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Studies the acoustic properties of mixed ligand in DMF-water mixture at 303.15K

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Abstract: Acoustical properties have been measured for ligand (Ondansetron) in DMF-water mixture at 303.15K. The measurement have been perform to evaluate acoustical parameter such as adiabatic compressibility (βs), Partial molal volume (ϕ_v), intermolecular free length (L_f), apparent molal compressibility (ϕ_κ), specific acoustic impedance (Z), relative association (R_A), salvation number (Sn).

Key words: Ultrasonic velocity, Salvation number, specific acoustic impedance.

INTRODUCTION

The selected drug used to prevent nausea and vomiting caused by chemotherapy, radiation therapy, migraines, or surgery [1]. In present scenario, measurements of the Ultrasonic velocity are helpful to interpreted solute-solvent, ion-solvent interaction in aqueous and non aqueous medium [2-6]. Fumio Kawaizumi [7] have been studied the acoustical properties of complex in water. Jahagirdar et. al. has studied the acoustical properties of four different drugs in methanol and he drawn conclusion from adiabatic compressibility . The four different drugs compress the solvent methanol to the same extent but it shows different solute-solvent interaction due to their different size, shape and structure [8]. Meshram et. al. studies the different acoustical properties of some substituted Pyrazolines in binary mixture acetone-water and observed variation of ultrasonic velocity with concentration[9]. Palani have investigated the measurement of ultrasonic velocity and density of amino acid in aqueous magnesium acetate at constant temperature [10]. The ion-dipole interaction mainly depends on ion size and polarity of solvent. The strength of ion-dipole attraction is directly proportional to the size of the ions, magnitude of dipole. But inversely proportional to the distance between ion and molecules. Voleisines has been studied the structural properties of solution of lanthanide salt by measuring ultrasonic velocity [11]. Syal et.al. has been studied the ultrasonic velocity of PEG-8000, PEG- study of acoustical properties of substituted heterocyclic compounds under suitable condition[12],[13]. Mishra et.al. have investigated ultrasonic velocity and density in non aqueous solution of metal complex and evaluate acoustic properties of metal complex **[14].** M. Arvinthraj et.al. have determined the acoustic properties for the mixture of amines with amide in benzene at 303K-313K .They also determined thermodynamic parameters **[15].** S. K. Thakur et.al. have studied the different acoustical parameters of binary mixture of 1-propanol and water **[16].**

The ultrasonic interferometric investigations of 3-(chloroaryl)-5-aryl-1-substituted pyrazolines in different percentage of dioxane medium at different temperature have studied by Deshmukh and Raghuwanshi **[17]**. They are reported that the ultrasonic velocity decreases with increase in percentage of organic solvent.Thorat S. A. and Thakur S. D.have studied theultrasonic behaviour and molecular interaction of substituted 3,5-diaryl isoxazoline in different percentage DMF-water mixture at 305 K. They reported that there is weak solute-solvent interaction in all systems **[18]**.

Ultrasonic behviour and study of molecular interactions of chalcone in dioxane at different concentrations and in different percentages of dioxane- water mixture at 305 K at 1 MHz frequency have been investigated by Pathare **[19]**. The investigator has been studied the Ultrasonic study of molecular interactions in organic liquid with CCl4 at different temperature **[20].** The researcher studied the Ultrasonic Wave Velocity and Adiabatic Compressibility: Comparative Analysis in Phenol and Water **[21].**

After review of literature survey the detail study of substituted heterocyclic drug under identical set of experimental condition is still lacking. It was thought of interest to study the acoustical properties of substituted heterocyclic drug under suitable condition.

EXPERIMENTAL

The substituted heterocyclic drug is used in the present study. DMF was purified by Vogel's standard method [22]. The double distilled dioxane is used for solution preparation of different drug. The density was determined by using specific gravity bottle by relative measurement method with accuracy ± $1x10^{-5}$ gm/cm^3. The ultrasonic velocity was measure by using ultrasonic interferometer having frequency 2MHz (Mittal Enterprises, Model No F-81) .The constant temperature is mentioned by circulating water through the double wall measuring cell made up of steel.

In the present investigation different parameters such as adiabatic compressibility (βs), apparent molal volume (ϕ_v), intermolecular free length (L_f), apparent molal compressibility (ϕ_κ), specific acoustic impedance (Z), relative association (R_A), Solvation number (S_n) were studied.

RESULTS AND DISCUSSION

From table-1, these found that ultrasonic velocity decreases with increase in percentage of dioxane for all systems. Variation of ultrasonic velocity in solution depends upon the increase or decrease of molecular free length after mixing the component, based on a model for sound propagation proposed by Eyring and Kincaid [23]. It was found that, intermolecular free length increases linearly on increasing the percentage of dioxane in solution. The intermolecular free length increase due to greater force of interaction between solute and solvent by forming hydrogen bonding. This was happened because there is significant interaction between ions and solvent molecules suggesting a structure promoting behavior of the added electrolyte .This may also indicates that decrease in number of free ions showing the occurrence of ionic association due to weak ion-ion interaction. The value of specific acoustic impedance (Z) increases with increase in percentage of dioxane in all substituted heterocyclic compounds in dioxane. The increase of adiabatic compressibility with increase of percentage of dioxane in solution may be due to collection of solvent molecule around ions, this supporting weak ion-solvent interaction [24-25]. This indicates that there is significant solute-solvent interaction. The increase in adiabatic compressibility following a decrease in ultrasonic velocity showing there by weakening intermolecular interaction.

From table-2, it is observed that apparent molal volume decreases with increase in percentage of dioxane in all system indicates the existence of weak ion-solvent interaction. The value of apparent molal compressibility is increase with increase in percentage of dioxane of all systems. It shows strong electrostatic attractive force in the vicinity of ions. It can be concluded that strong molecular association is found in all systems. The value of relative association decreases with increase in percentage of dioxane in all systems. It is found that there is weak interaction between solute and solvent.

The Solvation number decrease with increase in percentage of dioxane due to weak solute-solvent interaction. There is regular decrease in Solvation number with increase in percentage of dioxane indicates the decrease in size of secondary layer of Solvation. The Solvation number in all system decreases with increase in percentage of dioxane indicates the solvent molecule forms weak coordination bond in primary layer.

Table-1: Ultrasonic velocity, density, adiabatic compressibility (β_S), Specific acoustic impedance (Z) Intermolecular free length (L_f) in different percentage of dioxane-water mixture.

% of DMF	Density(ds) Kg m-^{3}	Ultrasonic velocity (Us) m s^{-1}	Adiabatic compressibiliy (β_S) x10^{-10}m^{2}N^{-1}	Intermolecular free length (L_f) x10^{-11}m	Specific acoustic impedance (Zx10^6)kg m^{-2} s^{-1}
Ondeansetron + DMF					
45	964.18	1514.32	4.2025	4.1224	1.5377
55	965.99	1509.68	4.2207	4.1313	1.5528
65	967.99	1504.40	4.2419	4.1417	1.5558
75	969.98	1492.40	4.3016	4.1707	1.5643

Table-2: Concentration (m), Relative association (R_A), apparent molal compressibility (ϕ_κ), Apparent molal volume (ϕ_v), Solvation number (S_n)-

% of DMF	Apparent molal volume (ϕ_v) m^{3}mole^{-1}	Apparent molal compressibility (ϕ_κ)x10^{-9} m^2 N^{-1}	Relative association (R_A)	Solvation number (S_n)
Ondeansetron + DMF				
45	0.9375	0.7921	1.0372	1.1891
55	0.9350	0.7941	1.0030	0.9726
65	0.9313	0.7965	0.9687	0.7851
75	0.9277	0.8062	0.8875	0.4673

CONCLUSION

In the present study mentions the experimental data for ultrasonic velocity, density and at 303.15 k for all substituted heterocyclic drug in water mixture. From experimental data calculated acoustical parameters and studied to explanation solute-solvent interaction and ion-ion / solute-solute interaction are existing between drug and DMF-water mixture. From experimental data it can be conclude that weak solute-solvent interaction in all systems.

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