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STUDY OF MOLECULAR INTERACTION OF OCTANOL-1 IN NONPOLAR LIQUID LIKE CARBON TETRA CHLORIDE, BENZENE AND TOLUENE ULTRASONICALLY

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ABSTRACT

Densities,ultrasonic velocities and viscosities of binary mixtures of octanol-1 in carbon tetra chloride,benzene and toluene have been measured over entire range of composition at different temperatures and atmospheric pressure.From the experimental values of ultrasonic velocity ,density and viscosity,the excess isentropic compressibility(βsE) and excess viscosity (ηE) have been computed.Deviation in βsE and ηE throw light on the molecular interaction between like molecules.

Keyword: Molecular Interaction, Carbon Tetra Chloride, Toluene

I. INTRODUCTION

Ultrasonic velocity,density and viscosity related parameters such as isentropic compressibility,molar volume and available volume yield valuable information about intermolecular interaction between nonpolar and polar molecules.The interaction behaviour is due to deviation from ideajity cause the solvent interaction[1-3]Subbarangaiah et al,[4] and Erying & Hirschfelder[5] investigated ultrasonic behaviour of aqueous solution and discuss the results by hydrogen bonded complex formation. Verma et al [6-9] reported various thermodynamic compressibility, molar volume and viscosity for binary mixtures of thioxane in alcohols.

II. EXPERIMENTAL

Octane-1 carbo in tetra chloride in benzene and toluene were used after single distillation. Binary mixtures were prepared by mixing known volume of each liquid in a air tight Stoppard glass bottle. Care was taken to avoid contamination during mixing.

Ultrasonic veleocity was measured by Ultrasonic interferometer M-80 manufactured by M/S Mittal Enterprises,new Delhi having accuracy of about+0.015.

Density of pure liquid and mixtures were measured by using double walled picknometer.The picknometer was calibrated with distilled water.The value obtained were tally with the literature values.The viscosities have been determined by using Ostwald viscometer. The accuracy in viscosity measurements was ±0.0002 cp.

Isentropic compressibility were calculated using following relation

$$\beta s = 1/v2\rho$$

Where v is ultrasonic velocity and ρ is density

Excess isentropic compressibility have been calculated ng formula

$$\beta sE = \beta s_{exp} - (X_1 \beta s_1 + X_2 \beta s_2)$$

Where βs_{exp} βs_1 and βs_2 are isentropic compressibility of mixture and pure component 1 and 2 respectively and X1 and X2 are mole fraction of component 1 and 2.

Excess viscosity has been calculated by using the relation,

$$\eta^E = \eta_{exp} - (X_1\eta_1 + X_2\eta_2)$$

III. RESULT AND DISCUSSION

The values ultrasonic velocity,density,excess isentropic compressibility and excess viscosity of octanol-1 with toluene,carbon tetra chloride and benzene are given in Table-1,Table-2 and Table-3.

Table-1 Mole fraction (X1) of octanol-1,ultrasonic velocity,density,excess isentropic compressibility and excess viscosity for octanol-1 with toluene chloride at 313K

Mole fraction (X1)	Ultrasonic velocity v (m/s)	Density ρ (gm/ml)	Excess isentropic compressibility βs^E (cm2/dyne.)1012	Excess vidcosity η^E (cp)
0.0000	1308	0.8101	0.00	0.0000
0.2247	1293	0.8200	0.22	-0.1400
0.4201	1281	0.8270	0.44	-0.2100
0.5917	1271	0.8370	0.51	-0.2100
0.7435	1263	0.8410	0.33	-0.1800
0.8787	1249	0.8570	0.00	-0.1000
1.0000	1249	0.8570	0.00	0.0000

Table-2 Mole fraction (X1) of octanol-1,ultrasonic velocity,density,excess isentropic compressibility,and escess viscosity of octanol-1 with carbon tetra chloride at 313K

Mole fraction (X1)	Ultrasonic velocity v (m/s)	Density ρ (gm/ml)	Excess isentropic compressibility βs^E (cm2/dyne),1012	Escess viscosity η^E (cp)
0.0000	1308	0.8106	0.00	0,0000
0.1526	1221	0.9000	3.63	-o.1200
0.2442	1180	0.9432	1.18	-0.1650
0.4468	1058	1,1280	1.78	-0.2850
0.5536	1034	1.1650	1.69	-0.3100
0.6177	998	1.2412	1.66	-0.3000
0.7636	948	1.3482	1.40	-0.2150
0,8898	918	1.4060	1.04	-0.1150
1.0000	874	1.5620	0.00	0.0000

Table-3 Mole fraction (X1) of octanol-1,ultrasonic velocity ,density,excess isentropic compressibility and excess viscosity for octanol-1 with benzene at 313K

Mole fraction(X1)	Ultrasonic velocity v(m/s)	Density ρ (gm/ml)	Excess isentropic compressibility βs^E (cm2/dyne).1012	Excess viscosity η^E (cp)
0.0000	1308	0.8106	0.00	0,0000
0.2573	1287	0.8148	0.10	-o.2400
0.4641	1267	0.8238	0.23	-0.3200
0.6339	1254	0.8302	0.27	-0.3400
0.7639	1244	0.8366	0.24	-0.2200
0.8965	1237	0.8418	0.14	-0.1200
1.0000	1231	0.8468	0.00	0.0000

As it can be seen from Table-1,Table-2 ans Table-3 that ultrasonic velocity decreases with increasing mole fraction of octanol-1.It is obvious that the moles of octanol-1 are so dense.

The positive deviation in isentropic compressibility i.e, -ve β^E expects nonspecific molecular interaction between the unlike molecules. The tabulated experimental and computed data throw light on molecular interaction. The nature and extent of acoustic properties define molecular interaction between the binary mixtures. The octanol-1 having more carbon atom in alkyl has least repealing power to the other molecule hence least intraction will be possible with nonpolar carbon tetrachloride, benzene and associating toluene.

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