ACOUSTIC PARAMETERS OF PANTOPRAZOLE SOLUTION AT DIFFERENT CONCENTRATION

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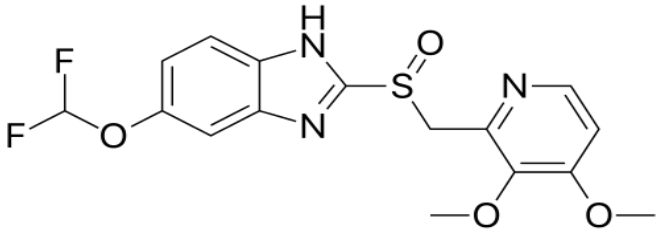
ABSTRACT
Experimental measurements of ultrasonic velocity, density and viscosity have been carried out on aqueous solution of Pantoprazole at different concentrations at 303 K temperature and 2 MHz frequency. Ultrasonic studies may throw more light on the molecular interaction to know the behavior of solute and solvent molecules in liquid mixtures and solutions. Acoustical parameters as Adiabatic compressibility (β_a), Intermolecular free length (L_f)and Relaxation time (τ) for aqueous solution of Pantoprazole solution were calculated from ultrasonic velocity and effect of concentration on molecular interaction was predicted.

Keywords: Concentration, Impedance Molecular, Pantoprazole, Ultrasonic

I. Introduction:

Ultrasonic study is very much useful for characterizing the Physico-chemical behavior of liquids mixtures and measurements are used to study molecular interactions in the liquids [1,2]. The ultrasonic technique is a powerful and effective tool for investigation of different types of molecular interaction present in the solution. The measurement of ultrasonic velocity has been adequately employed in understanding the molecular interactions in liquid mixtures. Ultrasonic velocity measurement have been successfully employed to detect and assess weak and strong molecule interactions, present in binary and ternary liquidmixtures[3] Molecular interaction studies can be carried out by bothspectroscopic[4-5] and non–spectroscopic[6-7] techniques. However, ultrasonic velocity[8] and viscosity[9] measurements have been widely used in the field of interactions and structural aspect evaluation studies. The ultrasonic study of liquid mixtures have of greater significance in under-standing intermolecular interactions between the component molecules as they can locate numerous applications in industrial and technological processes[10-11].Pantoprazole is used to treat certain stomach and esophagus problems (such as acid reflux). It works by decreasing the amount of acid your stomach makes. This medication relieves symptoms such as heartburn, difficulty swallowing, and persistent cough. It helps heal acid damage to the stomach and esophagus; helps prevent ulcers, and may help prevent cancer of the esophagus. Pantoprazole belongs to a class of drugs known as proton pump inhibitors (PPIs). In the present investigation ultrasonic velocity, densities and viscosities were measured at different concentrations. The effect of concentration on molecular interaction was predicted from acoustical parameters. The structure of pantoprazole is as below



II. Materials and methods

The ultrasonic velocity (U) in liquid mixtures which prepared by taking purified AR grade samples, have been measured using an ultrasonic interferometer (Mittal type, Model F-81) working at 2MHz frequency and at temperature 303K. The accuracy of sound velocity was ±0.1 ms^{-1}. An electronically digital operated constant temperature water bath has been used to circulate water through the double walled measuring cell made up of steel

containing the experimental solution at the desire temperature. The density of pure liquids and liquid mixtures was determined using pycknometer by relative measurement method with an accuracy of ±0.1Kgm^{-3}. An Ostwald's viscometer was used for the viscosity measurement of pure liquids and liquid mixtures with an accuracy of ±0.0001NSm^{-2}. The temperature around the viscometer and pycknometer was maintained within ±0.1K in an electronically operated constant temperature water bath. All the precautions were taken to minimize the possible experimental error.

Using the experimental data of ultrasonic sound density, velocity and viscosity, various acoustical parameters such as adiabatic compressibility (βa), Intermolecular free length (L_f)and relaxation time (τ) have been calculated from the measured data using the following standard expressions:

$\beta_a = (U^2\rho)^{-1}$ .... (1)

$L_f = K_T\beta a^{1/2}$ .... (2)

$\tau = 4/3\eta\beta_a$ …. (3)

Where, K_T is the temperature dependent constant, K is constant equal to $4.28*10^9$ in MKS system, T is the experimental temperature,

III. Results and Discussion

The experimentally measured values of Density (ρ), Ultrasonic velocity (U) and Viscosity (η) and calculated thermodynamic parameters Adiabatic compressibility (βa), Intermolecular free length (L_f) and relaxation time (τ) of aqueous solution of Pantoprazole at different concentrations at temperatures 303 K at frequency 2 MHz are presented in Table-1.

Table-1 clearly shows that, density and Viscosity decreases with increasing concentration of aqueous solution of Pantoprazole at temperatures 303K. The ultrasonic velocity values also have the opposite trend in the system. Velocity increases in this system, suggesting thereby more association between solute and solvent molecules [6-8].

The structural change of the molecules in the mixture takes place due to the existence of electrostatic field between the interacting molecules. The structural arrangement of the molecule affects the adiabatic compressibility. From the Table-1, the adiabatic compressibility and free length decreases with increases of concentration of Pantoprazole in the solution. This indicates the presence of strong hydrogen bonding between the molecules of the liquid mixture. Generally, when the ultrasonic velocity increases; the value of free length decreases [9,10].

But relaxation time (τ)have completely reverse trend with that of velocity.Thus, a progressive decrease in relaxation time (τ)in aqueous solution of Pantoprazole mixtures clearly indicates the existence of intermolecular interaction, due to which the structural arrangement is considerably affected. This also indicates the significant interactions in the system [11-14].

Table 1: The experimentally measured values of Density (ρ), Ultrasonic velocity (U), Viscosity (η) and the calculated values of Adiabatic compressibility (β_a), Intermolecular free length (L_f)and Relaxation time (τ) for aqueous solution of Pantoprazole at different concentrations at temperatures 303 K at 2MHz frequency.

Composition	Velocity U(m/s)	Density ρ(kg/ m^3)	Viscocity η*10^{-3} (CP)	Adiabatic Compre. (βa*10^{-10})	Free Length L_f*10^{-12}	Relaxation time τ *10^{-13} (Sec)
0.00025	1452.66	1530	0.5361	3.097	36.22	2.214
0.005	1539.42	1520	0.4723	2.776	34.30	1.748
0.01	1664.66	1506	0.3191	2.396	31.86	1.023

IV. Conclusion

The ultrasonic velocity, density, viscosity and other related parameters were calculated. The existence of type of molecular interaction in solute-solvent is favored in the system, confirmed from the U, ρ, η, βa, $L_f$and τ data. The variation in ultrasonic velocity (U), density (ρ) and viscosity (η) and other related thermodynamic parameters such as βa, $L_f$and τ at various concentrations and at 303K temperature in the aqueous solution of Pantoprazole shows the variation -linear. Strong intermolecular interactions are confirmed in the systems investigated.. This provides useful information about inter and intra molecular interactions of the mixture as existing in the liquid system.

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