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Inter Molecular Interaction of Amino Acids at Different Temperatures

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***Abstract* - The structure of liquids is less well established than that of gases or solids. Despite a great deal of research in this area, we still do not have a clear picture of the way in which molecules are arranged in even the most common liquid, water. We do, however, have a reasonably detailed knowledge of the average distances between atoms or molecules in a liquid. Moreover, we can estimate with considerable accuracy the magnitude of the forces between particles in a liquid. Since the molecules in a liquid are much closer together than those in a gas, attractive forces between molecules are considerably stronger.**

Keywords – Amino Acids, Temperatures, Molecular Interaction.

I. INTRODUCTION

The energy of perfect gas is the sum of the internal energies and the transactional kinetic energies of the individual molecules, the intermolecular potential energy being zero. The inter-atomic or vibrations have low potential energies. However in this case also an adequate partition function can be obtained. In a liquid Cohesive forces are not strong enough to present a considerable transactional energy to individual molecules. A liquid shows short range ordering in space. Ultrasonic studies of electrolytic solutions yield valuable information about the nature and strength of molecular interactions. The estimation of ultrasonic velocity helps to evaluate the internal pressure and free volume of solutions.

Internal pressure of liquids provides a wealth of information about the state of liquid. It explains many of the properties of liquids and solutions. Internal pressure though a single factor appears to vary due to all the internal interactions such as hydration of solute solvent interactions.

The effect of temperature and concentration on internal pressure and free volume are studied and quantitative relationships are established. The dependence of internal pressure and free volume on each other is also checked.

II. EXPERIMENTAL STUDIES

The aqueous solution of Aspartic Acid and Glutamic Acid

(AR Grade) is dissolved in double distilled water for making up different concentrations under study. A Mittal type fixed frequency Interferometer (2 MHz) is used for the determination of Ultrasonic velocity. A 10 ml specific gravity bottle& cannon Fenske Viscometer was used for determining both density & viscosity of the solutions respectively. A circulating thermostat to maintain the temperature of the system constant for temperature variation studies. If the distance is now increased or decreased and the variation is exactly one half wavelength (λ/2) or multiple of it, anode current becomes maximum. From the knowledge of wavelength (λ)) the velocity (v)can be obtained by the relation:

Velocity =Wavelength x Frequency

v= λ x f where λ= 2d / n

Mathematical formulas:

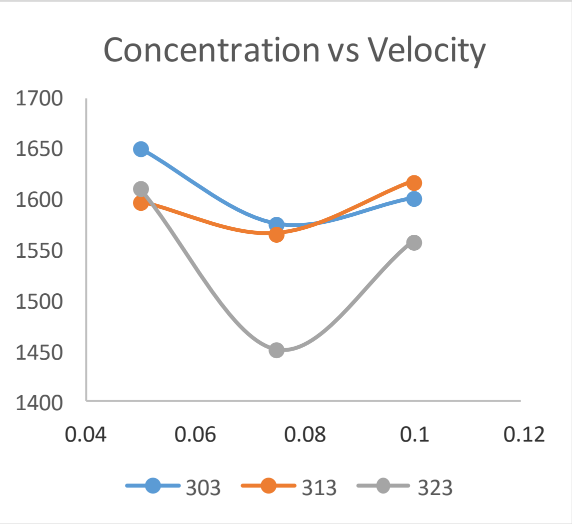
Rao's Constant(R)=

$$R = \frac{M}{\rho} \bullet u^{1/3}$$

$$\text{Internal Pressure } \pi_i = bRT\left(\frac{K'\eta}{u}\right)^{\frac{1}{2}} \frac{\rho^{\frac{2}{3}}}{M^{\frac{7}{6}}}$$

$$\text{Free Volume } V_f = \left(\frac{MU}{K'\eta}\right)^{\frac{3}{2}}$$

III. GRAPHS - ASPARTIC ACID



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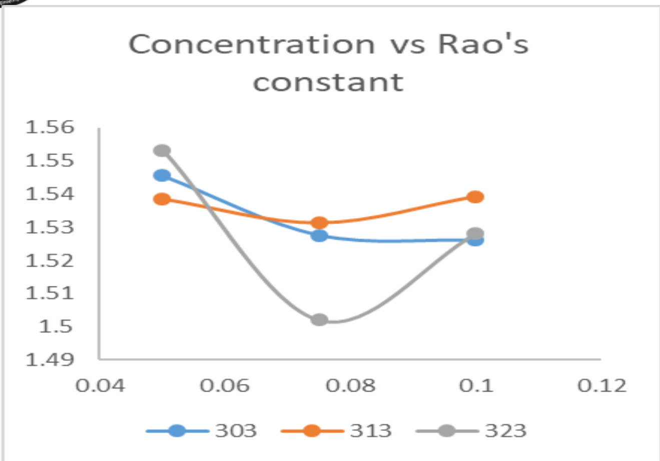
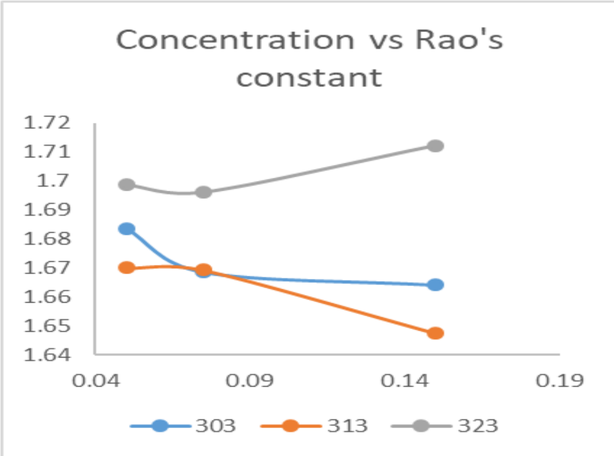
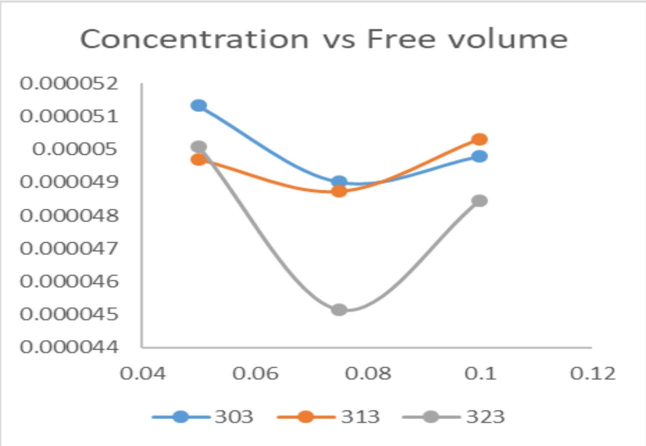
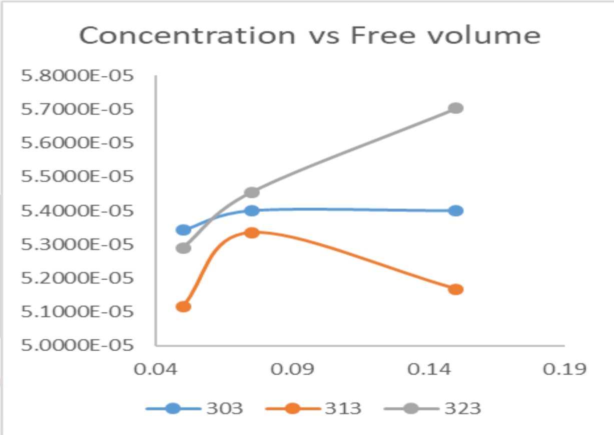
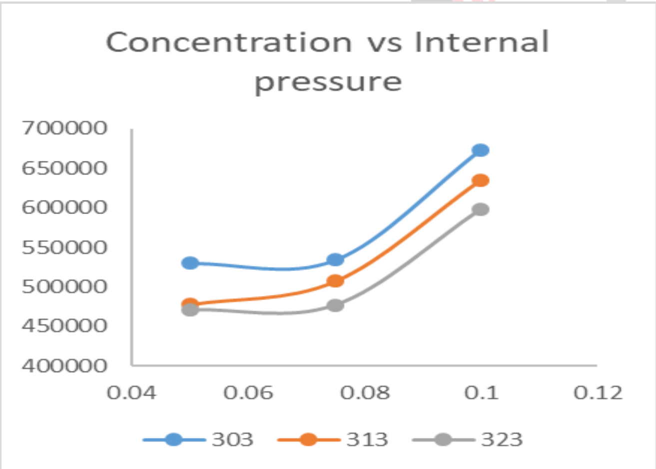
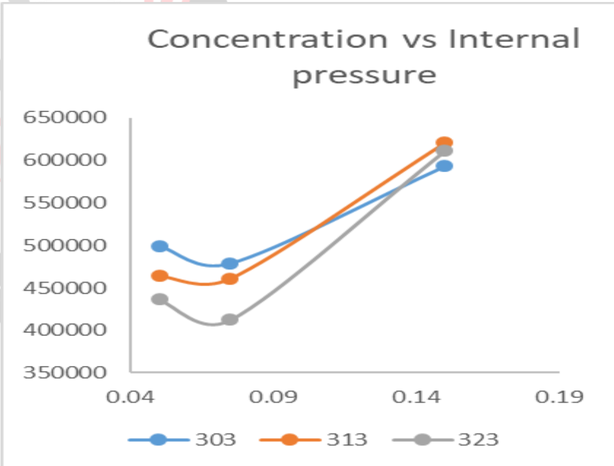




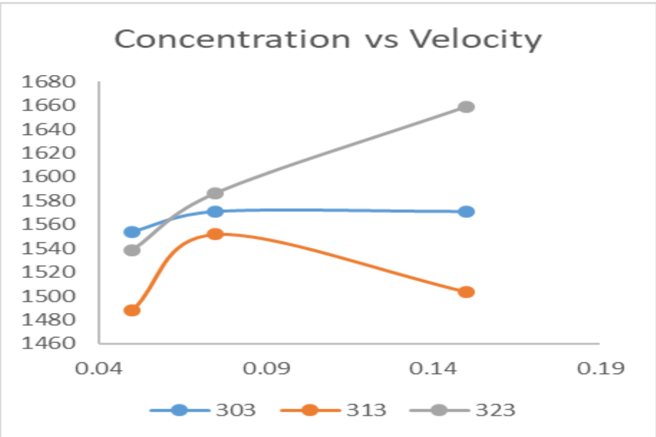








Graphs ***Glutamic acid***



IV. RESULTS AND DISCUSSION

The experimentally determined values of ultrasonic velocity for Aspartic Acid and Glutamic Acid at temperatures at 303K,313K 323K are summarized in the table.

The measurement of ultrasonic velocity is an important tool to study the physical & chemical properties of the liquid. Ultrasonic velocity and allied parameters of for Aspartic Acid and Glutamic Acid for various concentrations, at different temperatures are represented graphically in figures.

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The parameters derived from ultrasonic measurements such as Internal Pressure,Free Volume,Rao's Constant prove a better insight into molecular environment in liquid mixtures and solutions.

In this the ultrasonic velocity increases with increase in both temperature and concentration.

The plots between the ultrasonic velocity and concentration potential shows that the ultrasonic velocity is found to decrease and then linearly increase with concentrations and temperatures. This linear increase suggests that there are strong solute-solvent interactions in the liquid solution. These interactions are both concentration and temperature dependent. The effects of temperature on the interactions are more than that of concentration. At low concentrations, the number of hydrogen bonds formed may be less and at higher concentrations, it may be more due to solute-solute interactions[Graph1].

The variations of molar sound velocity (Rao's constant) shows similar trend with the variation of concentrations and temperatures as achieved in Velocity[Graph 2].

Thermodynamic importance of internal pressure is shown by bringing out its quantitative relationship with entropy and the partition function of the system. Internal pressure is shown to be related to the transport properties in liquids and solutions. As stated in the review the study of internal pressure is important as it reflects the sum total balance of solvent-solute, solute-solute and solvent-solvent interactions in a liquid solution system. The method of computing the internal pressure from the salvation number is also developed and is compared with the method suggested by Suryanarayana .Internal Pressure decreases with increase in temperature[Graph4] .

The free volume plays on important role in ultrasonic wave propagation in liquids. Free Volume changes with increase in temperature[Graph 3] .

V. CONCLUSION

Based on the ultrasonic analysis of the sample the Ultrasonic velocity indicates that there is more solute-solvent interaction.

Based on Internal Pressure and Free volume it explains the relationship with Entropy and also explains the transport properties of a liquid.

Rao established the empirical relationship between molecular weight, density and ultrasonic velocity of liquids.

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