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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]

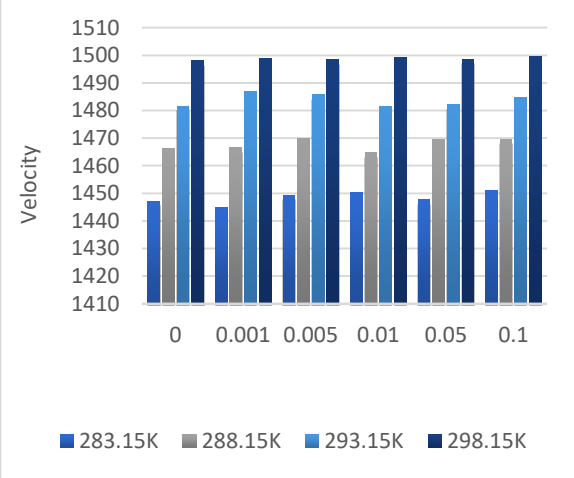

Fig.1 Variation of velocity with conc. and temp.

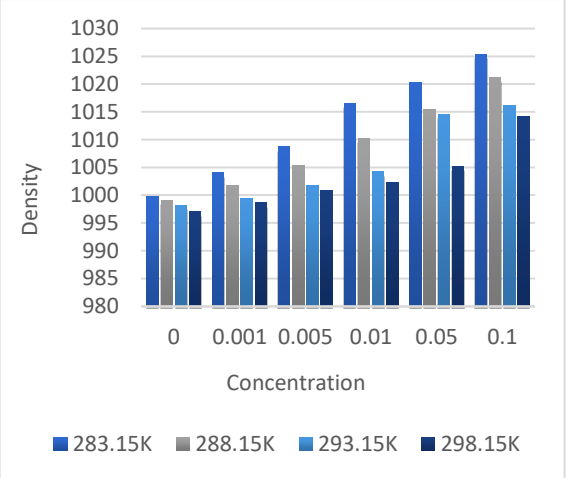

Fig.2 Variation of Density with conc. and temp.

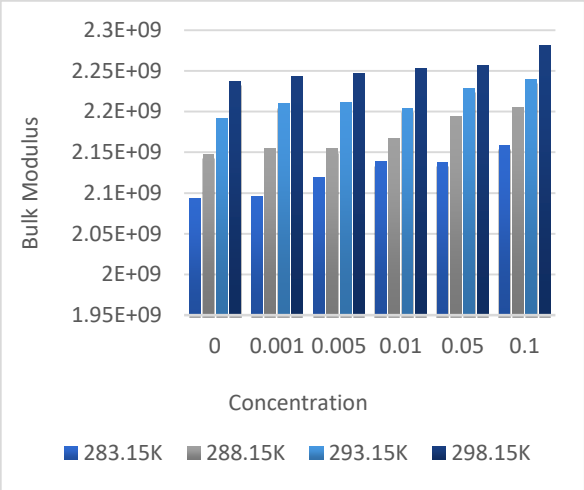

Fig.3 Variation of Bulk modulus with conc. and temp.

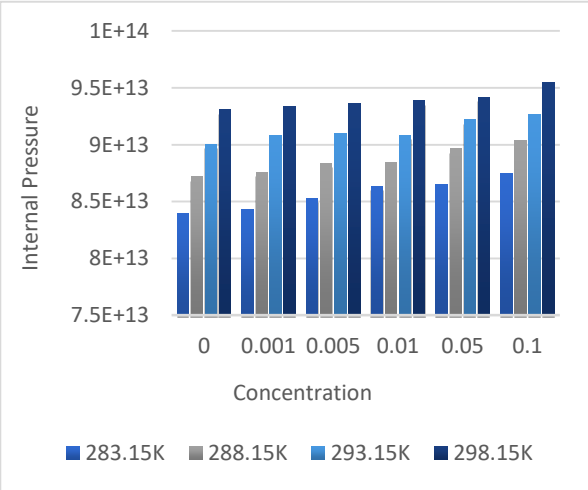

Fig.4 Variation of internal pressure with conc. and temp.

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

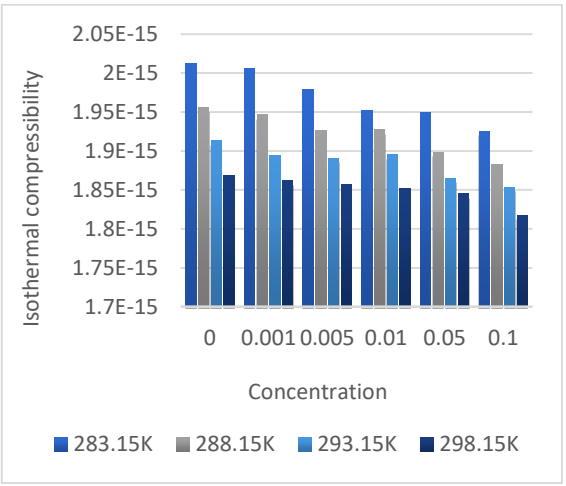

Fig.5 Variation of k_{T1} with conc. and temp.

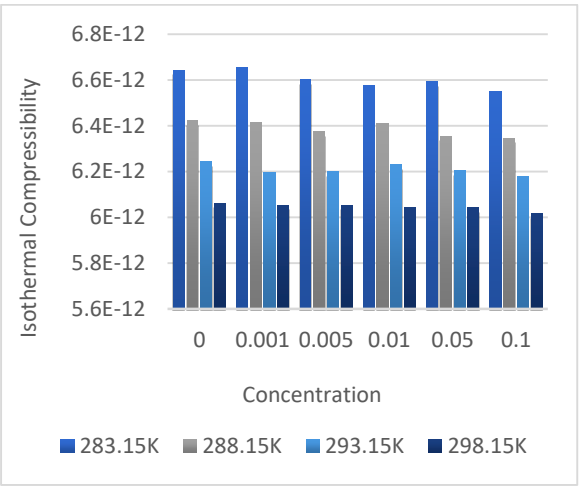

Fig. 6 Variation of k_{T2} with conc. and temp.

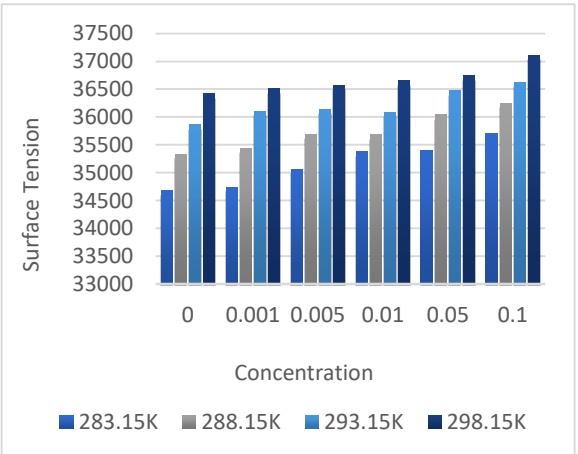

Fig.7 Variation of surface tension with conc. and temp.

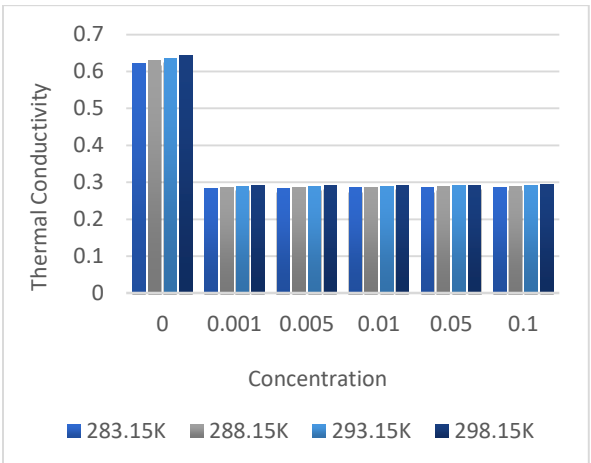

Fig.8 Variation of thermal conductivity with conc. and temp.

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.

REFERENCE

1. M.Praharaj, S. Mishra, *Journal of Chemical Science*, vol 5(6) , pp 32-39 , (2015).
2. S. Sasikumar, G. Meenakshi, *International Journal of Research in Engineering and Technology*, vol 04, (2015)
3. G. Coleman, A. Alvarado, *Organic Synth*eses, vol 3, pp 3-5, (1923)
4. A. Dash, R. Paikaray, *Journal of Chemical Science*, vol 4(3), pp 45-53 , (2014).
5. J. McGowan, *Nature (londan)*, vol 210(43), pp 36, (1969).
6. J. Pandey, Vyaas, Pramana, *Journal of Physics*, vol 43, pp 36, (1994)
7. P. Mishra, A. Lad, U. Manik, *Journal of pure Applied Ultrason.*, vol 43, pp 27-34, (2021).
8. S. Geetha, K. Renuka, S. Rathika, A. Gomalthiyalini, *International Journal of Recent Scientific Research*, vol 5, pp 1585-1588, (2014).
9. P. Mishra, A. Lad, U. Manik, *International Research Journal of Science and Engineering*, pp 260-265, (2020)
10. M. Rashin, J. hemalatha, *Journal of Molecular Liquid*, vol 197, pp 257-262, (2014)
11. P. Bageshwar, N.Pawar , O.Chimankar , *International Journal of Science and Research*, pp 199-201, (2013).
12. V.Dudhe, V.Tabhane , O.Chimankar , C.Dudhe , *Universal Journal of Applied Science*, vol 2(2) , pp 53-56 (2014).
13. M.Iqbal, R. Venrall, *Canadian Journal of Chemistry*, vol 64(7) , pp 727-735 , (1989).
14. N. Pawar, O. Chimankar, S. Dhoble, G. Aghalte, *Journal of pure Applied Ultrason* , vol 38 , pp 65-70 , (2016).
15. J. Marty, W. Andrew, Hakin, M. Michelle, Journal *of Chemical Society Faraday Trans.* , vol 90 , pp 20-27 (1994).
16. P. Mishra, U. Manik, *International Journal of Science and Research*, pp 215-217 (2013).
17. V.Yusufova, R. Pepinov, V. Nekolev, G. Guseinov, *Inzh. Fiz. Zh*., vol 29(4) pp 600-605, (1975).