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Comparative Studies of Aqueous Solution Some Anta Acids at Different Concentration Andat 4MHz Frequency

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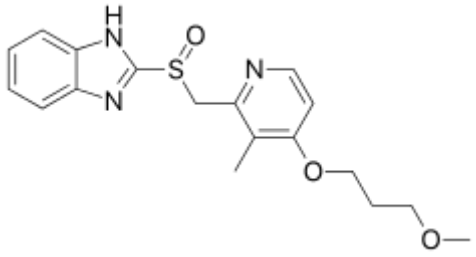
Abstract: *Ultrasonic velocity measurements have been made in aqueous solution of some anta acids at frequency 4MHz , different concentration and at temperature 303.15k.The experimental values of ultrasonic velocity (U) and densities (ρ) were useful to calculate acoustic parameters as adiabatic compressibility(βa), intermolecular free length(L_f)and acoustic impedance (Z). From these values molecular interaction present in the solution was predicted. The molecular interaction is useful to predict reactivity of the drugs.*
Keywords: *Anta acids,Concentration, Impedance, Molecular, Ultrasonic*

I. Introduction:

The ultrasonic studies are widely used to estimate the thermodynamic properties and predict the intermolecular interactions in pure liquid [1], liquid mixtures [2] and ionic interactions in electrolytic solutions[3]. Bythe propagation of ultrasonic waves,the nature of molecular interaction of the system can be determined.Ultrasonic wave propagation in a medium affects its physical properties.The Physico-chemical behavior of different liquids mixtures and measurements can used to study molecular interactions in the liquids by ultrasonic study [4-6.]

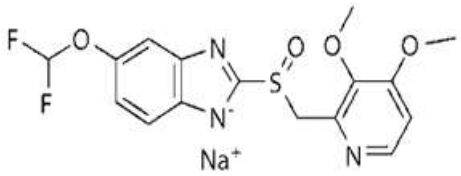
Rabeprazole sodiumis used for the purposes of gastric acid suppression. This effect is beneficial for the treatment and also prevention of conditions in which gastric acid directly worsens symptoms, such as duodenal and gastric ulcers. In the setting of gastroesophageal reflux disease (GERD), whose pathophysiology is characterized by prolonged exposure to gastric acid in the esophagus (often due to changes in stomach and/or esophagus anatomy, such as those induced by abdominal obesity), acid suppression can also provide symptomatic relief.

The structure of Rabeprazole is as below

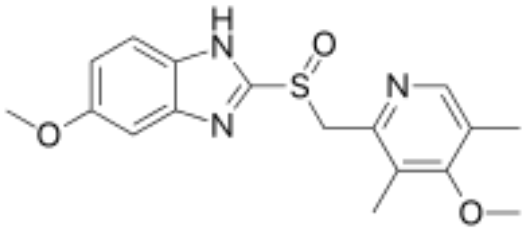


Pantoprazole is alsoused to treat certain stomach and esophagus problems (such as acid reflux). It works by decreasing the amount of acid that stomach makes. This medication relieves symptoms such as heartburn, difficulty swallowing, and persistent cough. It alsohelps heal acid damage to the stomach 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).Pantoprazole can also be used to treat or reduce the risk of stomach ulcers due to medications known as nonsteroidal anti-inflammatory drugs (NSAIDs), which irritate the stomach. In the present investigation ultrasonic velocityand densities were measured at different concentrations. The effect of concentration on molecular interaction was predicted from different acoustical parameters.

The structure of pantoprazole is as below



Omeprazole can be also used in the treatment of gastroesophageal reflux disease(GERD), peptic ulcers, erosive esophagitis, Zollinger-Ellison syndrome, and eosinophilic esophagitis[7,8].
The structure of Omeprazole is as below-



II. Materials And Methods

The ultrasonic velocity (U) in liquid mixtures have been measured using an ultrasonic interferometer (Mittal type, Model F-81) working at 4MHz 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}. All the precautions were taken to minimize the possible experimental error.

Adiabatic compressibility (βa), Intermolecular free length (L_f)andSpecific acoustical impedance (Z)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)

$Z = U\rho$ … (3)

Where, K_T is the temperature dependent constant

III. Results And Discussion

The experimentally measured values of Ultrasonic velocity (U),Density (ρ) and calculated thermodynamic parameters Adiabatic compressibility (βa), Intermolecular free length (L_f) and Specific acoustical impedance (Z)of aqueous solution of some anta acids Rabeprazole, Pantoprazole and Omeprazole at different concentrations at temperatures 303 K at frequency 4MHz are presented in Table-1.

Table-1 clearly shows that, ultrasonic velocity increases with increasing concentration of aqueous solution ofRabeprazole sodium, Pantoprazole and Omeprazole at temperatures 303K. But it shows that the solution of Rabeprazole sodium has the high ultrasonic velocity values by suggesting that more cohesion exist in solution of Rabeprazole sodium indicating strong solute – solvent interaction. The density values also have the same trend in the system. Velocity increases in this system, suggesting thereby more association between solute and solvent molecules [9,10].

Ultrasonic velocity in the solutions depends on intermolecular free path length.In Rabeprazole ultrasonic velocity is highest while it decreases in Pantoprazole and Omeprazole gradually. It shows that the there is strong molecular interaction in the Rabeprazole as compared to others.More is the ultrasonic velocity more is the cohesive forces in the molecules. This indicates that there is a significant interaction between phytochemicals of Rabeprazoleand the solvent.

The decrease of adiabatic compressibility in aqueous solution of Rabeprazole sodium, Pantoprazole and Omeprazoleshows that there is formation of more hydrogen bonding in Rabeprazolesodium as compared to others [9,10].

The free length dependents on the adiabatic compressibility and inverse to that of velocity. Intermolecular free length is minimum in Rabeprazolesodiumas compared to others in water shows strong

molecular interaction in water suggesting a structure promoting behavior ofRabeprazolesodiumas compared to others with the water solvent.

Acoustic impedance is more in Rabeprazole sodium as compared to others shows more molecular interaction in water solvent. The acoustic impedance (Z) (which is the product of ultrasonic velocity and density of the solution) increases with increase in concentration, and increase of Z with the concentration of Rabeprazole sodium, Pantoprazole and Omeprazole suggest the presence of intermolecular interactions between solute and solvent. [11-16].

Table 1: The experimentally measured values of Ultrasonic velocity (U), Density (ρ)and the calculated values of Adiabatic compressibility (βa), Intermolecular free length (L_f) and Specific acoustical impedance (Z)for aqueous solution of some anta acidsRabeprazolesodium, Pantoprazole andOmeprazole at different concentrations at temperatures 303 K at 2MHz frequency.

Concentration (M)	Aqueous solution of some anta acids	Velocity U (m/s)	Density ρ(kg/ m^3)	Adiabatic Compressibility $\beta_{aa} *10^{-10}$ (Pa^{-1})	Intermolecular free length $L_f *10^{-10}$ (m)	Acoustic Impedance $Z*10^4$ (kg/m^2s)
0.0001	Rabeprazole	1661.35	1315.01	2.75	0.0105	218.46
	Pantoprazole	1535.38	1503.89	2.81	0.0106	230.94
	Omeprazole	1470.01	1400.02	3.3	0.0115	205.8
0.001	Rabeprazole	1699.27	1316.45	2.63	0.0103	223.46
	Pantoprazole	1585.75	1507.21	2.63	0.0103	239.00
	Omeprazole	1501.28	1402.65	3.16	0.0113	210.57
0.01	Rabeprazole	1703.45	1318.47	2.61	0.0102	224.59
	Pantoprazole	1592.2	1509.63	2.61	0.0102	246.36
	Omeprazole	1545.38	1404.57	2.98	0.0109	217.05

IV. Conclusion

The ultrasonic velocity, density and other related parameters were calculatedfor aqueous solution of some anta acids Rabeprazolesodium, Pantoprazole and Omeprazole. The strong molecular interaction in solute-solvent is favored in the Rabeprazolesodium, confirmed from the U, ρ, Adiabatic compressibility (βa), Intermolecular free length (L_f)andSpecific acoustical impedance (Z)data. From the molecular interactions reactivity of the drug may be predicted.

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