STUDIES IN THE ACOUSTIC PARAMETERS OF SOME BROMO SUBSTITUTED CHALCONES IN DIFFERENT PERCENTAGE OF DIOXANE-WATER MIXTURE.

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A B S T R A C T

Ultrasonic velocity and density measurements in different Percentage at 0.01 M concentration of 1(5-bromo-2-hydroxyphenyl)-3- (4-methoxyphenyl) prop-2-en-1-one (L_1) &1-(5-bromo-2-hydroxyphenyl)-5-phenylpenta-2,4-dien-1-one (L_2) chalcones in different Percentage with dioxane-water mixtures were measured at 303 k by using ultrasonic interferometer at frequency 2 MHz. The ultrasonic Velocity, density and Percentage were used to calculate adiabatic compressibility (βs), apparent molal volume (Φv), apparent molal compressibility (Φks), Intermolecular free length (Lf), specific acoustic impedance (Zs), relative association (RA). The results were used to discuss solute-solvent interactions.

Keywords: Ultrasonic interferometer, Ultrasonic parameters, Density, Solute-solvent interactions, Bromo substituted chalcons.

1.Introduction

Ultrasonic techniques are best studied for the physico-chemical studies of a system and molecular interactions occurring in Dioxane-Water mixtures.G. Nath have studied interaction in the binary mixture of acetone with bromobenzene and chlorobenzene by computing the various acoustic parameters such as acoustic impedance (Z), isentropic compressibility (β), intermolecular free length (Lf) and their excess values at different frequencies (1 MHz, 3 MHz and 5 MHz) using a multi frequency ultrasonic.Interferometer over the entire range of mole fraction at temperature 303.16 K[1].Deosarkar et al. have studied the acoustical properties like adiabatic compressibility (βs), apparent molal volume (Φv), apparent molal compressibility (ΦK), intermolecular free length (Lf), specific acoustic impedance (Z) and relative association (RA) of some substituted pyrazoles viz. [5-(2-hydroxyphenyl)-3-(pyridin-3-yl)-4-(benzoyl)]-pyrazol, [5-(2-hydroxyphenyl)- 3-(3-nitrophenyl)-4-(3-pyridinoyl)]-pyrazol, [5-(2-hydroxyphenyl)-3-(3-nitrophenyl)-(4-benzoyl)]-pyrazol and [5- (2-hydroxyphenyl)-3-(phenyl)-4-(3-pyridinoyl)]-pyrazol have been calculated from measured sound velocities (U) and densities (d) of their solutions of 0.01M concentrations in different percentage of dioxane-water mixture at 298.15 K[2].

Santhi et al. have been measured Ultrasonic velocity, viscosity and density of alcohol in n-hexane at various temperatures in the range of 303.15 - 318.15K[3].Kalambe et al. have been measured Ultrasonic velocity (u) and density (d) values in the solvent CCl_4 containing 2-hydroxy substituted chalcone dibromide using 0.01 M concentration at 297 K. From this data, acoustical parameters such as adiabatic compressibility (βs), apparent molar volume (φv), apparent molar compressibility (φk), intermolecular free length (Lf), relative association (RA) and specific acoustic impedance (z) have been estimated[4].Watane et al. have studied the different acoustic properties of substituted chalcone dibromides using 0.01 M concentration in ethanol at 303K[5].Wadekar et al. have observed interaction between solute-solute and

solute-solvent interaction of substituted imidazolinone in 70% (DMF+water) solvents by measuring ultrasonic velocity and density in different concentration of solute in the range ($1x10^{-2}$ M to $6x10^{-4}$ M) in 70% of solvent has done at 298K[6].Pathare et al. have studied Ultrasonic velocity and density measurement of chalcone - 3-bromo-2-hydroxy-5- methyl-4-chloro chalcone in dioxane-water mixture have been carried out in the concentration range $1x10^{-2}$ - $5x10^{-2}$ mole dm^{-3} and in different percentages of dioxane-water mixtures[7].Wadekar et al. studied the acoustical properties of substituted 2-oxo-2-H-chromene-3-carbohydrazide derivatives in 70% DMF-water at 305K was done[8].Bante et al. have studied Ultrasonic behaviour of some chalcones of p-chlorobezaldehyde,salicylaldehyde,& benzaldeyde and also their mixtures[9].Patil et al. have been studied Ultrasonic velocity and density measurements of 2-hydroxy – 5– bromo – N – (m - hydroxyphenyl) - chalconeimines in dioxane – water mixtures, in the concentration range 1×10^{-2} -5×10^{-2} - mol dm^{-3} and in different percentage of dioxane water mixtures[10]. Ultrasonic behavior and study of molecular interaction of schiff base ligand were carried out in different percentage of ethanol-water mixture at 303 K by Nehete et al.[11].

2. Experimental methodology

2.1 Material and Methods

All chemicals used to synthesize bromo substituted chalcones are A.R.Grade in this present investigation attempt is made to understand behaviour of 1(5-bromo-2-hydroxyphenyl)-3- (4-methoxyphenyl) prop-2-en-1-one (L_2) &1-(5-bromo-2-hydroxyphenyl)-5-phenylpenta-2,4-dien-1-one (L_3) For evaluating the acoustic properties. The very pure and analytical grade solvent and extra pure double distilled water is used.The dencities of pure solvent and solutions are determined by using specific gravity bottle. The ultrasonic velocity measurements were made using a crystal controlled variable path ultrasonic interferometer (Mittal Enterprise, Model F-05) of 2MHz with accuracy of ± 0.03 %.

2.2 Theory and calculation

Adiabatic compressibility (β), Apparent molal volume (Φv), Apparent molal compressibility (Φks), Intermolecular free length (Lf), Specific acoustic impedance (Z) and Relative association (R) were calculated by using following equations

$$\beta s=100/(Us^2d \quad (1)$$

$$\beta o=100/Uo^2*do \quad (2)$$

$$\phi v=(M/ds)+[(do–ds)10^3]/mdsd \quad (3)$$

And

$$\phi k(s) = [1000\ (\beta sdo – \beta o\ ds) / m\ dsdo] + (\beta s\ M /ds) \quad (4)$$

$$Lf=K\times\sqrt{\beta s} \quad (5)$$

$$Z=Usds \quad (6)$$

Where,

do = Density of pure solvent,

m = Molality, M = Molecular weight of solute,

βo = Adiabatic compressibility of pure solvent

βs =Adiabatic compressibility of solution

K = Jackbson's constant

Us = Ultrasonic velocity in the solution in m/s.

βs is in bar^{-1} and ϕk(s) is in $cm^3\ mol^{-1}\ bar^{-1}$

Table 1

Acoustic Parameters of BHMPPO (L_1) in Dioxane at different percentage of Dioxane

% Dioxane	Mole fraction of Dioxane	Ultrasonic velocity U_s (m/sec) x 10^{-2}	Density ds (g/m^3)	Adiabatic compressibility B_s (bar^{-1}) x 10^{-6}	Intermolecular free length L_f (A°)
100	1	4.532	1.0148	4.7975	0.2056
90	0.9023	4.152	1.0035	5.7804	0.2256
80	0.8041	3.872	0.9858	6.7661	0.2441
70	0.7054	3.44	0.9715	8.6981	0.2768
60	0.6063	3.012	0.9429	11.6892	0.3209

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% Dioxane	Mole fraction of Dioxane	Apparent molal volume ϕv (m^3/mole) x 10^{-5}	Apparent molal compressibility $\phi_{k(s)}$ (m^3 mol^{-1} bar^{-1}) x 10^{-2}	Relative association (R_A)	Specific acoustic impedance Z_s (kg m^{-2} s^{-1}) x 10^{-2}
100	1	1.0032	-9.22	0.9029	4.5992
90	0.9023	1.0033	-9.34	0.9119	4.1666
80	0.8041	1.0033	10.7	0.9248	3.8170
70	0.7054	1.0034	2.82	1.0042	3.3420
60	0.6063	1.0035	19.0	1.0354	2.8402

Table 2
Acoustic Parameters of BHPPPDO (L_2) in Dioxane at different percentage of Dioxane

% Dioxane	Mole fraction of Dioxane	Ultrasonic velocity U_s (m/sec) x 10^{-2}	Density ds (g/m^3) x 10^6	Adiabatic compressibility B_s (bar^{-1}) x 10^{-6}	Intermolecular free length L_f (A°) x 10^{-9}
100	1	4.488	0.9872	5.0286	4.6531
90	0.9023	4.224	0.9794	5.7225	4.9637
80	0.8041	4.04	0.9607	6.3774	5.2401
70	0.7054	3.98	0.9503	6.6426	5.3479
60	0.6063	3.784	0.9351	7.4685	5.6706

% Dioxane	Mole fraction of Dioxane	Apparent molal volume ϕ_v (m^3/mole) x 10^{-5}	Apparent molal compressibility $\phi_{k(s)}$ (m^3 mol^{-1} bar^{-1}) x 10^{-2}	Relative association (R_A)	Specific acoustic impedance Z_s (kg m^{-2} s^{-1}) x 10^{-2}
100	1	1.0034	-5.54	0.8870	4.4309
90	0.9023	1.0034	-8.51	0.8748	4.1370
80	0.8041	1.0035	-13.0	0.8637	3.8812
70	0.7054	1.0035	-16.9	0.8490	3.7824
60	0.6063	1.0036	-25.2	0.8173	3.5384

3. Results and discussion

In the present in vestigation different acoustic parameters such as adiabatic Compressibility (βs), apparent molal volume (Φv), apparent molal compressibility (Φk(s)), acoustic impedance (Zs), relative association (RA) and intermoleculer free length (Lf) of the solutions in different percentage of dioxane at 303 k and presented in table 1& 2.Velocities, densities and calculated acoustical properties in different percentage of dioxane and in 0.01M solution at 303K are given in Table (1) & (2). Existence of molecular association between the components of the liquid mixtures can be understood from the decrease in ultrasonic velocity (U) with decreasing percentage of dioxane. The values of adiabatic compressibility (βs) increase with decrease in the percentage of dioxane which may be due to departure of solvent molecules around the ions.

The apparent molal volumes (ϕv) found to be increase with decrease in the percentage of dioxane. It is observed that (ϕk) values of (L_1) increase with decrease in the percentage of dioxane.It could also be seen that the intermolecular free length (Lf) of (L_1) increase with decrease in the percentages of dioxane, this may be due to the weak interaction between ions and solute molecules, which suggest the structure promoting behaviour of solute. This may also imply that the increase in free ions, showing the occurrence of ionic dissociation due to weak ion-ion interaction. The values of relative association (RA) of (L_1) increase with decrease in the percentage of dioxane -water mixture, which may be due to breaking up of solvent molecules on addition of dioxane in it. Specific acoustic impedance (Z) decreases non-linearly with decrease in percentage of dioxane.

Conclusions

It can be concluded from above study that there exist the interactions between bromo substituted

chalcones and dioxane-water mixture. Breaking up of solvent molecules on addition of dioxane in the solution is observed. Solute-solvent interactions are more favourable than other interactions.

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