INVESTIGATION OF THE ULTRASONIC BEHAVIOR IN WATER AND AMINES SOLUTIONS AT LOW CONCENTRATIONS

Dr. Dr. R. E. Ugandar[1*], Sachinkumar Dnyaneshwar Gunjal[2], Sandeep Gupta[3], Pragati Baghel[4], Nemalapalli yamini[5], Pravin Sampat Tajane[6]

Article History: Received: 12.12.2022 **Revised:** 29.01.2023 **Accepted:** 15.03.2023

Abstract

Aqueous solution different solution showcases different properties. Moreover, the aqueous solution of different molecules indicated different properties of a molecule and different behaviour highlighted. Thus, the study aims for analysing the impact of amine molecules in an aqueous solution. Moreover, the implication of, the aqueous molecule is discussed with mathematical expression. The following study has discussed the implication of an aqueous solution and the ultrasonic behaviour of the amine solution. Moreover, abortion of the Diethylamine water is discussed in the study helps to understand the ultrasonic property of water solution of some molecule In addition, homogenization theory is used in order to describe the properties of the acquiesce solution indicating the ultrasonic property of the molecule. The analysis is done based on the aqueous solution of the different water-based molecules and their properties which indicated the basic structure of the amine solution. Similarly, the implication of different molecules related to the amine solution is described in the study.

Keywords- Diethylamide water solution, amines water solution homogenization theory, water and amines solution

[1*]Professor and Head, Department of Pharmacy Practice, Santhiram College of Pharmacy, NH-40, 518112, Panyam (M), Nandyal, District, Andhra Pradesh, India
[2]Department of Pharmaceutics, Amrutvahini College of Pharmacy, Sangamner, Maharashtra State, India. Savitribai Phule Pune University. Pin-422605.
[3]Principal, Tagore Institute of Pharmacy and Research, Turkadih Bypass Road, Sakri, Bilaspur, Chhattisgarh 495001, India
[4]Associate Professor, Faculty of Pharmacy, Bharti Vishwavidhalaya, chandrakhuri- 49122, Chhattisgarh
[5]Assistant professor (adhoc) Department of Pharmacology Jntua otpri, jawaharlal nehru technological University, Ananthapuramu, Andhra Pradesh,515001
[6]Department of Pharmaceutical Chemistry, S.V.N.H.T's College of B.Pharmacy, Rahuri Factory, Dist-Ahmednagar, Maharashtra-413706, India

DOI: 10.31838/ecb/2023.12.1.111

1. Introduction

Diluted solution when in the water of different amines showcases a supersonic behaviour that is directly related to sound. Moreover, no electrolytes in the cause solution for a water-rich region indicated supersonic property [1]. Thus the ultra-diluted solution indicated such behaviour Due to the stability of the hydrogen bond. Therefore the ultrasonic velocity data is gathered and analysed in order to understand the molecular function of the molecular amine when diluted in an aqueous solution. Thus the study has presented a detailed discussion about different mine bonding among molecules and with the help of numerical analysis a detailed view is presented in the study. Moreover, the implication of amine solution is discussed in the studying order to analyse the molecular bonding of the molecule and the amine molecule. The study has discussed the maintained bonding of the water molecule with different amines attached the formation of the molecule is described in a detailed manner according to the process associated with the diluted solution. Additionally ultrasonic abortion of the Diethylamine water is discussed in the study.

Objectives

The analysis of the topic and detailed discussions are done based on the following objectives:

- To analyse the ultrasonic behaviour of follicles
- To understand the aqueous solution of amine in different solution
- To analyse the hydrogen bond of the amine and water molecule
- To discuss the aqueous property of amine
- To discuss the problems related to a dilute solution of water in amine

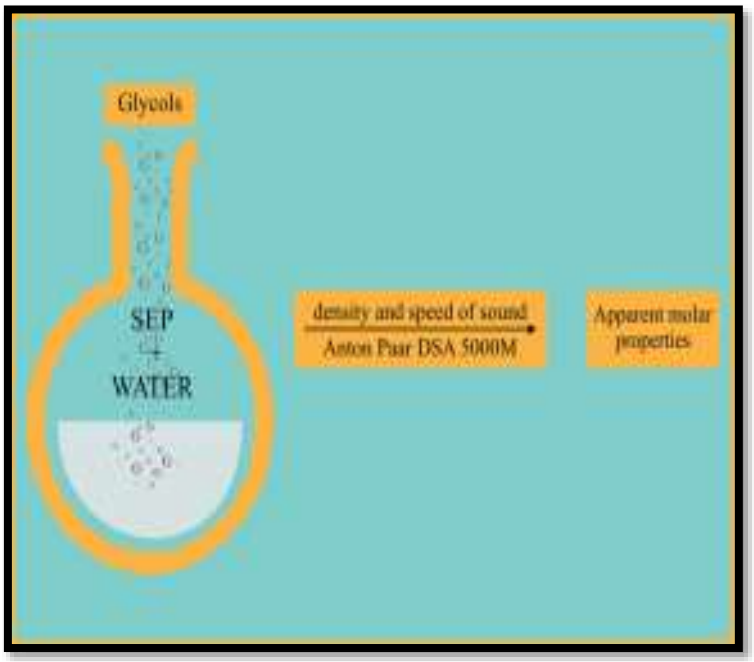

Figure 1: Water base mixing of ammine for ultrasonic property

2. Methodology

The methodology of a study is related to the exact steps undertaken for the development of a study [11]. In order to analyse the overall study secondary qualitative methadone of analysis was used. Secondary qualitative methods of analysis provide an overall understanding of the topic through an appropriate review of sanctity data. In order to collect data secondary method was used where the collected data was gathered from the analysis. Similarly, the qualitative data related to the collected data helps to have an appropriate and detailed discussion related to the topic [10]. Thus with the implication of secondary qualitative methods, a detailed analysis is conducted. Moreover, the implication of a secondary qualitative method helped to analyse the overall data related to the equalised solution of different amines and the ultrasonic properties.

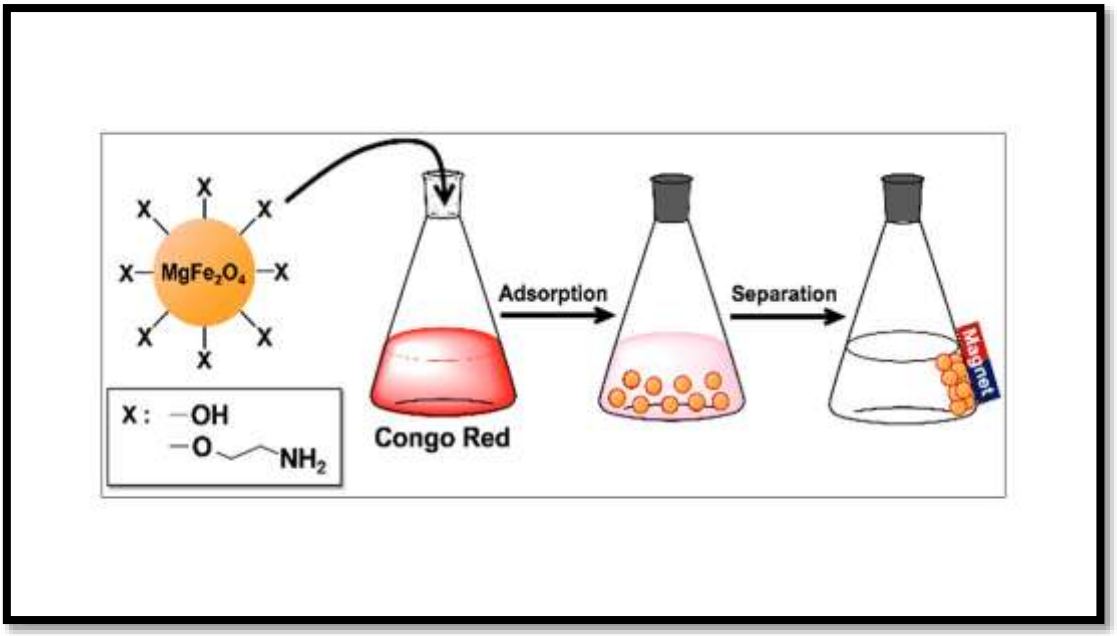

Figure 2: Amine molecule separation in water base

3. Discussion Related To Ultrasonic Velocities

The relationship between the ultrasonic velocities, u, in diluted water solutions in diethylamide, di-sec-butyl amine, butyl amine, and triethylamine can be described like x^2 from the water base. Theus thermodynamically validity of a solution is determined through the following equation

$$u^E = u_{exp} - u_{id}$$

where

$$u_{id} = \frac{1}{(\rho_{id}\beta_{id})^{1/2}}$$

and

$$\beta_{id} = K_{id} - \frac{TV_{id}(\alpha_{id})^2}{C_{pid}}$$

Here

$$\rho_{id} = \phi_1\rho_1 + \phi_2\rho_2$$
$$K_{id} = \phi_1 K_1 + \phi_2 K_2$$
$$\alpha_{id} = \phi_1\alpha_1 + \phi_2\alpha_2$$
$$V_{id} = X_1 V_1 + X_2 V_2$$
$$C_{pid} = X_1 C_{p1} + X_2 V_{p2}$$

In the above equation K, ρ, α, φ, X, β, V and Cp describe a fraction and volume of the solution, mole fraction of the reaction, adiabatic compressibility, and isothermal compressibility of used solution. In addition density, the coefficient of thermal expansion, and volume and heat capacity are described in mole at constant pressure respectively.

Additionally First suffix of the solution refers for the solvent which is organic and the presence of pure water is represented by the second suffix.

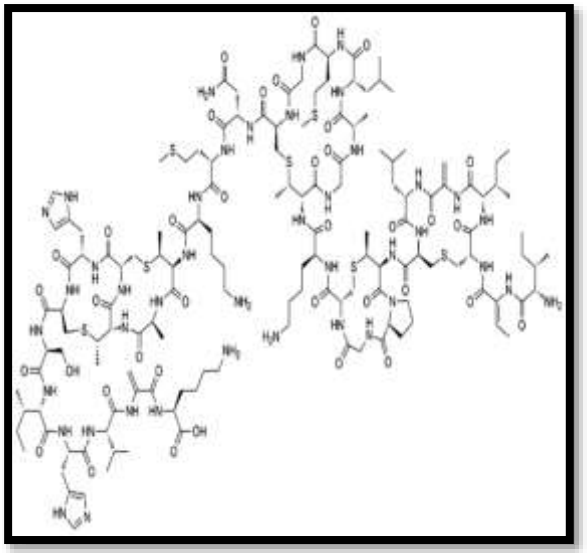

Figure 3: Molecular structure of ammine with water that shows ultrasonic property

The following table is related to the pure liquid specifications needed to calculate u^E. In contrast to the molar heat capacity data, the ultrasonic density velocity, and the coefficient of thermal expansion data in the table come from a related study.

Furthermore due to the high and intensive molecular interactions between the water molecule and the soul amine molecule that is specific to an aqueous mixture when compared with other mixtures' whistles solubility.

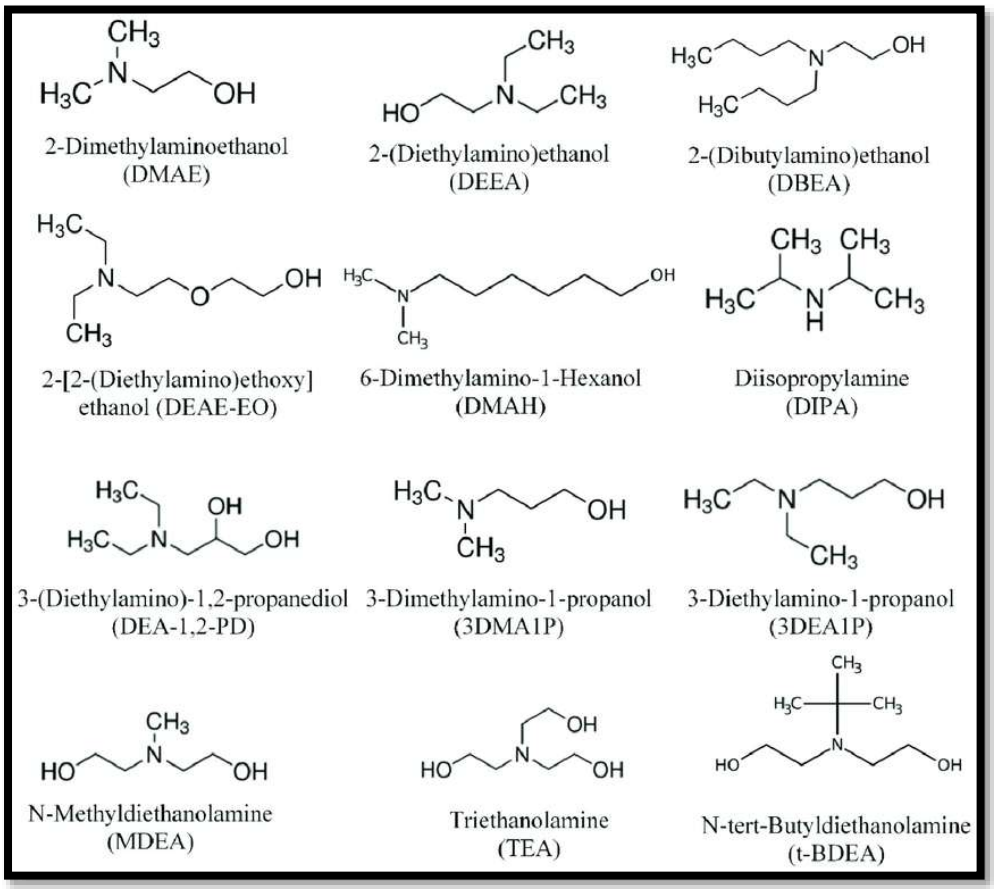

Figure 4: Table of outcome relate to different solutions
(Source: 6)

The structure of the solution related with amine and water moreover the diethylamide may be considered as an open solution than an ideal solution that indicates hydrogen bonding or other weak bonds between molecules clusters of aqueous solution molecules and diethylamine.

Homogenization Theory

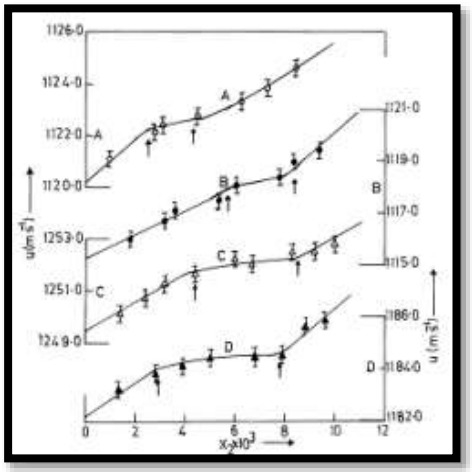

Figure 5: Graphical presentation of different molicule ultrasonic property

The homogenisation theory describes the diffusion of different solutions that shows macromolecular properties in water solution [14]. Homogenisation of different macromolecules is important in order to describe the macromolecule property of different solutions. It is important to understand the bonding properties of different macromolecules and their ability to mix in aqua solution [13]. Therefore, the ability of different macromolecules is described with the help of homogenization theory. Different biological aspects such as drug diffusion, assembly of protein and encapsulation of cells are described with the help of the homogenized nature of different solutions [11]. Thus in order to derive the ultrasonic capabilities of an aqueous solution in amine bases theory of homogenisation is implemented. Moreover, the implication of the homogenisation theory helped to describe the ultrasonic velocity of different water base solutions therefore it is possible to describe the ultrasonic nature of water-based solutions. From the figure adobe, it can be seen that four different molecules of water and amine solution highlight different ultrasonic properties [16]. The four different molecules are dimer, octamer, monomer, and quadra mar of a water molecule. Therefore, the ultrasonic behaviour of the water solution might be for the presence of water molecules in the molecular structure. Additionally, the presence of different water bases indicates uniform behaviour in the water base [9].

Liquid	u ($m\,s^{-1}$)	ρ ($kg\,m^{-3}$)	C_p ($J\,mol^{-1}\,K^{-1}$)	$\alpha \times 10^4$ (K^{-1})	$\beta \times 10^{11}$ ($N^{-1}\,m^2$)	$K \times 10^{11}$ ($N^{-1}\,m^2$)	Ref
Water	1496.7	997.07	75.3	2.59	44.77	45.25	6
Diethylamine	1120.2	702.56	169.2	12.94	113.27	143.01	25
Triethylamine	1115.1	723.62	219.9	12.45	111.14	140.45	25
Dibutylamine	1249.1	755.62	292.9	11.11	84.70	106.19	25
Di-sec-butyl-amine	1182.0	748.84	253.2	11.46	95.81	134.26	25

Figure 6: Different molecule of amine base and there ultrasonic property

Problem Statement

During the study, it was found that there is a problem regarding the dilution of the solution. The increases in the ultrasonic velocity of the water impact the concentration of the solution. Therefore the ultrasonic property of the equation decreases. Similarly, increasing velocity further impacts the velocity of the molecule.

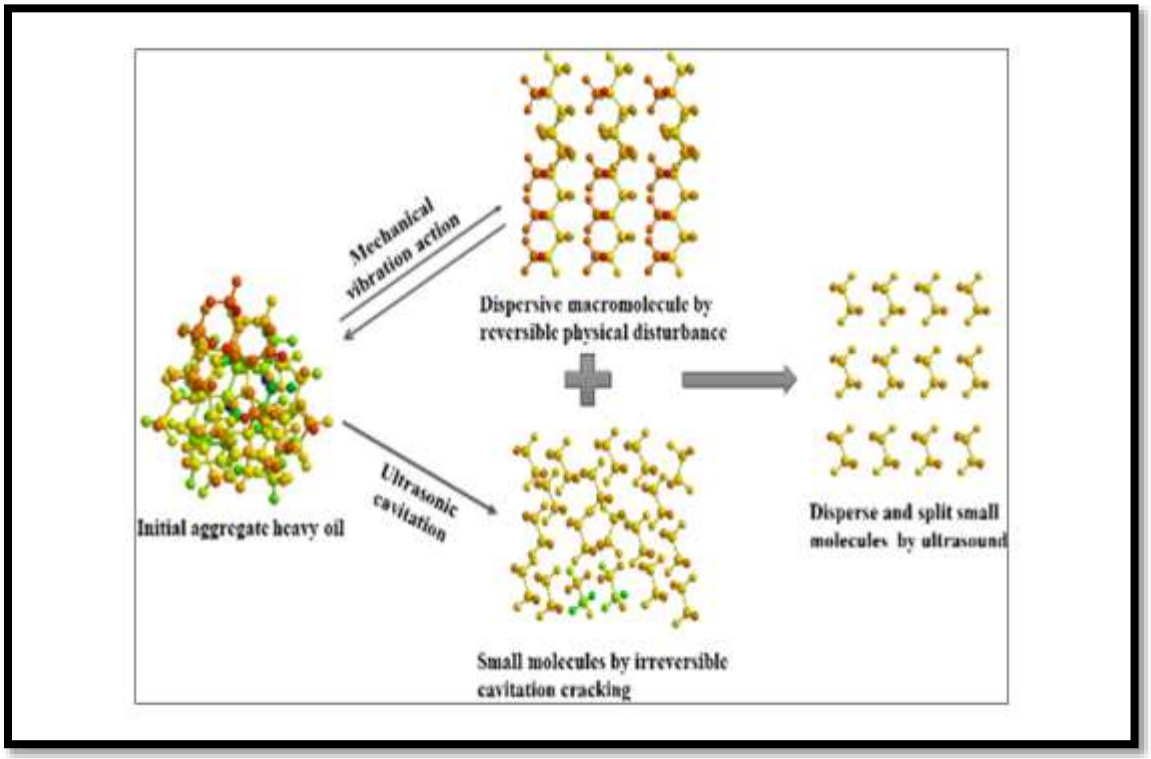

Figure 7: Molecular structure of water base that shows ultrasonic property (Source: 15)

Thus, it is suggested that the development of hydrogen bonds between the water and amine molecules, which intensify with an increase in the amines' molecular weight, causes the structure of the solutions to be more open. Hence, in diluted solutions of amines, the interaction between water molecules and amine molecules rises as the molecular weight increases. In addition, the problem is related to the bonding of the molecule with different elements. It was found that at the time of bonding with water molecules a weak hydrogen bond might disrupt the ultrasonic capabilities of an aqueous solution.

4. Conclusion

Thus, the above discussion highlighted different factors related to the equalised solution of amine. It was found that the implication of amines in the Aquse solution showcases ultrasonic properties. It was noticed the hydrogen bond between an amine molecule and a water molecule plays an important role at the time of highlighting ultrasonic properties formed in an aqueous solution. The findings show that except at very low concentrations, amine molecules missed with the water solution indicated ultrasonic velocity. Furthermore, various solutions are nonlinear with water concentration in all systems. the highest concentrations at which a linear trend can be seen is when there is a strong bond between the amine molecule and the water molecules. In the end, it can be concluded that the ultrasonic property of the water base solution of amine is due to the rigidity of bonds.

5. References

Azarpour, A., Zendehboudi, S., Yusup, S., Khalid, A., & Zhang, Y. (2019). Effects of ultrasonic cavitation on neutralization process of low molecular weight polyethylene glycol. *The Canadian Journal of Chemical Engineering*, *97*(1), 395-405.Available At: https://www.academia.edu/download/93026111/cjce.2330920221025-1-1jpwwju.pdf

Bacciocchi, M., Savino, V., Lanzoni, L., Tarantino, A. M., & Viviani, M. (2022). Multi-phase homogenization procedure for estimating the mechanical properties of shot-earth materials. *Composite Structures*, *295*, 115799.Available At:

https://www.sciencedirect.com/science/article/pii/S0263822322005694

Chakraborty, N., Kaur, K., Juglan, K. C., & Kumar, H. (2020). Volumetric and ultrasonic studies on interactions of glycols in aqueous solutions of xylitol at different temperatures. *Journal of Chemical & Engineering Data*, *65*(4), 1435-1446.Available At: https://www.academia.edu/download/72298410/acs.jced.9b00869.pß

Cui, Q., Zhang, A., Li, R., Wang, X., Sun, L., & Jiang, L. (2020). Ultrasonic treatment affects emulsifying properties and molecular flexibility of soybean protein isolate-glucose conjugates. *Food Bioscience*, *38*, 100747.Available At: https://www.sciencedirect.com/science/article/pii/S2212429220310853

Dewani, R., Rasheed, M., Ahmed, F., Asim, M. Z., Shaikh, M., & Pervez, M. K. (2022). Ultrasound-assisted reduction of bis azo dye into aromatic amines on natural textile fibres: A greener approach. *Coloration Technology*, *138*(3), 315-326.Available At: https://www.researchgate.net/profile/Farman-Ahmed-2/publication/357582285_Ultrasound-assisted_reduction_of_bis_azo_dye_into_aromatic_amines_on_natural_textile_fibres_A_greener_approach/links/61d83ca3e669ee0f5c8f082a/Ultrasound-assisted-reduction-of-bis-azo-dye-into-aromatic-amines-on-natural-textile-fibres-A-greener-approach.pdf

Du, Q., Engquist, B., & Tian, X. (2020). Multiscale modeling, homogenization and nonlocal effects: Mathematical and computational issues. *Contemporary mathematics*, *754*, 115-140.Available At: https://arxiv.org/pdf/1909.00708

Hasani, K., Peyghami, A., Moharrami, A., Vosoughi, M., & Dargahi, A. (2020). The efficacy of sono-electro-Fenton process for removal of Cefixime antibiotic from aqueous solutions by response surface methodology (RSM) and evaluation of toxicity of effluent by microorganisms. *Arabian Journal of Chemistry*, *13*(7), 6122-6139.Available At: https://www.sciencedirect.com/science/article/pii/S1878535220301593

Huidobro, P. A., Silveirinha, M. G., Galiffi, E., & Pendry, J. B. (2021). Homogenization theory of space-time metamaterials. *Physical Review Applied*, *16*(1), 014044. Available At:

Juglan, K. C., & Kumar, H. (2020). Ultrasonic and volumetric behaviour of glycols with sodium ethylparaben in aqueous medium from T= 293.15 to 308.15 K at atmospheric pressure. *Results in Chemistry*, *2*, 100049.Available At:

Mishra, S. B., & Alok, S. (2022). Handbook of research methodology.Available At: https://www.nkrgacw.org/nkr%20econtent/nutrition%20and%20dietetics/PG/II.M.Sc%20N&D/BookResearchMethodology.pdf

Pandey, P., & Pandey, M. M. (2021). *Research methodology tools and techniques*. Bridge Center.Available At: http://dspace.vnbrims.org:13000/jspui/bitstream/123456789/4666/1/RESEARCH%20METHODOLOGY%20TOOLS%20AND%20TECHNIQUES.pdf

Shin, H., Choi, J., & Cho, M. (2019). An efficient multiscale homogenization modeling approach to describe hyperelastic behavior of polymer nanocomposites. *Composites Science and Technology*, *175*, 128-134.Available At: https://www.sciencedirect.com/science/article/pii/S026635381832774X

Singh, S., Dhal, K., & Talukdar, M. (2020). A comparative study on the effect of temperature and concentration on density, sound velocity and their derived properties for diclofenac potassium in aqueous urea media. *Biointerface Res. Appl. Chem*, *10*(5), 6377-6388.Available At: https://biointerfaceresearch.com/wp-content/uploads/2020/05/2069583710563776388.pdf

Zafarani-Moattar, M. T., Shekaari, H., & Mazaher Haji Agha, E. (2019). Investigation of the thermodynamic properties in aqueous solutions containing d-fructose and some imidazolium-based ionic liquids at different temperatures. *Journal of Chemical & Engineering Data*, *64*(4), 1385-1398.Available At: https://www.academia.edu/download/68496218/14774315.pdf

Zhao, X., Jiang, X., Peng, D., Teng, J., & Yu, J. (2021). Behavior and mechanism of graphene oxide-tris (4-aminophenyl) amine composites in adsorption of rare earth elements. *Journal of Rare Earths*, *39*(1), 90-97.Available At: https://www.sciencedirect.com/science/article/pii/S1002072119308221