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9. D.N. Kumar, B.S. Gare, J. Thema. Anal. Cal., 2004, 69, 607.
10. B.K. Singh, P. Mishra, B.S. Garg, Spectrochin. Acta, 2007, 67, 719.
11. R.N, Muthuraj, V. Ravichandran S. Kulandaisamy Journal of Chemical Sciences. 2003, 115(3), 161.
12. Z.H. Chohan, S.K.A. Sherazi, Metal-Based Drugs., 1997, 4(6), 327.
13. A.S. Aswar, P. Bahad., A. Pardhi, N.Bhave., J. Poym. Mater., 1988, 5, 232.
14. Furniss B., Hannaford A., Smith P. and Tatchell A., Vogel's practical organic chemistry 5th Ed. (Logman Scientific Technical, John Wiley and Sons), 1989.
15. J.D. Joshi, N.P. Patel, S.D. Patel, J. Indian Poly., 2006, 15(3), 219.
16. N.Raman, Y.P. Raja, A. Kulandaisamy, J. Indian Acad. Sci., 2001, 113(3), 183.
17. B. Naik, K.R. Desai, Indian J. Chem., 2006, 45B, 267.
18. E.J. Campbell, S.T. Nquyen, J. Tetrahedron, 2001, 42, 1221.
19. P. Pietikainen, A. Haikarainen, J. Mole. Catalysis, 2002, 180, 59.
20. M. Gottschaldt, R.Wegner, H. Gorls, P. Klufers, E.G Jager, D. Klemm, J. Carbohydrate, 2004, 339, 1941.
21. T. Matsushita, T. Shono, J. Polyhedron, 1986, 5(3), 735.
22. S.K.Gupta, P.B. Nutchcock, Y.S. Kushwah, G.S. Argal, J. Inorg. Chimica Acta, 2007, 360, 2145.
23. L.H. Cai, P.Z. Hu, X.L. Du, L.X. Zhang, Y. Liu, Indian J. Chem., 2007, 46B, 523.
24. M. Kidwai, P.R. Poddar, K. Singhal, Indian J. Chem., 2009, 48B, 886.
25. K.Mallikarjun, E. J. Chem., 2004, 1(2), 105.
26. H.Horowitz and G.Metzger, Anal. Chem., 1963, 35, 1464.
27. A.Broido, J. Polym. Sci. Part A2, 1964, 1761.

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Study of Solute-Solvent Interaction in a Different Medium at 303 K Temperature by Ultrasonic Technique

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ABSTRACT :

The basic parameters like velocity (u), density (ρ) and viscosity (η) can be measured by experimental procedures using bicapillary pyknometer, Ostwald viscometer Ultrasonic Interferometer. From these parameters various thermodynamical and acoustical parameters such as adiabatic compressibility (β_s), apparent molar compressibility (ϕ_k), apparent molar volume (ϕ_v) specific acoustic impedance (Z), Solvation number (Sn), Intermolecular free length (Lf), have been estimated using standard relations by observed values of Ultrasonic velocities, densities and viscosities in the wide range of concentrations at 303K, temperatures for Acetone+water and Methanol +water Binary system. The solvent-solvent interactions are studied on the basis of increase or decrease in ultrasonic velocity, density, viscosity and other derived acoustical parameters in terms of structure making and structure breaking tendencies of various solvent molecules. The results are interpreted in terms of molecular interactions occurring in these solutions.

Keywords: Ultrasonic velocity, solute-solvent interaction, basic parameters

Introduction :

The study of solute-solvent interactions has been of intense activity in the recent past in all branches of chemistry and in other parallel disciplines as well. Various experimental methods have been employed to explore the information from the study of such interactions. Experimental data of thermodynamics, acoustic and transport properties of solutions are of great importance to get insight into such intermolecular forces. Several workers[1-2] have successfully used ultrasonic velocity and its related thermodynamic properties to study inter molecular interactions in binary systems. Ultrasonic waves provide valuable information about the molecular interaction in pure liquids[3], aqueous solutions[4], liquid mixtures[5] and also provide valuable information about the structure of solids[6].

In continuation of these investigations, the present paper reports acoustical properties of the anti- psychotic drug Prochlorperazine Maleate in different solvents.

The acoustic properties of this drug have been studied in 20% Dioxane-water and 20% DMF-water solutions at 303 K.

Experimental

Ultrasonic velocity measurements were made by using an ultrasonic interferometer (Mittal Enterprises, New Delhi) at a frequency of 2MHz with a tolerance of ± 0.005%.

Solvents dioxane and dimethyl formamide used in the present work were of AR grade and were purified and dried by standard procedure before use. Densities, viscosities and ultrasonic velocities were measured at 303 K over a wide range of composition. Densities were determined by using bicapillarypyknometer. The viscosities were measured by precalibrated Ostwald type viscometer with an accuracy of about ± 0.1K. Binary system is studied at 303K with different concentrations of the system such as 0.02 mole, 0.04 mole, 0.06 mole, 0.08 mole, and 0.1 mole. All the measurements were carried out at 303 K.

Theory

Acoustic parameters such as adiabatic compressibility (β_s); apparent molar volume (ϕ_v), apparent molar compressibility (ϕ_k), intermolecular free length (L_f), specific acoustic impendence (Z), Limiting apparent molar volume (ϕ^0_v), Limiting apparent molar compressibility (ϕ^0_k) were determined from the experimental data of density (ρ) and ultrasound velocity (u) of pure solvent and solutions, using following standard equations[7].

Adiabatic compressibility $\beta_s = 1/u^2_s \rho_s$ ——1

Apparent molar volume $\phi_v = 10^3(\rho_0 - \rho_s)/m\rho_0\rho_s + M/\rho_0$ ——2

Apparent molar compressibility $\phi_k = 10^3(\rho_0\beta_s - \rho_s\beta_0)/m\rho_s\rho_0 + \beta_s M/\rho_s$ ——3

Intermolecular free length $L_f = K(\beta_s)^{1/2}$ ——4

Specific acoustic Impendence $Z = \rho . u$ ——5

Limiting apparent molar volume $\phi_v = \phi^0_v + S_v C^{1/2}$ ——6

Limiting apparent molar compressibility $\phi_k = \phi^0_k + S_k^{1/2}$ ——7

Table no.1

Ultrasonic Velocity(u), Density (ρ_s) and Viscosity (η) of drug in 1, 4 Dioxane and DMF at 303K

Solvents	Conc. mol dm^{-3}	Ultrasonic Velocity(u) m/s	Density ρ_s Kgm^{-3}	Viscosity x10^{-3} Nsm^{-2}
20% Dioxane-Water Medium	0.02	1368.3	1029.07	1.15066
	0.04	1374.1	1029.10	1.15523
	0.06	1383.4	1029.63	1.15748
	0.08	1388.9	1030.04	1.15815
	0.1	1397.5	1030.15	1.15471
20% DMF-Water Medium	0.02	1437.2	950.22	0.83912
	0.04	1460.3	956.83	0.83978
	0.06	1478.1	967.15	0.84132
	0.08	1481.2	976.28	0.84428
	0.1	1484.6	983.35	0.84856

Table no.2

Some acoustical parameters with concentration of the drug in 1, 4 Dioxane and DMF at 303 K

Solvents	Conc. mol dm^{-3}	β_s x10^{-11} Pa^{-1}	ϕ_v x10^{-3} m^{3}mol^{-1}	ϕ_k x10^{-11} m^{3}mol^{-1} Pa^{-1}	L_f x10^{-11} (m)	Z x10^5 Kg m^{-2} sec^{-1}
20% Dioxane-Water Medium	0.02	3.9488	-62.3	-62.8204	4.8511	16.2595
	0.04	3.9472	-7.19	-56.6014	4.7024	16.2930
	0.06	3.9336	4.82	-30.7532	4.5927	16.3273
	0.08	3.9258	13.9	-24.6438	4.3831	16.3679
	0.1	3.9105	14.7	-11.6717	4.3692	16.4250
20% DMF-Water Medium	0.02	4.8218	11.83	292.703	4.9709	14.6379
	0.04	4.8049	19.06	288.683	4.8632	14.6694
	0.06	4.7993	20.23	198.406	4.7575	14.7016
	0.08	4.7801	22.54	143.164	4.6652	14.7419
	0.1	4.7686	24.07	111.356	4.4364	14.7661

Table-3

Limiting values of $\hat{o}_v$ and $\hat{o}_k$ along with slope (S_v&S_k) for CPZ in different medium at 303K temperature

Temp. ,T (K)	Medium	Parameters			
		$\phi^0_v \times 10^{-6}$ $m^3 mol^{-1}$	$\phi^0_k \times 10^{-14}$ $m^3 mol^{-1} pa^{-1}$	$S_v \times 10^{-7}$ $m^3 mol^{-3/2} dm^{3/2}$	$S_k \times 10^{-11}$ $m^3 mol^{-3/2} dm^{3/2} pa^{-1}$
	20%D-W	-96.28	-104.6	331.7	354.6
	20%DMF-W	7.162	631.4	69.56	-1851.0

Results and discussion:

Ultrasonic velocity, density and viscosityfor the 20% Dioxane-water and 20% DMF-watrehave been listedintable1. It is seen from the data that density (ρ), ultrasonic velocity (u) and viscosity (η) increases with increase in concentration the two systems. The increase in ultrasonic velocity is due to decrease in intermolecular free length (L_f) as shown in table 2. This suggests that there is a strong interaction between drug and solvent molecule. Adiabatic compressibility (β_s) is a measure of intermolecular association or repulsion calculated from the measured ultrasonic velocity (u) and density (ρ). Adiabatic compressibility is found to decrease with increase in concentration[8]. Since adiabatic compressibility is inversely related to the product of density and ultrasonic velocity based on this the compressibility is expected to decrease which has observed in the present case. The decrease in adiabatic compressibility with increase in concentration confirms the presence of solvent-solvent interactions through dipole-dipole interactions between Dioxane+Water and DMF+Water. When the sound waves travels through the solution, certain part of it travels through the medium and rest gets reflected by the ion i.e. restriction for flow of sound velocity by the ions. The character that determines the restriction movement of sound waves is known as acoustic impendence (Z). It has been found that acoustic impendence increases with increase in concentration. The apparent molar compressibility (ϕ_k) explains the solute-solvent and solute- solute interactions in solution and was calculated by using the equation no. 3. The apparent molar volume (ϕ_v) is defined as the change in volume of solution for the added one mole of a particular component at constant temperature and pressure. It is thermodynamic property which helps in elucidating solvation behavior of electrolyte in solution. Apparent molar volume was evaluated from the density of solution and solvent.

It is evident from the table 3 that ϕ^0_k values are negative for 20% Dioxane-water but for 20%DMF-water ϕ^0_k values are positive. The negative ϕ^0_k values are suggest solute- solvent interaction whereas positive values are due to solute-solute interaction, is further confirmed by ϕ^0_v values which are positive for 20% DMF-water and negative for 20% Dioxane-water for the drug. S_v is a measure of solute – solvent interaction. It is observed from the table 3 that Sv values are higher in 20% Dioxane-water and low in 20% DMF-water solution. This confirms that in 20% DMF-water solution solute-solute interactions and in 20% Dioxane-water solute – solvent interaction predominate.

REFERENCES

1. Pandey J.D., Shukla R.K., Shukla A.K. and Rai R.D.: J Chem Thermodyn, 21, 725 (1989).
2. Wang G.C., Benson and Lu B.: J Chem Thermodyn 21, 67 (1989).
3. RP Verma and S Kumar, Ind J Pure and apply Phy 2000;312:59.
4. S Kamila, S jena and B Bihari. J Chem Thermodyn 2005; 37:820.
5. R Abraham, M Abdulkhadar and CV Asokan. J Chem Thermodyn 2001; 32:1.
6. S Mukharjee, C Basu and US Ghosh. J Non-Cryst Solids.1992;144:159.
7. Baluja, S. and S. Oza, "Ultrasonic studies of some derivatives of 6-ethylbenzene-1,3-diol in 1,4-dioxane," Fluid Phase Equil.,208, 83-89 (2003).
8. Owen B.B and Kronick P K, J Phys Chem, 1961; 65:81.