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ULTRASONIC VELOCITY, DENSITY MEASUREMENT OF SCHIFF BASE OF (5-HYDROXY -3-METHYL-1-(2, 4-DINITROPHENYL) PYRAZOL-4-YL) (PHENYL) METHANONE AND ISONIAZIDE IN DIOXANE-WATER AT 303 K

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ABSTRACT

Using the ultrasonic velocity and density measurements of Schiff base of (5-hydroxy -3-methyl-1-(2,4dinitrophenyl)-pyrazol-4-yl)(phenyl)methanone and Isonicotic acid hydrazide (isoniazid) the acoustical properties have been studied in 10% 1, 4 dioxane at 300K. The acoustical parameter such as intermolecular free length (Lf), adiabatic compressibility (□s), Partial molal volume (□v), specific acoustic impedance (Z), apparent molal compressibility (□ k), relative association (RA), solvation number (Sn) have been evaluated and from the experimental data it is concluded that the interaction between solute and solvent in Schiff base of benzoyl Pyrazolone & dioxane systems are strong.

Keyword: - Apparent molal volume, Adiabatic compressibility, Schiff base, Ultrasonic velocity, Viscosity.

I. INTRODUCTION

In the modern research, interpretation of solute-solvent, ion-solvent interaction in non-aqueous and aqueous medium is done via measurements of the Ultrasonic velocity[1-5]. The acoustical properties of complex in water have been determined by F. Kawaizumi et.al[6]. The acoustical properties of four different drugs in methanol have been determined by Jahagirdar et.al[7]. And the conclusion was drawn by him from adiabatic compressibility. The solvent methanol compress by four different drugs to the same extent but their solute-solvent interaction is different due to the difference in their size, shape and structure[8]. The different acoustical properties of some substituted Pyrazolines in acetone-water binary mixture have been determined by Meshram et.al[9]. and he observed that the ultrasonic velocity vary with concentration. The ultrasonic velocity and density of amino acid in aqueous solution of magnesium acetate at constant temperature have been investigated by Palani et.al[10]. The ion-dipole interaction largely influenced by the size of ion and polarity of solvent. The strength of ion-dipole attraction is directly related to the ion size and magnitude of dipole but inversely related to the space between

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molecules and ion. By measurement of ultrasonic velocity, the structural properties of solution of lanthanide salt have been studied by Voleisines et.al[11]. The ultrasonic velocity of PEG-8000 and substituted heterocyclic compounds under suitable condition have been determined by Syal et.al[12]. The thermodynamic and acoustical properties of citric acid in water at various temperatures have been studied by Tadkalkar et.al[13]. The acoustic properties, ultrasonic velocity and density of metal complex in non-aqueous solution are evaluate by Mishra et.al[14]. The thermodynamic parameters and acoustic properties for the solution of amide and amines in benzene have been determined by M. Arvinthraj et.al[15]. The different acoustical parameters of water and 1-propanol binary mixture have been studied by S.K. Thakur et.al[16]. The molecular interaction of liquids has been investigated by Mirikar et.al[17].The survey of literature show that, the detail study of Schiff base of Benzoyl Pyrazolone and Isonicotic acid hydrazide (isoniazid) under indistinguishable set of experimental circumstance is still lacking. It was thought of interest to study the acoustical properties of Schiff base of (5-hydroxy-3-methyl-1-(2,4dinitrophenyl)-pyrazol-4-yl)(phenyl)methanone and Isonicotic acid hydrazide (isoniazid) under appropriate condition.

II. EXPERIMENTAL

In the present study, the Schiff base of (5-hydroxy -3-methyl-1-(2,4dinitrophenyl)-pyrazol-4-yl)(phenyl)methanone and Isonicotic acid hydrazide (isoniazid) was used. Vogel's standard method use for purification of Dioxane[22]. The solution of different concentration of Schiff base was prepare in double distilled dioxane. The specific gravity bottle use to determine the densities by relative measurement method with accuracy ± $1x10^{-5}$ gm/cm^3. The ultrasonic interferometer having frequency 3MHz was used to determine the ultrasonic velocities. The temperature maintain constant by circulating water through the double wall measuring steel cell.

In the present analysis, different properties such as intermolecular free length (Lf), adiabatic compressibility (βs), apparent molal volume (ϕ_v), apparent molal compressibility (ϕ_κ),relative association (RA), specific acoustic impedance (Z), limiting apparent molal compressibility (ϕ^0_κ), limiting apparent molal volume(ϕ^0_v), solvation number(Sn) and their constant (S_k, S_v) have been evaluated.

III. THEORY

Adiabatic compressibility (βs) is calculated by using the relation

$$\beta s = \frac{1}{U^2_s d_s} \qquad (1)$$

Apparent molal compressibility (ϕ_κ) is determine by using the relation

$$(\phi_\kappa) = 1000 \text{ x } \left(\frac{\beta s\, d_0 - \beta 0\, d_s}{m \text{ x } ds \text{ x } d_0} \right) + \frac{\beta s \text{ x } M}{ds} \qquad (2)$$

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Where d_s,βs and d_0,β0 are the density and adiabatic compressibility of solution and solvent respectively. m is concentration of solute in terms of molality and The molecular weight of solute is M .

$$\text{Apparent molal volume } (\phi_v) = \frac{M}{ds} \times \frac{(d_0 - ds) \times 10^3}{m x ds x d_0} \quad (3)$$

Specific acoustic impedance (Z) = Us ds (4)

Intermolecular free length (L_f) = K√βs (5)

Relative association (R_A) = $(ds / d_0) \times (U_0 / U_s)^{1/3}$ (6)

$$\phi_\kappa = \phi^0_\kappa + S_k C \quad (7)$$

$$\phi_v = \phi^0_v + S_V C \quad (8)$$

III. RESULTS AND DISCUSSION

In the present study, different acoustical properties such as Ultrasonic velocity (Us), adiabatic compressibility (β_S), Specific acoustic impedance (Z) and Intermolecular free length (L_f) are recorded in table-1. Solvation number (S_n), Relative association (R_A), Apparent molal volume (ϕ_v), Apparent molal compressibility (ϕ_κ) are recorded in table-2. Limiting Apparent molal compressibility (ϕ^0_κ), Limiting Apparent molal volume and their constant (S_k, S_v) are recorded in table-3. It was found that when concentration for system increase the ultrasonic velocity also increase (Table-1). Deviation of ultrasonic velocity in solution is depends on the decrease or increase of molecular free length after mixing the component. This is based on a model proposed by Eyring and Kincaud[13] for sound propagation. When concentration of Schiff base of benzoyl Pyrazolone in 10% 1, 4 dioxane increase Intermolecular free length(L_f) decrease linearly and hence increased in ultrasonic velocity observed with increase in concentration of Schiff base of benzoyl Pyrazolone. It was occurred due to strong interaction between solvent and ion molecules suggesting a structure promoting behavior of the added electrolyte. The specific acoustic impedance (Z) increased with the increase in concentration of Schiff base of benzoyl Pyrazolone in 10% dioxane. When concentration of electrolyte was increased, increase in ionic strength is observed hence the thickness of oppositely charged ionic atmosphere is decreases. This is suggested by increase in acoustic impedance with concentration in system. It was seen that when concentration in system increases the intermolecular free length is decreases. The intermolecular free length decreased due to greater force of attraction between solvent and solute molecule by creating hydrogen bonding. As the concentration of solution increases, the adiabatic compressibility is decreases. The decrease in to collection of solvent molecule around solute molecules indicates that there are solute-solvent interaction are presence. This indicates that there is strong interaction between solvent and solute molecule in solution and the solution is becoming more and more compressible.

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It was observed that concentration in system is increases the apparent molal volume also increases. It indicates the existence of strong interaction between solvent and solute molecule. It was initiated that the value of apparent molal compressibility was decreased with the increase in concentration of Schiff base of benzoyl Pyrazolone in dioxane. It shows weak electrostatic attraction force between the close vicinity of ions. From the data, we were concluded that there are weak molecular association was found in Schiff base of benzoyl Pyrazolone. The value of relative association decreased as the concentration in system increases. It has been observed that there was weak interaction between solvent- solute. There was a decrease in solvation number as the concentration in system increases; it indicates the strong coordination bond forms by solvent molecule in primary layer. And due to this decrease in size of secondary layer of Solvation are observed. The value of S_k exhibits negative. It indicates the weak solute-solute or ion-ion interactions in Schiff base of benzoyl Pyrazolone system are present. From table-3, it was observed that the value of limiting apparent molal volume is positive. It indicates that the ion-dipolar interaction in Schiff base of benzoyl Pyrazolone and 1, 4 dioxane. The all value of Sv are positive, indicates the strong interaction between solvent and solute molecule. These value indicates an induced effect of 1, 4 dioxane on solvent- solute interaction. From fig. 1 and 2 the value of S_k and Sv has been determine.

Table-1 Density (ds), Ultrasonic velocity (Us), adiabatic compressibility (β_S), Specific acoustic impedance (Z) and Intermolecular free length (L_f).

Concentration moles lit^{-1} (m)	Density (ds) $Kg.m^{-3}$	Ultrasonic velocity (Us) $m.s^{-1}$	Adiabatic compressibiliy $(\beta_S)x10^{-10}$ m^2N^{-1}	Intermolecular free length $(L_f)x10^{-11}$ m	Specific acoustic impedance $(Zx10^6)$ kg $m^{-2}.s^{-1}$
Schiff base of benzoyl Pyrazolone + 10% 1,4 Dioxane					
$1x10^{-3}$	1019.86	1496	4.38240	4.2103	1.5255
$2x10^{-3}$	1019.96	1502	4.34356	4.19160	1.5324
$3x10^{-3}$	1020.05	1514	4.27801	4.15985	1.5442
$4x10^{-3}$	1020.13	1520	4.24396	4.14327	1.5504
$5x10^{-3}$	1020.21	1527	4.20371	4.12357	1.5579
$6x10^{-3}$	1020.28	1533	4.17058	4.10729	1.5641
$7x10^{-3}$	1020.35	1538	4.14430	4.09433	1.5691
$8x10^{-3}$	1020.41	1546	4.10233	4.07355	1.5771
$9x10^{-3}$	1020.47	1553	4.06100	4.05297	1.5852

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

Concentration (m) $Moles.lit^{-1}$	Apparent molal volume (ϕ_v) m^3mole^{-1}	Apparent molar compressibility $(\phi_k)x10^{-10}$ $m^2 N^{-1}$	Relative association (R_A)	Solvation number (S_n)

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$1x10^{-3}$	0.37215	2.09437	0.99789	0.98853
$2x10^{-3}$	0.37693	2.07553	0.99520	0.97964
$3x10^{-3}$	0.38170	2.04389	0.99153	0.96470
$4x10^{-3}$	0.38648	2.02739	0.98965	0.95692
$5x10^{-3}$	0.38933	2.00792	0.98739	0.94773
$6x10^{-3}$	0.39283	1.99189	0.98553	0.94016
$7x10^{-3}$	0.39532	1.97914	0.98406	0.93415
$8x10^{-3}$	0.39838	1.9589	0.98163	0.92459
$9x10^{-3}$	0.40076	1.93895	0.97922	0.91518

Table-3 Limiting Apparent molal compressibility (ϕ^0_κ), Limiting Apparent molal volume (ϕ^0_v), S_v and S_k

Ligand	Limiting Apparent molal volume (ϕ^0_v)m^3mole^{-1}	Limiting Apparent molal compressibility (ϕ^0_κ)$x10^{-10}$ m^2N^{-1}	S_v $m^3kg^{1/2}mole^{-3/2}$	S_k $m^3mole^{-2}kg.N^{-1}$
Schiff base of benzoyl Pyrazolone	0.3705	2.1078	3.5397	-18.943

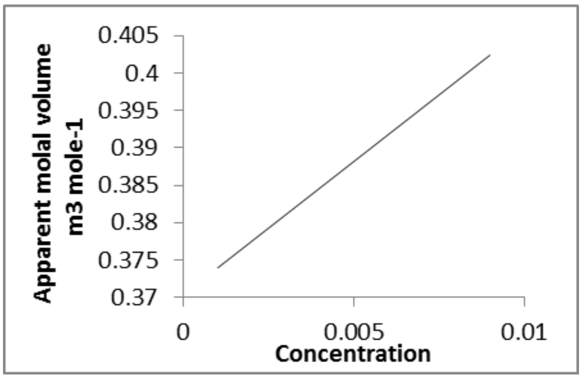

Fig.-1 -Apparent molal volume ($m^3.mole^{-1}$) Vs Concentration ($mole.lit^{-1}$)

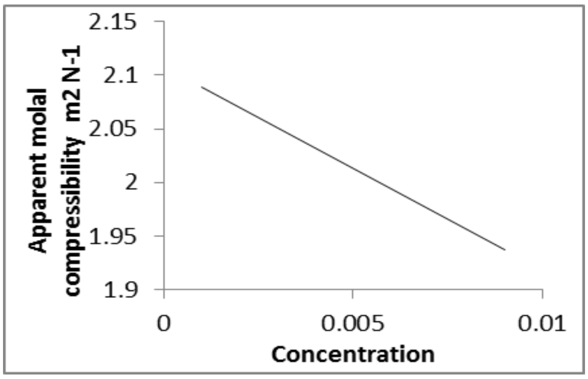

Fig.-2- Aparent molar compressibility10^{-9} ($m^2.N^{-1}$) Vs Concentration ($mole.lit^{-1}$)

IV. CONCLUSION

The present study shows the experimental data for density, ultrasonic velocity and viscosity at 300K for Schiff base of (5-hydroxy -3-methyl-1-(2,4dinitrophenyl)-pyrazol-4-yl)(phenyl)methanone and Isonicotic acid hydrazide (isoniazid) in 10% 1,4 dioxane . The acoustical properties were calculated from experimental data. The interaction between solute-solute or ion-ion and solvent-solute exists between Schiff base of benzoyl Pyrazolone and 1,4dioxane were also studied with the help of experimental data. Lastly from the experimental

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data it is concluded that the interaction between solute and solvent in Schiff base of benzoyl Pyrazolone & dioxane systems are strong.

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