal bloom, cyanobacteria.

1. INTRODUCTION

Global population is approaching 8 billion in 2021 and its impact on environment and ecology has been notable. Among them water pollution has been the greatest environmental issues owing to the higher demand of drinkable water. Water pollution is mainly caused by the eutrophication of water entities such as ponds, lakes and rivers [1, 2]. Eutrophication is the process of enrichment of water with excess nutrients, nitrogen and phosphorous which is responsible for the excess algal growth, periphyton or macrophytes. Continuous addition of organic matter to the water bodies also contributes in eutrophication. The causes of eutrophication are complex, as eutrophication involves various economic, social, ecological and numerous other factors [3]. The joint effect of natural and human activities mainly contributes in the eutrophication of water bodies which are also the root causes for the algal blooms and fish kills. Conversion of water bodies from oligotrophic to eutrophic is a natural process and takes years for achieving eutrophic level but the human intervention has accelerated this process. Therefore, it is important to monitor the water quality and identify the risk of eutrophication and adopt quick measures for its potential management [4]. Trophic status of lakes can be determined by the guidelines of Organization for Economic Cooperation and Development (OECD), indicates that the phosphorous levels greater than 35 µg l^{-1} signifies the eutrophic nature of lake. Amalnala dam is located at the foothills of Manikgarh hillock in Gadchandur town of Chandrapur district, Maharashtra state (19°41'17"N, 79°9'37"E). The medium-scale irrigation dam is a main source of water for surrounding villages and local industries. It is also a well-known tourist spot in Chandrapur district. Amalnala dam was constructed by Maharashtra government as a part of irrigation project in year 1985. Fishing activities are carried year-round in these waters. It is constructed on Amalnala River. Nearest city to dam is Gadchandur. The type of dam is Earth fill with diameter of 1607 m and height of 37.75 m. The dam has ungated spillway with catchment area of 8,417 hectors. Maximum storage capacity is 25.98 MCM. Live storage capacity is 24.48 MCM. Most of the water bodies like dams and ponds are famous as a picnic spots. Amalnala Lake is also one of the popular tourist attractions for its hilly terrain,

scenic beauty and lush green forest which again adds to the natural beauty. From last couple of years, water of the dam is turning dark green, especially, in the month of August resulting in the increased viscosity and stinking of water (Fig. 1).

Greening of water can be attributed to the change in the colour of water body to green which usually appears turbid or transparent year-round. The change in appearance of water body can be attributed to dissolved or suspended materials in the water. Organic matters such as leaves, roots, plant remains etc. contributed the addition of dissolved materials such as tannins. The slow degradation of plant materials results in the formation of dissolved organic matters which imparts colour to the water. Suspended material in water bodies may be a result of natural causes and/or human activity. Transparent water with a low concentration of dissolved materials appears blue. Dissolved organic matter, such as humus, peat or decaying matter, can impart a yellow or brown colour. Cyanobacteria, algae or dinoflagellates may impart red or yellowish colour to water bodies. Green colour may be imparted by the phytoplankton and green algae grown in the water as a result of eutrophication.

Eutrophication is characterized by the increase in phosphates, nitrates and sulphates in the lake. These high doses of nutrient usually contribute in the growth of cyanobacteria. Previous studies of eutrophic water bodies have showed the presence of neurotoxic cyanobacteria (*Microcystis*) which is green in color imparting green color to water [5]. The excessive growth of single cell cyanobacteria can be due to rise in nitrates and phosphate levels in water which in other words is known as eutrophication. Eutrophication of lakes has allowed the growth of various neurotoxic cyanobacteria such as Microcystis, Synechococcus, Trichodesmium, Snowella, Nostoc, Hapalosiphon [5] On the basis of the preliminary studies the hypothesis has been established as shown in Fig. 1.

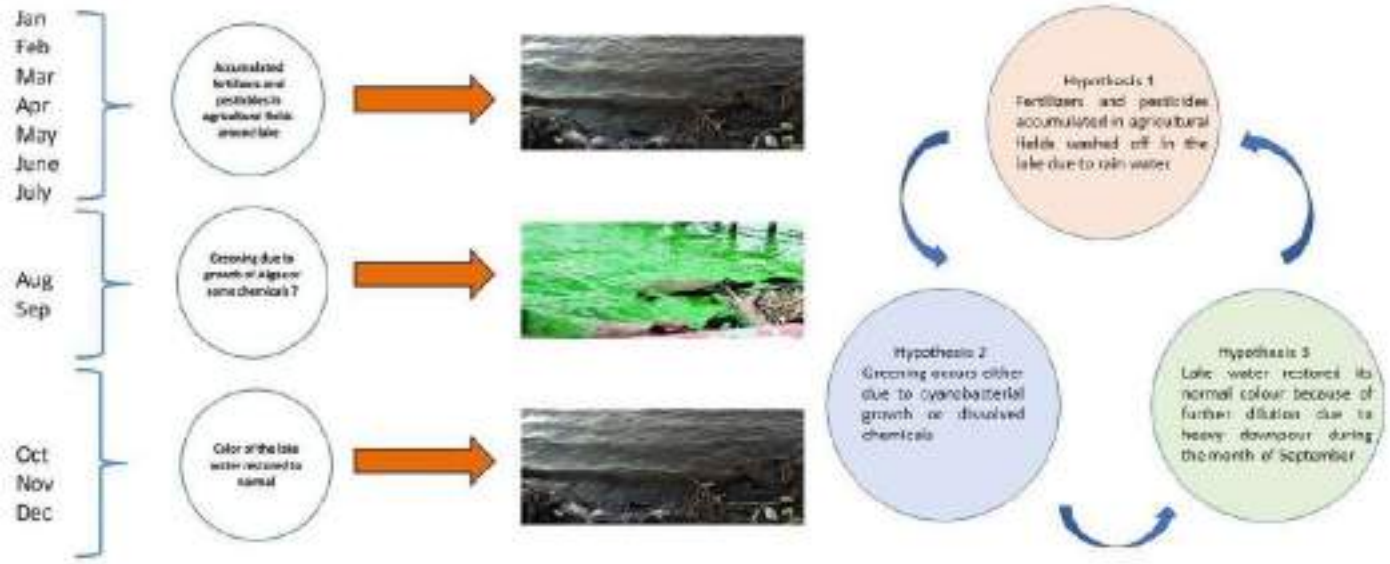

Fig. 1:Hypothesis for greening of Amalnala Lake, Gadchandur

2. PROBABLE REASONS OF GREENING OF AMALNALA LAKE

2.1. Excess nutrients and eutrophication of Amalnala Lake

One of the greatest water pollution challenges in the recent times is eutrophication caused due to the enrichment of water bodies by excess nutrients. Excessive phosphorus and nitrogenous compounds are the major sources of eutrophication [6-8]. Apart from that, acidification of freshwater lakes and streams [9], forest decline, climate change [10], disturbances to ecosystems and changing decomposition rates also contributes in eutrophication. Of all the environmental concerns related with excessive nutrients, eutrophication consistently ranks as the leading surface water quality impairment and is directly related to public health issues, economic impacts, ecological concerns and aesthetic impairments. In the world almost half of the impaired lake area and 60% of impaired river are due to eutrophication [11]. To overcome this problem,

an effective nutrient management strategy is essential to protect quality of surface water, aquatic ecosystems, public health and economic benefits. Variations in hydrologic behavior, geology dominated by limestone and both industrial and agricultural land use can dramatically influence nitrogen and phosphorus loads to receiving waters such as Amalnala dam.

Table 1:Sources of phosphate and nitrates inputs in lakes and rives

Sources of phosphates and nitrates
Water runoff from agricultural lands
Effluent runoff from the industries
Runoff from waste disposal site and animal feedlots
Runoff from storms and sanitary sewers
Runoff from construction sites
Leachate from abandoned mines

Furthermore, several complex mechanisms existing within a water body (e.g., phosphorous spiraling, hydraulic retention time, the phosphate buffer and light availability that affects the concentration and availability of nutrient concentrations leading to eutrophication. The relationship is established between increased growth yields and nutrient supply. It has been known and studied extensively since the work of the German agricultural chemist Justus von Liebig in the mid-1800s. By early 1900, there was evidence of a link between nutrients and aquatic productivity, or eutrophication [12]. Till date, the complexity and heterogeneity of watersheds has been the largest challenge in developing a well-defined numeric nutrient standard. Variations in hydrology, ecology, pesticides, sewage water management and ecological nutrient uptake all contribute to the eutrophication and the challenge of developing a management strategy that will protect the surface waters of our country.

Table 2:Effects of eutrophication on lake water properties

Effects of eutrophication
Increase in biomass and phytoplankton
Oxygen depletion
Increase in bloom forming species which can be toxic
A reduction in fish harvesting
Decrease in water transparency, foul odour and bad taste
Increased biomass of consumer species

Thus, it becomes necessary to study the source of nitrates and phosphates and possible bioremediation with different methods such as treatment of water by specialized filter or degradation of pesticides by microbes.

2.2. Optimum growth conditions for the growth of algal blooms

Algal blooms is the consequence of variety of factors ranging from human intervention to the environmental factors. The environmental factors contributing for the proliferation and growth of algal population includes the combination of physicochemical factors such as pH, carbon availability, salinity, conductivity, ecosystem disturbing factors such as stable or mixing of water and turbidity. Hydrological conditions influenced by river flow and water storage levels. Environmental factors such as sunlight, available nutrients and temperature of the water bodies. However, the exact combination of above factors that trigger and sustain an algal bloom is not well studied and it is impossible to correlate the algal blooms to any factor specifically. These conditions are further aggravated by the human interference with environment and cultural eutrophication. Increase in human global population have contributed in the increase of cultural eutrophication [13].

2.3. Effect of nutrients on growth of algae

Nitrogen, phosphorous, carbon etc. are the basic nutrients for the algal blooms. These nutrients available in optimum conditions, initiates, promotes and sustain the algal or cyanobacterial blooms. Enrichment of nutrients resulting in the formation of oligotrophic water bodies leads to the eutrophication. The eutrophication of waterways is considered as a major factor for the growth of algae. The main nutrients contributing to eutrophication are phosphorus and nitrogenous compounds. In the landscape, runoff and soil erosion from fertilized agricultural areas and lawns, river beds, river bank erosion, deforestation, and sewage effluent are the major sources of phosphorus and nitrogen entering water ways. All of these are considered as external sources. Sediments act as the internal origin contaminants. Phosphate attaches to sediments and when dissolved oxygen concentration is low in the water (anoxic), sediments release phosphate into the water column. This phenomenon enhances the phosphates and allows the growth of algae and results in the algal bloom [14]. There is the shift of growth in phytoplankton community to cyanobacterial growth

[14]. According to empirical calculation growth of cyanobacterial can initiated at the phosphorous concentrations between 100 μg l^{-1} to 1000 μg l^{-1} [15].

2.4. Temperature dependence of algal booms

Range of temperature has deep impact on the algal blooms. Algal blooms start towards the beginning of the spring where the intensity of the light is highest and the temperature also increase. Usually blue-green algal blooms develop during this season. Algal blooms are sustained during warmer days of the year. Water temperatures above 25°C supports the growth of cyanobacteria. At these temperatures, blue-green algae dominate over other types of algae whose optimal growing temperature is much lower usually between 12°C to 15°C. In temperate equatorial regions, lower temperature during winter months is not suitable for sustaining the growth of blue-green algal blooms. Higher water temperatures in tropical regions may cause blue-green algal blooms to persist throughout the year [16].

2.5. Light plays a major in growth of blue-green algae

Long duration of high light intensities is inhibitory for the growth of blue-green algae populations. This photo-inhibition checks the growth of algal blooms but the intermittently exposed high light intensities are favorable for their growth. These conditions are met under the water surface where light environment is fluctuating. In turbid conditions or in the conditions of low light the blue-green algae can also grow luxuriantly with higher growth rates than any other types of algae [16]. Thus, a critical competitive advantage of flexibility of growth in all types of light conditions gives the cyanobacteria evolutionary benefit to sustain their growth in variety of water bodies and lakes such as Amalnala.

2.6. Stable Conditions and its effects on algal blooms

Stable water conditions of low flow, low turbulence, light winds and long retention time with low tides and turbid environments are the most favorable conditions for the growth of blue-green algae. Other type of algae prefers mixing water conditions and turbulent environments. Since, Amalnala dam is built as a part of irrigation project on Amalnala river, it slowed the flow of river. Decrease in the water flow can also be brought by drought, water extraction for irrigation, human and stock consumption and the regulation of rivers by dams. In standstill water conditions water becomes ponded, which encourages the growth of algae. In water bodies, another consequence of stable conditions is thermal stratification. In thermal stratification the upper region of water column becomes warmer as compared to the lower and deeper water column. These temperature changes results in the stability of the water body and the mixing of water are also halted. This is when the upper warmer layer in summer months supports the growth of blue-green algae resulting in the buoyant algal blooms. When a water body is stratified, bottom waters often become depleted with oxygen. These anoxic conditions may lead to increased nutrient release from the sediments supporting the growth of cyanobacteria [17]. Source of nutrient from the colder bottom layer may fuel up the algal growth in the top layer.

2.7. Turbidity affects the algal growth

Reduction on the water appearance due to the presence of suspended particles and scattering of the light is turbidity. Turbidity is caused by the presence of suspended particles and organic matter (flocs) in the water column. Heavy downfall followed by heavy runoff of water and the acid rains are the main factors contributing the high turbidity of the water body. Less suspended particles in the water body causes less turbidity. Stable or slow-moving water allows the suspended particles to settle down resulting in the low turbidity. Low turbidity increases the availability of light to the lowest strata of the water column and benefits the growth of algae. This creates optimal conditions for algal growth. In return, growing algae create a turbid environment [18].

2.8. Mitigating of pesticide pollution by microorganisms

Both abiotic and biotic factors are responsible for the fate of the pesticides (Fig. 2). Degradation of pesticides by action of microorganisms is known as biodegradation [19]. Rate of degradation of pesticides is variable. Recalcitrant pesticides such as DDT (1, 1, 1-trichloro-2, 2-bis-(*p*-chlorophenyl) ethane) and dieldrin take longer time to get degraded and thus remain for the longer time in environment. These pesticides accumulate into the food chain [20].

Pesticides such as the organophosphates are now used preferably than more persistent chlorinated pesticides. Pesticides such as Atrazine and simazine have comparatively very slow rate of biodegradation. This

increases their chances of getting leached from soil to ground water, and contaminate drinking water sources [21]. Some pesticides are very fast degrading but low bioavailability decreases the rate of effectiveness of such pesticides. Examples of such pesticides are carbofuran and diazinon. They are broken down so rapidly under certain soil conditions that they may not allow effective pest control [22]. Thus, depending on the type of pesticides and their degradation rates, they should be chosen wisely and it is also import to study the fate of particular pesticide in environment and the factors that limit their activity *in situ*. The mechanism of degrade pesticides by microbes has been studied and reviewed in depth and extensively [23-25]. Thus, it is important to study the bacterial metabolism factors influencing the degradation of pesticide degradation, genes involved in the catabolic pathways of the degradation. All the factors will holistically contribute in the selection and application of pesticides so as to avoid ground water pollution and lake water pollution causing in greening of the lakes.

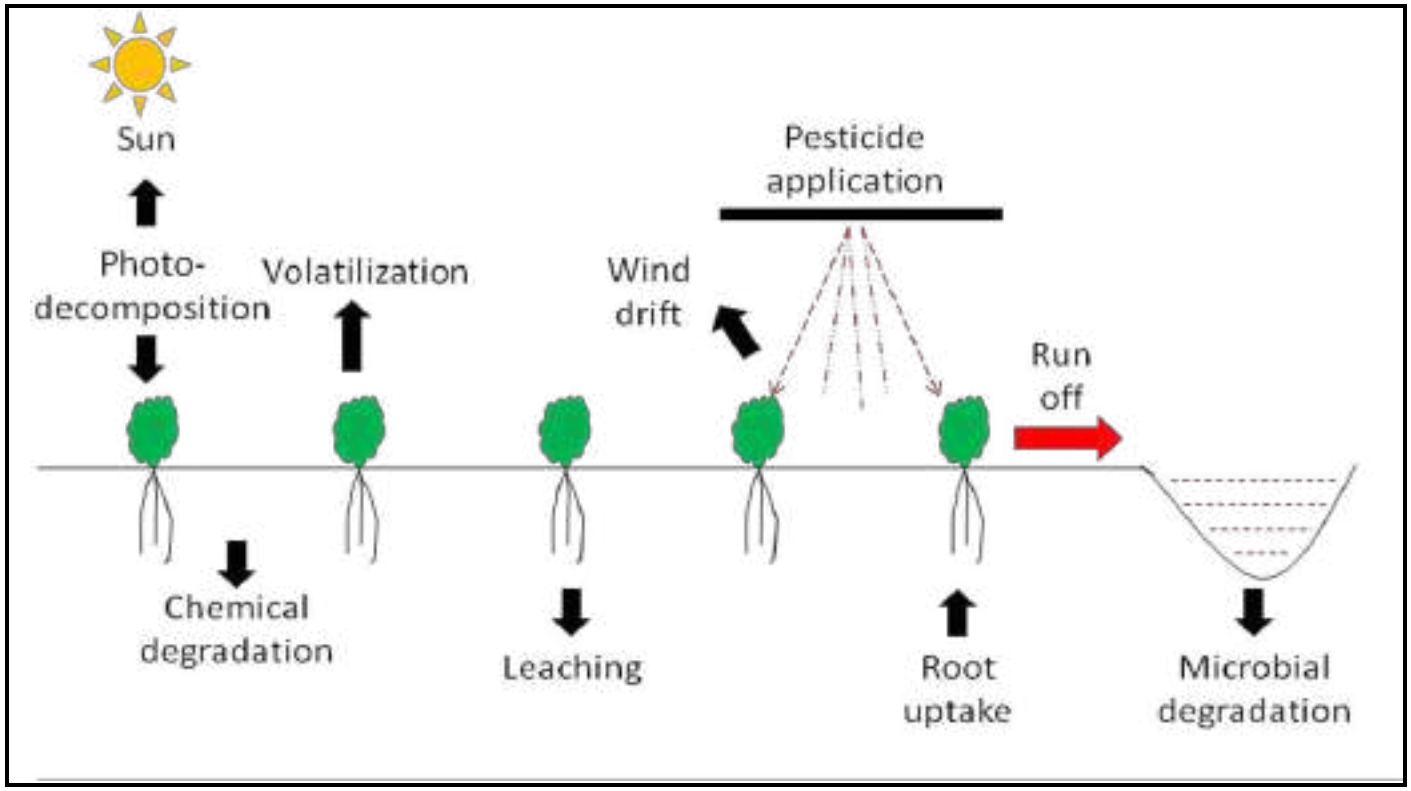

Fig. 2:Fate of pesticides in the environment

3. CONCLUSION

Effective management of the all the factors responsible of the growth of the cyanobacteria many avoid the greening of the Amalnala dam. In depth studies followed by the isolation and identification of the cyanobacteria followed by the physico-chemical studies of lake water, identification of the pesticides in the lake and mitigating the pesticide degradation by the microorganism will be the effective way to control eutrophication and algal blooms.

Conflict of interest

Authors declare that there is no conflict of interest.

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