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ULTRASONIC INTERFEROMETRIC STUDY OF 4-(*p*-CHLORO) -PHENYLTHIOCARBAMIDOPHENOL IN MIXED SOLVENT MEDIA

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Abstract:

Recently in last four decades many evolutions and new theories in pharmaceutical, agricultural, medicinal, industrial, space research, forensic sciences and biochemical sciences get updated through ultra sound and ultrasonic wave's measurements. Recently ultrasonic velocity and density for solutions of 4-(p-chloro)phenylthiocarbamidophenol (L_2) at different molar concentrations and 303K, in 70% compositions ethanol-water mixtures have been investigated for determination of adiabatic compressibility (β), apparent molal compressibility (ϕ_k), apparent molal volume (ϕ_v), intermolecular free length (L_f), relative association (R_A) and specific acoustic impedance (Z). These properties were studied to solute-solute and solute-solvent interaction in solvent, which provide important and versatile information regarding internal structure, molecular association.

Keywords: *4-(p-chloro)phenyl thiocarbamidophenol (L_2), interferometric measurements, acoustic properties, solute-solvent interaction.*

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INTRODUCTION:

Ultrasonic is the branch of acoustic, which consists of waves of high frequencies. Ultrasonic is the technique used for the study of molecular interaction inliquids. The study of molecular interaction in liquids provides valuable information regarding internal structure, molecular association, complex formation, internal pressure and stability of complexes [1]. Ultrasonic parameters are used extensively to study molecular interactions in pure liquids [2-4], liquid mixture [5,6] and electrolyte solution [7,8]. Aswale et al [10] investigated the comparative study of intermolecular interaction by acoustic properties of α-bromoacetophenones and cumaran-3-ones in ethanol and dioxan solvents. Acoustical studies on ternary mixture of toluene in cyclohexane and nitrobenzene at 308K [11]. Ultrasonic velocity and density of binary liquid mixture of diethyl ether with three non-polar solvents such as CCl_4, CS_2 and C_6H_6 at 303.15K [12].

Now-a-days dynamic studies in the research of ultrasonic are continuously going on due to its gigantic scope in chemical, physical, mechanical and biological sciences. Taking all these things into consideration, present investigation was carried out for the determination of ultrasonic velocity and density for solutions of 4-(p-chloro)phenyl thiocarbamidophenol (L_2) at different molar concentrations and 303K, in 70% compositions ethanol-water mixtures have been investigated for determination of adiabatic compressibility (β), apparent molal compressibility (ϕ_k), apparent molal volume (ϕ_v), intermolecular free length (L_f), relative association (R_A) and specific acoustic impedance (Z).

MATERIALS AND METHODS:

All AR grade chemicals used during present investigation. Freshly prepared solution used for analysis. The solvents were purified by standard method. Prepared 0.1M, 0.075M, 0.050M and 0.025M concentrations of 4-(p-chloro)phenylthiocarbamidophenol (L_2) 70% ethanol-water mixture. 4-(p-chloro)phenylthiocarbamidophenol (L_2) was synthesized by known method [13]. The solvent ethanol was purified by standard procedure [14]. Densities were measured with the help of bicapillary pyknometer (10.1 % kg m^{-3}). Pyknometer used of Borosil, 0.01M solution of ligand in ethanol solvent. Weighing were made on Citizen CY 104 one pan digital balance (± 0.0001 gm). A special thermostatic arrangement was done for density and ultrasonic velocity measurements. Elite thermostatic bath was used, in which continuous stirring of water was carried out with the help of electric stirrer and temperature variation was maintained within ± 0.1 ^{0}C. The speed of sound waves was obtained by using variable path, Single crystal interferometer (Mittal Enterprises, Model MX-3) with accuracy ± 0.03% and frequency 1 MHz was used in the present work. The densities and ultrasonic velocity of liquids in ethanol solvent at 303 K. for the calculation of intermolecular free length the value of Jacobson's constant [15] (K = 631) at temperature 303 K is used.

RESULTS AND DISCUSSION:

In the present investigation measurement of densities and ultrasonic velocities of 4-(p-chloro) phenylthiocarbamidophenol (L_2) in 70% ethanol-water mixture has been carried out and given in Table No.1

Table no. 1: Acoustic Parameters at Different Concentration of PTP at 303K

W-E Mix. %	Conc. C (Mole/lit)	Average Ultrasonic Velocity Us (m/sec)	Density d_s ($Kg.m^{-3}$)	$\beta s x 10^{-10}$ (pa^{-1})	ϕ_V ($m^3 mol^{-1}$)	ϕ_k x10^{-10}	L_f (A_0)	R_A	$Z * 10^4$ ($Kgm^{-2} sec^{-1}$)
70	0.1	1489.587	1030.32	4.3235	0.2845	-2.3711	0.0163	1.004	150.319
	0.075	1322.591	1028.32	5.4854	0.3229	11.775	0.018	1.040	132.491
	0.050	1217.366	1021.32	6.4901	0.3256	33.577	0.0193	1.063	121.016
	0.025	1072.416	1016.22	8.3733	0.3763	89.430	0.0216	1.102	105.582

CONCLUSION:

Table-1 revels resultant values of Acoustic Parameters of L_2 at (0.1M, 0.075M, 0.050M and 0.025M) and 303K in 70% ethanol-water mixture. from table-1 it was concluded that Ultrasonic Velocity: (Us) , Density: (ds) decreases while Adiabatic compressibility: (βs), Apparent molar volume: (φv), Apparent molar compressibility: (φk), Intermolecular free length: (L_f), Relative association: (R_A) increases and Specific acoustic impedance: (Z) decreases along with decreasing concentration of L_2 at 303 K. By using ultrasonic interferometric study Us , ds, βs, φv, φk, Lf, RA, z etc. acoustic properties were determined, which explain how these interactions occur and responsible for breaking and making of the structure in the solution.

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