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ORIGINAL ARTICLE

The Study of Acoustic and Thermodynamic Behavior of p-Toludine in Ethanol

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ABSTRACT

The Determination of Viscosity (η) and density (ρ), ultrasonic velocity (U) of p-Toludine with Ethanol have been studies at various temperature and atmosphere pressure by using a single crystal in Interferometer at frequency of 2MHz. The Parameter and concentration were used at calculating intermolecular free length (L_f), solvation number (S_n) and relative association (R_a) Specific acoustic impedance (Z) Isentropic compressibility (β_S), and Badas Constant (B) The result indicates that there are dependent of there properties on Significant Interaction between solute and solvent molecules.

Key words: *Ultrasonic velocity, p-Toludine, Ethanol, Isentropic compressibility, specific acoustic impedance, Intermolecular free length, Badas constant*

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INTRODUCTION

Acoustic an important branch of science deals with the phenomena of second. It has been termed as science of description, creation and comprehension of human experience. Ultrasound is the branch of acoustic science which deals with phenomena of frequency above the upper audible limit approximately 20,000 cycle/second, ultrasound wave frequencies above these range cannot be perceived by the human ear. The human ear range can perceive a vibration with in a definats range, 16 up to 20,000 cycle/second. The ultra sounds Frequencies lie between 20 kilo cps to 500 kilo cycle/second are known as ultrasound waves sound waves with frequencies beyond 20,000 cycle/second are known as supersonic waves can travel through liquid & solids.

Determination of ultrasonic velocity and viscosity of p-Toludine in ethanol at various temperature 30ºC, 35ºC, 40ºC. The present work will cover both theoretical and practical progress made in the field of ion solvent and solute interaction as well as the development and application of new experimental methods and techniques to the acoustic and discuss properties of p-Toludine in Ethanol ion solvent interaction[1-10] is always attractive because the solvent molecule can orient their dipole in the direction.

The present paper is an investigation of the behavior of binary solution of p-Toludine in ethanol with regards Isentropic compressibility (β_S), specific acoustic impedance, (Z) Intermolecular free length (L_f), solvation number (S_n), relative association (R_n) from ultrasonic measurement at various temperature as 30ºC,35ºC,40ºC

EXPERMENT

Determination of different parameters we used of analytical reagent (AR) grade. The purity of the used chemicals was checked by density determination at 35°C, the values of density obtained tally with the literature values, Binary liquids mixtures of different known compositions were prepared inairtight-stopperedmeasuring flask to minimize the

leakage of volatile liquids. The weighing was done using electronic balance with precision ± 0.01mg. The double walled bicapillaryPyknometer was used for the measurement of densities of solvents and solutions[11-12] with an accuracy of ± 0.0005gm/cm^3. An ubbelohde viscometer, having frequency of 2 MHz (Mittal Enterprises, New Delhi, Model: F-81) with an accuracy of $\pm 0.05\%$[13-15], Detailed of Experimental techniques are given elswhere[16-19].

THEORY AND CALCULATION

Determination of various thermodynamic parameters such as Isentropic compressibility(β_S), Intermolecular free length (L_f), Specific acoustic impedance (Z), Badas constant (B) solvation number (S_n) and relative association (R_a), have been calculated at 30ºC,35ºC,40ºC using ultrasonic velocity (U), density (ρ) and viscosity (η) of these solutions with the help of following equations.

1. $\beta_S = \dfrac{1}{V^2\rho}$
2. $L_f = K \times \beta^{-1/2}$
3. $Z = U \times \rho$
4. $B = (\overline{M}/\rho)\beta_s^{-1/7}$
5. $S_n = n_1/n_2(1-\beta/\beta^0)$
6. $R_a = (\rho/\rho^0)(U^0/U)^{1/3}$

Where ρ, ρ^0 and U, U^0 are the densities and ultrasonic velocities of solution and solvent, respectively; B is Badas constant; M molecular weight of solute; β_s is the Isentropic compressibility of solvent, and solution, C is concentration in mole/Liter; n_1 and n_2 are the number of moles of solvent and solute, respectively.

Table 1: Measured parameters of p-Toludine with Ethanol, at 30ºC

C mol/lit	ρ gm/mol	ηc.p.	U m/sec	β_s cm^2/dyne. 10^{12}	Z×10^5 g/s. cm	L_f A	wadas constant(B)	R_a	S_n
0.01	0.8008	0.2739	1200	86.72	0.9610	0.5876	28.15	1.02	0.00
0.02	0.8121	0.3224	1211	83.97	0.9837	0.5782	27.86	1.03	0.00
0.03	0.8280	0.3708	1218	81.41	1.0085	0.5693	27.41	1.05	0.00
0.04	0.8423	0.4194	1229	78.60	1.0352	0.5594	27.46	1.06	0.00
0.05	0.8566	0.4669	1240	75.92	1.0622	0.5498	26.71	1.08	0.00
0.06	0.8702	0.5154	1251	73.37	1.0895	0.5404	26.37	1.09	0.00
0.07	0.8852	0.5649	1262	70.93	1.1171	0.5324	26.05	1.10	0.00
0.08	0.8985	0.6134	1273	68.60	1.1451	0.5226	25.73	1.12	0.00
0.09	0.9138	0.6619	1284	66.38	1.1733	0.5140	25.42	1.13	0.00
0.10	0.9281	0.7104	1295	64.25	1.2019	0.5057	25.12	1.15	0.00

Table 2: Measured parameters of p-Toludine with ethanol, at 35ºC

C mol/lit	ρ gm/mol	ηc.p.	U m/sec	β_s cm^2/dyne. 10^{12}	Z×10^5 g/s. cm	L_f A	wadas constant(B)	R_a	S_n
0.01	0.7959	0.0100	1177	90.70	0.9368	0.6061	28.22	1.01	0.05
0.02	0.8075	0.0266	1186	88.04	0.9577	0.5972	27.97	1.03	0.15
0.03	0.8189	0.0424	1195	85.51	0.9786	0.5885	27.74	1.04	0.31
0.04	0.8308	0.0598	1205	82.90	1.0011	0.5795	27.51	1.05	0.54
0.05	0.8429	0.0764	1215	80.37	1.0241	0.5706	27.28	1.06	0.82
0.06	0.8549	0.0930	1225	77.95	1.0473	0.5619	27.05	1.07	1.14
0.07	0.8679	0.1096	1235	75.63	1.0706	0.5533	26.83	1.09	1.52
0.08	0.8789	0.1262	1245	73.40	1.0942	0.5453	26.52	1.10	1.94
0.09	0.8998	0.1428	1255	70.56	1.1292	0.5346	26.19	1.12	2.47
0.10	0.9029	0.1594	1265	69.21	1.1422	0.5295	26.21	1.12	2.90

Table 3: Measured parameters of p-Toludine with ethanol, at 40ºC

C mol/lit	ρ gm/mol	ηc.p.	U m/sec	β_s cm^2/dyne. 10^{12}	$Z\times10^5$ g/s. cm	L_f A	wadas constant(B)	R_a	S_n
0.01	0.7917	0.0049	1147	96.01	0.9081	0.6295	28.14	1.01	0.04
0.02	0.8015	0.0024	1154	93.69	0.9249	0.6218	27.94	1.02	0.13
0.03	0.8109	0.0096	1161	91.49	0.9415	0.6145	27.75	1.03	0.27
0.04	0.8210	0.0169	1169	89.13	0.9597	0.6065	27.56	1.04	0.46
0.05	0.8311	0.0242	1177	86.85	0.9782	0.5987	27.36	1.05	0.70
0.06	0.8412	0.0315	1185	84.66	0.9968	0.5911	27.18	1.06	0.98
0.07	0.8513	0.0387	1193	82.53	1.0156	0.5837	26.99	1.07	1.30
0.08	0.8614	0.0460	1201	80.48	1.0345	0.5764	26.82	1.08	1.67
0.09	0.8715	0.0533	1209	78.50	1.0536	0.534692	26.64	1.09	2.07
0.10	0.8817	0.0606	1217	76.58	1.0730	0.5622	26.47	1.10	2.50

RESULT AND DISCUSSION

The measured parameters viz ultrasonic velocity (U), density (ρ), viscosity (η) are given in the tables (1,2,3) The tables shows that some parameters increase with concentration of p-Toludine. This shows that strong interaction observed at higher concentrations of p-Toludine and suggests more association between solute and solvent molecules in the system. The variation of ultrasonic velocity (U) with solute concentration (C) can be expressed in terms of the concentration derivatives of density (ρ) Isentropic compressibility (β_S).

The intermolecular free length increases while specific acoustic impedance decreases with increasing concentration of solute are shows in the tables which can be explained on the basis of lyophobic interaction between the solute and solvent molecule which increases the intermolecular distance leaving relatively wider gaps between the molecules and thus becoming the main cause impediments to the propagation of ultrasound waves and effect the structural arrangements. The specific acoustic impedance, a product of the density of the solution and the velocity has shown the reverse trend to that of intermolecular free length, thus the fact that increaseing of velocity as well as isentropic compressibility increases in the system, while intermolecular free length increases as well as wadas constant decreases.

Relative association is influence by two factors– (i) The breaking up of solvent molecules on addition of electrolyte to it and (ii) the solvation of ions are simultaneously present investigation, it has been observed that relative association values decreases as well as concentration increases. Similar results have been reported in the literature, solvation number (S_n) are calculated using passynaky equation and are listed in tables. The (S_n) values are found to decrease with the increase solute which also suggested close association between solute and solvent.

REFERENCE

1. Rattan V.K., Sukhmehar S. and Rajni, M.C. (1993): Ind. J. Tech., 31, 37.
2. Singh S. Prasad, N. Kushwaha, M., Sivanarayan, K. and Prakesh S. (1980): Ind. J. Pure & Appl. Phys. 18, 254(1980).
3. Jain DVS and Dhar N.S. (1992): Ind. J. Tech. 30, 630.
4. Orlega J. and Susial P. (1989): Can. J. Chem. 67, 1120.
5. Saxcena S.K. and Saxcena M.C. (1981): Ind. J. Pure & Appl. Phys. 19, 550.
6. Gupta M., Chauhan M. and Shukla J.P. (1981): Adv. mole Relax Int. Process.
7. Prasad R. (1945): Ind J. Phys. 19: 47.
8. Singh A. and Saxcena M.V. (1982): J. Mole Liq., 25, 81.
9. Hemmes P., Mayerki A.A., Buckin V.A. and Sarvazyn (1980): J. Phy. Chem. 84, 699.
10. Reddy M.A. (1980): J. Acoust. Soc. India, 24 VIII.
11. Kaulgud M.V. and Mohan Rao K.S. (1988): I*ndian j. chem.,* 27A, 12.
12. Shrivastav T.N., Singh R.P. and Swaroop B. (1983): *Indian J. pure., Appl, phys.,* 21,67.
13. Prakash O., Prasad S., Pandey S.V. and Prakash S. (1982).: I*ndian j. pure Appl. phys.,* 20, 631.

14. Nikam P.S. and Sawant A.B.: J. Chem, Engg, Data, 42, 585.
15. Nikam P.S. and Sawant A.B. (1998): J. Ind. Lig. 75, 199.
16. Gupta A.K., Yadav G.K. and Krishna K. (2004): J Ind. Council Chem. 17,32.
17. Mehra R. and Gaur A.K. (2008): J. Chem. Engg. Data. 53, 683.
18. Dash A.K. and Paikaray R. (2014): Acoustical study in binary liquid mixture containing dimethyl acetamide using utrasonic and viscotity probes. Der chem. Sinica, 5(1): 81-88.
19. Saxcena Indu Kumar and Vijay Devi Rikkam (2015): Determination and Density of solvent Mixture by Magnetic Float densitometer and study value change and some acoustical Parameters from ultrasonic velocity, Golden research through, 4(9): 1-12.