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Selection of organic solvent by using thermophysical properties of binary liquid mixtures at 308.15, and 313.15 and 318.15k temperatures

Saisri Movva [1], K Pallavi[1], K Pratyusha[1], Ganta Nikhil Krishna[1] and Golamari Siva Reddy[2]
Centre for Bioprocess Technology, Department of Biotechnology, K L University, Green Fields, Vaddeswaram, Andhrapradesh, India-522502
***Corresponding author: E-Mail:siva_bt@kluniversity.in**

ABSTRACT

Surface tension, density, ultrasonic velocity, viscosity and refractive index values have been determined at temperatures 308.15 K, 313.15 K, 318.15 K for the whole compositions for the binary liquid mixtures of Aniline with water at atmospheric pressure. These experimental values have been used to estimate respective excess properties along with some acoustic properties namely Excess molar volume (V^E), viscosity deviation ($\Delta\eta$), deviation in refractive index (Δn_D), deviation in ultrasonic velocity (Δu), isentropic compressibility (β), acoustic impedance (Z) and degree of intermolecular interaction (δ). The excess values of these parameters are also evaluated over the different mole fraction range. The results are interpreted in terms of molecular interaction such as dipole-dipole interaction through hydrogen bonding between components of mixtures. The dependence of excess properties of mixtures on compositions were compared and discussed in terms of the molecular interaction and other factors affecting the salvation and self association effect. The excess values of these indicate the complexity of dipole induced interaction in the binary liquid mixtures and also discussed selection of organic solvent by using above mentioned thermophysical properties of binary liquid mixtures. Also the new model equations have been developed by using design expert program for viscosity, ultrasonic velocity, refractive index, surface tension and density. The results were interpreted in terms of molecular interaction occurring in the solution.

KEYWORDS: Accoustical Properties, Molecular interactions, Physical and Thermodynamic properties, Dipole-Dipole interactions.

1. INTRODUCTION

Surface tension is a flexible non-ruinous property and exceedingly helpful for measurement of different properties like Excess molar volume (V^E), Viscosity deviation ($\Delta\eta$), deviation in refractive index (Δn_D), Deviation in ultrasonic velocity (Δu), isentropic compressibility(β), acoustic impedance(Z), Degree of intermolecular attraction(δ) at temperatures 308.15K, 313.15 K, 318.15 K. The study of molecular interaction plays a vital role in the development of molecular science and selection of organic solvents by using thermophysical properties of binary liquid mixtures. Molecular interactions and structural behavior of molecules and their mixtures can be identified by using surface tension in medication, building and forming. (Megremis, 2010; Golamari Siva Reddy, 2013; Golamari Siva Reddy, 2014; Golamari Siva Reddy, 2013). The practical application of mixed solvents, rather than single solvent, in industrial and biological process has been recognized all over the world, as they provide a wide choice of solvent mixtures with appropriate properties (Kashiwagi, 1982; Ramanujappa, 2000). Ultrasonic Velocity and surface tension together with Density and Viscosity information outfit excess of data about the association between particles, Dipoles, Hydrogen bonding, Multi-polar and Dispersive forces (Vodamalar, 2011; Thirumanan, 2009; Ali, 2000; Devadss, 2003). We focus in this paper the selection of organic solvent and also results of surface tension, refractive index, density, viscosity and ultrasonic studies of binary mixtures of Aniline with Water. As a result, the organic solvent is identified best at particular temperature and significant interaction through hydrogen bonding between unlike molecules in these binary mixtures is expected. Also, it is worth while examining the effect of intermolecular interaction at temperatures 308.15 K, 313.15 K, 318.15 K.

Various acoustical properties have been useful in understanding the molecular interactions. The excess property study has been used for the Design of equipments for heat transfer, fluid mechanics, process calculation, bioprocess technology, fermentation technology, biochemical engineering, drying and process control.

Literature survey shows that the work reported on thermophysical, thermoacoustical and thermodynamic properties of the binary mixtures is scanty. Hence, in the present study an attempt is made to find out the above properties for the system Acetone-water. The objective of present work is to provide new experimental data on the density, Viscosity, Refractive index, Ultrasonic velocity and surface tension of organic solvent with water mixture, and to estimate excess volumes and derived thermodynamic properties such as excess molar volume (V^E), Viscosity deviation ($\Delta\eta$),Refractive index deviation (Δn_D), deviations in ultrasonic velocity Δu, adiabatic compressibility(β), acoustic impedance (Z) and degree of intermolecular interaction (δ) using different correlations and a well known equation of state and also the new model equations have been developed by using Design Expert program for viscosity, ultrasonic velocity, refractive index, surface tension and density and then finally best organic solvent is identified.

2. MATERIALS AND METHODS

The blends of different fixations in mold division were read by taking systemic reagent grade and spectroscopic reagents grade chemicals with purity if 99.99% and got from E.Merck Ltd (India). In every one of the blends, the mole part of the blend is changed from 0 to 1.0. So, as to have the blend of distinctive focus. The density, Viscosity, Surface tension, Refractive index and Ultrasonic velocity were measured as an element of grouping of the parallel fluid blend at temperature of T=308.15K, 313.15 K, 318.15 K.

Measurements: The densities of the blend were measured utilizing a 50ml specific gravity bottle with an accuracy of ±0.01 kg/m^3. An Oswald Viscometer (10ml) with an exactness of ±0.001 m.Pa was utilized for the viscosity estimation. Refractive indexes were measured utilizing thermostatically controlled Abbe refractometer (Atago 3T) with exactness of ±0.001 units. Ultrasonic velocity estimations were made utilizing the ultrasonic interferometer (Model M-84, Supplied by M/S Mittal Enterprises, New Delhi), with the exactness of ±0.1m/sec. Surface tension was resolved utilizing drop volume tensiometer and the precision of the surface tension estimation was evaluated to be 0.1mNm^{-1}.

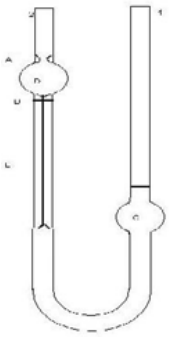

Figure.1.Ostwalds Viscometer

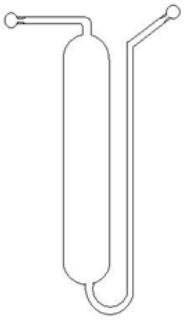

Figure.2.Pckynometer

Figure.3.Refractometer

Figure.4.Drop Volume Tensiometer

Figure.5.Ultrasonic Interferometer

Theoretical aspect: The following thermodynamic parameters were calculated:

Excess molar volume (V^E) has been calculated from the density (ρ) of the medium using the following equation

$$V^E = \left(\frac{x_1M_1+x_2M_2}{\rho_m}\right) - \left(\frac{x_1M_1}{\rho_1} + \frac{x_2M_2}{\rho_2}\right) \quad (1)$$

Where x_1 and x_2 refer to the mole fraction of components 1 and 2. ρ_1,ρ_2 and ρ_m refer to the density of components 1 and 2 and the density of the mixture, respectively.

Viscosity deviation (Δη) has been determined by $\Delta\eta = \eta - \left(x_1\eta_1 + x_2\eta_2\right)$ (2)

Where η, η_1, η_2 are the viscosity of the mixture and the viscosity of pure components 1 and 2, respectively. The uncertainty in the calculation of $\Delta\eta$ from viscosity measurements was estimated to be ±0.0001.

Refractive index deviation (Δn_D) from linear additive value of the mole fraction is obtained by

$$\Delta n_D = n_D - (x_1 n_{D1} + x_2 n_{D2}) \quad (3)$$

Where n_D, n_{D1}, n_{D2} are the refractive index of the mixture and the refractive index of pure components 1 and 2, respectively.

Ultrasonic velocity deviations (Δu) has been determined by $\Delta u = u - (x_1u_1 + x_2u_2)$ (4)

Where u, u_1, u_2 are the ultrasonic velocity of the mixture and the ultrasonic velocity of pure components 1 and 2, respectively. Isentropic compressibility (β) has been calculated from the ultrasonic velocity (u), and the density (ρ) of the medium using the Newton-Laplace equation, (Thirumaran, 2009) $\beta = \frac{1}{\rho u^2}$ (5)

Acoustic impedance (Z) has been determined by $Z = \rho u$ (6)

Where ρ is the density of mixture and u is the ultrasonic velocity of the mixture

Deviation in acoustic impedance (ΔZ) has been determined by $\Delta Z = Z - (x_1 Z_1 - x_2 Z_2)$ (7)

Where Z, Z_1 and Z_2 are the acoustic impedance of the mixture and the acoustic impedance of pure components 1 and 2, respectively.

Degree of intermolecular attraction (δ) was calculated by the equation $\delta = \left(\frac{u^2}{u_{im}^2}\right) - 1$ (8)

Where $u_{im}^2 = \frac{1}{(x_1 M_1 + x_2 M_2)\left(\frac{x_1}{M_1 u_1^2} + \frac{x_2}{M_2 u_2^2}\right)}$

3. RESULTS AND DISCUSSIONS

Density(ρ), viscosity(η), ultrasonic velocity (u),refractive index(n_D) and surface tension(σ) for Aniline with water at 308.15 K 313.15 K, 318.15 K. in table:1,2 & 3and the other parameters such as excess molar volume (V^E), Viscosity deviation (Δη),refractive index deviation (Δn_D), deviations in ultrasonic velocity(Δu), Acoustic impedance (Z) for the Aniline with Water at 308.15 K, 313.15 K, 318.15 K. have been calculated.

Table 1: shows that the density decreases from 1.0196 to 1.0015 g/cc with increase of concentration of aniline in the mixture from 0 to 1 mole fraction at 308.15 K. Decrease in the density indicates that maximum interaction between unlike molecules Golamari Siva Reddy, 2015.

Table 2: shows that the density decreases from 1.0089 to 1.0001 g/cc with increase of concentration of aniline in the mixture from 0 to 1 mole fraction at 313.15 K. Decrease in the density indicates that maximum interaction between unlike molecules.

Table 3: shows that the density decreases from 1.0019 to 1.0003 g/cc with increase of concentration of aniline in the mixture from 0 to 1 mole fraction at 318.15K. Decrease in the density indicates that maximum interaction between unlike molecules.

The equation generated for density of aniline with water mixture at 308.15 K termed as coded factor has been given as

$y = -0.0062x^2 - 0.012x + 1.0197$ (9)

$R^2 = 0.9953$

The equation generated for density of aniline with water at 313.15 K termed as coded factor has been given as

$y = 0.0076x^2 - 0.0159x + 1.0085$ (10)

$R^2 = 0.9905$

The equation generated for density of aniline with water at 318.15 K termed as coded factor has been given as

$y = 1E\text{-}05x^2 - 0.0014x + 1.0018$ (11)

$R^2 = 0.9763$

From the equations 9, 10 and 11 the R^2 values it has been seen that the predicted values of density is a linear function of actual on having intercept 0 and of slope 1, so aniline with water mixture at 308.15K is the best fitting binary mixture compared to other two remaining temperatures. Then at 308.15 K the aniline with water mixture is best.

Table 1: indicates that the viscosity increases from 0.7939 to 1.1197 CP with increase in concentration of Aniline with Water in the mixture from 0 to 1 mole fraction. The increase of viscosity in the mixture of aniline with water is due to Dipole-Dipole interaction between the binary systems (Saravanakumar, 2012).

Table 2 shows that the viscosity increases from 0.7942 to 1.0954 CP with increase in concentration of Aniline with water in the mixture from 0 to 1 mole fraction. The increase of viscosity in the mixture of aniline with water is due to Dipole-Dipole interaction between the binary systems.

Table 3: shows that the viscosity increases from 0.81769 to 1.2045 CP with the increase in concentration of Aniline with water in the mixture from 0 to 1 mole fraction. The increase of viscosity in the mixture of aniline with water is due to Dipole-Dipole interaction between the binary systems.

The equation generated for viscosity of aniline with water mixture at 308.15 K in terms of coded factor has been given as

$\eta = -0.2137x^2 + 0.6306x + 0.7285$ (12)

$R^2 = 0.8157$

The equation generated for viscosity of aniline with water mixture at 313.15 K in terms of coded factor has been given as

$\eta = -0.196x^2 + 0.565x + 0.7481$ (13)

$R^2 = 0.8706$

The equation generated for viscosity of aniline with water mixture at 318.15 K in terms of coded factor has been given as

$\eta = -0.5689x^2 + 0.9645x + 0.7948$ (14)

$R^2 = 0.923$

From the equations 12, 13 and 14 the R^2 values it has been seen that the predicted values of density is a linear function of actual on having intercept 0 and of slope 1, so aniline with water mixture at 318.15 K is the best fitting binary mixture compared to other two remaining temperatures. Then at 318.15 K the aniline with water mixture is best.

From table 1: it is observed that Refractive index decreases from 1.3969 to 1.1948 with the increase in concentration of Aniline with water at 308.15 K in the mixture from 0 to 1 mole fraction. The refractive index decreases with the increase in composition. The decreasing refractive index suggests that the strong interaction between unlike molecules due hydrogen bonding Saravanakumar, 2011.

From table 2: it is observed that Refractive index increases from 1.3321 to 1.3748 with the increase in concentration of Aniline with Water at 313.15K in the mixture from 0 to 1 mole fraction. The refractive index increase with increase in composition. The increasing refractive index suggests that the weak interaction between unlike molecules due to hydrogen bonding.

From table 3: it is observed that Refractive index increases from 1.3221 to 1.3648 with the increase in concentration of Aniline with Water at 318.15K in the mixture from 0 to 1 mole fraction. The refractive index increase with increase in composition. The increasing refractive index suggests that the weak interaction between unlike molecules due to hydrogen bonding.

The equation generated for refractive index of aniline with water mixture at 308.15 K in terms of coded factor has been given as

$n_{D=} -0.4979x2 + 0.297x + 1.3774$ (15)

$R^2 = 0.8335$

The equation generated for refractive index of aniline with water mixture at 313.15˚K in terms of coded factor has been given as

$n_{D=} 0.0345x2 + 0.0036x + 1.3341$ (16)

$R^2 = 0.9591$

The equation generated for refractive index of aniline with water mixture at 318.15˚K in terms of coded factor has been given as

$n_{D=} 0.0467x2 - 0.0045x + 1.322$ (17)

$R^2 = 0.971$

From the equations 15, 16 and 17 the R^2 values it has been seen that the predicted values of density is a linear function of actual on having intercept 0 and of slope 1, so aniline with water mixture at 318.15K is the best fitting binary mixture compared to other two remaining temperatures. Then at 318.15 K the aniline with water mixture is best.

Table1: It indicates that Ultrasonic velocity increases from 1070 to 1106 m/s with increase of concentration of Aniline with water mixture from 0 to 1.0 mole fraction due to intermolecular interactions at 308.15K. The ultrasonic velocity increases due to hetero-and homo molecular groups were the first to bring up the ultrasonic velocity approach for subjective estimation of the binary mixtures in fluids Manukonda, 2013; Bindhani, 2014, at the temperature 308.15 K

Table 2: It indicates that Ultrasonic Velocity increases from 970 to 1054 m/s with increase of concentration of Aniline with Water mixture from 0 to 1.0 mole fraction due to intermolecular interactions at 313.15 K. The ultrasonic velocity increases due to hetero-and homo molecular groups were the first to bring up the ultrasonic velocity approach for subjective estimation of the binary mixtures in fluids at the temperature 313.15 K.

Table 3: Ultrasonic velocity increases from 972 to 1035 m/s increase of concentration of Aniline with water mixture from 0 to 1.0 mole fraction due to intermolecular interactions at 308.15K. The ultrasonic velocity increases due to hetero-and homo molecular groups were the first to bring up the ultrasonic velocity approach for subjective estimation of the binary mixtures in fluids at the temperature 318.15K.

The equation generated for ultrasonic velocity of Aniline-water mixture at 308.15 K in terms of coded factor has been given as

$u = -99.442x^2 + 97.845x + 1066.2$ (18)

$R^2 = 0.1115$

The equation generated for ultrasonic velocity of Aniline-Water mixture at 313.15K in terms of coded factor has been given as:

$u = 28.543x^2 + 30.779x + 973.76$ (19)

$R^2 = 0.9733$

The equation generated for ultrasonic velocity of Aniline-water mixture at 318.15 K in terms of coded factor has been given as:

$u = 0.6294x^2 - 0.1524x + 972.33$ (20)

$R^2 = 0.9691$

From the equations 18, 19 and 20 the R^2 values it has been seen that the predicted values of density is a linear function of actual on having intercept 0 and of slope 1, so aniline with water mixture at 313.15K is the best fitting binary mixture compared to other two remaining temperatures. Then at 313.15 K the aniline with water mixture is best.

From table 1: Surface tension decreases from 26.42 to 16.61 dyne/cm with increase of concentration of Aniline with water mixture from 0 to 1.0 mole fraction due to intermolecular interactions at 308.15K. A decreasing surface tension suggests that the liquid structure and enthalpy decreases between unlike molecules due to hydrogen bonding Senthil Raja, 2004.

From table 2: Surface tension decreases from 25.44 to 18.64 dyne/cm with increase of concentration of Aniline with water mixture from 0 to 1.0 mole fraction due to intermolecular interactions at 308.15K. A decreasing surface tension suggests that the liquid structure and enthalpy decreases between unlike molecules due to hydrogen bonding.

From table 3: Surface tension decreases from 23.44 to 17.64 dyne/cm with increase of concentration of Aniline with water mixture from 0 to 1.0 mole fraction due to intermolecular interactions at 308.15 K. A decreasing surface tension suggests that the liquid structure and enthalpy decreases between unlike molecules due to hydrogen bonding.

The equation generated for ultrasonic velocity of Aniline-water mixture at 308.15 K in terms of coded factor has been given as:

$\sigma = -1.586x^2 - 8.3416x + 26.587$ (21)

$R^2 = 0.986$

The equation generated for ultrasonic velocity of Aniline-water mixture at 313.15 K in terms of coded factor has been given as:

$\sigma = -6.1363x^2 - 0.8753x + 25.628$ (22)

$R^2 = 0.9791$

The equation generated for ultrasonic velocity of Aniline-water mixture at 318.15 K in terms of coded factor has been given as:

$\sigma = -8.0756x^2 + 2.2501x + 23.425;$ (23)

$R^2 = 0.9633$

From the equations 21, 22 and 23 the R^2 values it has been seen that the predicted values of density is a linear function of actual on having intercept 0 and of slope 1, so aniline with water mixture at 308.15K is the best fitting binary mixture compared to other two remaining temperatures. Then at 308.15 K the aniline with water mixture is best.

Figure6shows that the excess molar volume aniline with water mixture is negative for all studied temperatures. Treszczanowicz, 1981, and Roux and Desnoyers, 1978, suggested that excess molar is the resultant contribution from several opposing effects. These may be divided arbitrarily into three types, namely chemical, physical and structural. A physical contribution, that is specific interactions between the real species present in the mixture, contribute a negative term to excess molar volume. The chemical or specific intermolecular interactions result in a volume decrease, and these include charge transfer type forces and other complex forming interactions. This effect contributes negative values to excess molar volume. The structural contributions are mostly negative and arise from several effects, especially from interstitial accommodation and changes of free volume. In other words, structural contributions arising from geometrical fitting of one component into the other due to the differences in the free volume and molar volume between components lead to a negative contribution to excess molar volume. From the above discussion it is concluded that the excess molar volume values are best at 308.15 K.

Viscosity values are positive for the all three temperatures. The variation of viscosity deviations, with the mole fraction of binary systems are shown in figure: 7 and the data shows that the viscosity deviations are positive for all three temperatures, indicating that interaction between binary mixtures is strong. The positive viscosity deviation indicates that the interaction between binary mixtures is strong and it is observed in the systems diethyl

carbonate with alcohols, diacetone Alcohol + Benzene or chlorobenzene, methanol, ethanol, *n*-Propanol, and *n*-Butanol with Pyridine (Kubendran, 2008; Changsheng vang, 2006). The viscosity of binary mixture highly depends on entropy of mixture, which is related with liquid's structure and enthalpy. Therefore the viscosity deviation depends on molecular interactions as well as on the size and shape of the molecules and also the negative V^E shows strong complex formation due to charge transfer between the liquids. So the best temperature is at 308. 15 K for Aniline-water mixture.

The result of refractive index deviation versus mole fraction at 308.15 K, 313.15 K, 318.15 K for the system Aniline with water. Here at 308.15 K the system exhibit positive deviation and 313.15 K, 318.15 K the system exhibits negative deviation. The positive deviation is due to the electronic perturbation of the individual molecules during mixing and therefore depends very much on the nature of the mixing molecules (Kubendran, 2010). The values of adiabatic compressibility are positive for the temperature 308.15 K and it is also reported similar results for the system acetophenone-methyl acetate (Tshibangu, 2011). The values of adiabatic compressibility become negative, the weak structure making interactions at elevated temperatures due to enhanced thermal motion. In the present systems the values of adiabatic compressibility become highly negative. This may be indicated that the weak structure making interactions at temperatures due to dipole-dipole interaction as shown in figure 8. Figure 9 show that the ultrasonic deviation is positive at 308.15 K and negative for 313.15 K, 318.15 K. The positive ultrasonic velocity deviation is depends on the only liquid structure and enthalpy of a binary mixtures.

The surface tension deviation is positive over the whole mole fraction range for all three temperatures. The positive surface tension deviation does not depend on molecular interactions as well as on the size and shape of the molecules Shafiq, 2011. Here surface tension deviation does not depend on entropy; hence the mixture molecular interactions are very low. When compared to 313.15 K and 318.15 K, 308.15 K has little high molecular interaction as shown in figure 10.

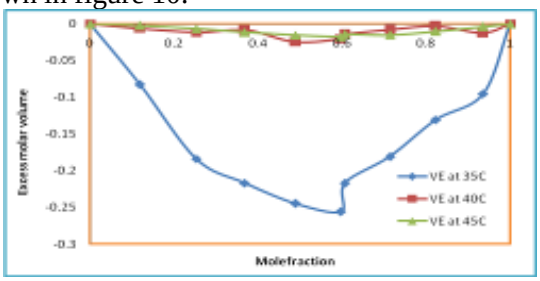

Figure.6.Excess molar volume of aniline with water at 308.15 K, 313.15 K and 318.15 K

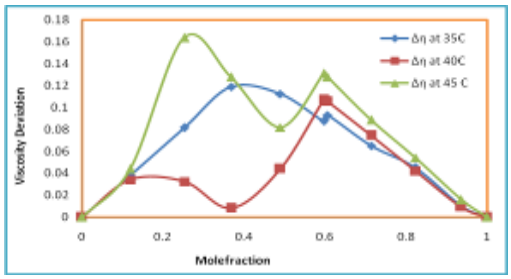

Figure.7.Viscosity Deviation of aniline with water at 308.15 K, 313.15 K and 318.15 K

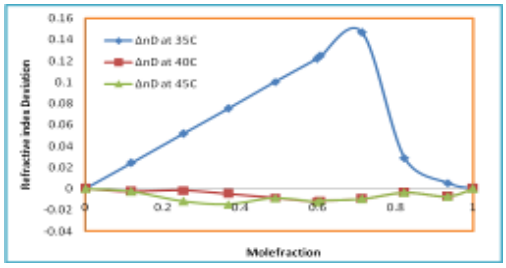

Figure.8. Refractive index deviations of aniline with water at 308.15 K, 313.15 K and 318.15 K

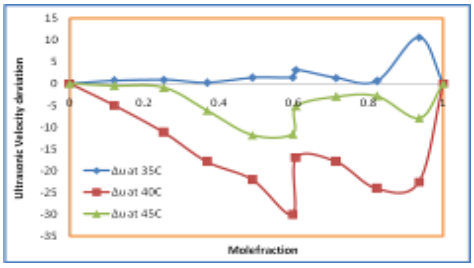

Figure.9.Ultrasonic velocity deviations of aniline with water at 308.15 K, 313.15 K and 318.15 K

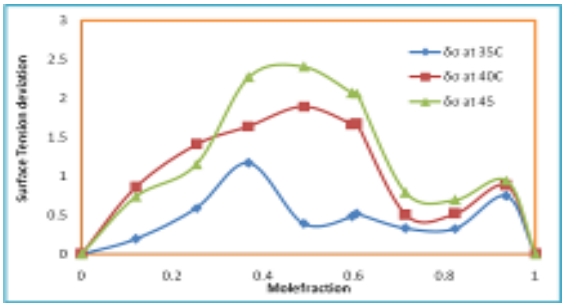

Figure.10.Surface tension deviation of aniline with water at 308.15 K, 313.15 K and 318.15 K

Table.1.Thermophysical properties of aniline with water at temperature 308.15K

308.15K													
X_1	X_2	ρ	n_D	u	σ	Δu	Δn_D	Δσ	Z	$\beta X10^7$	η	Δη	V^E
0	1	1.0196	1.3969	1070	26.42	0	0	0	1090.972	8.5665	0.7939	0	0
0.1187	0.8813	1.0178	1.3972	1075	25.45	0.7268	0.02429	0.19445	1094.135	80.502	0.7944	0.03817	-0.08258
0.2525	0.7475	1.0168	1.3975	1080	24.53	0.91	0.05163	0.58702	1098.144	8.4317	0.7945	0.08166	-0.1837
0.3678	0.6322	1.0145	1.3978	1083	23.98	0.2408	0.07523	1.16812	1098.704	8.4041	0.7948	0.11893	-0.21684
0.4892	0.5108	1.0125	1.3983	1089	22.01	1.3888	0.10027	0.38905	1102.613	8.3282	1.0658	0.11252	-0.24456
0.5965	0.4035	1.0108	1.3985	1090	21.05	1.474	0.12215	0.48167	1101.772	8.3269	1.0758	0.08756	-0.25582
0.6063	0.3937	1.0097	1.399	1095	20.99	3.1732	0.12463	0.5178	1105.622	8.2601	1.0841	0.09267	-0.21701
0.7135	0.2865	1.0074	1.3995	1097	19.09	1.314	0.1468	0.33057	1105.118	8.2487	1.0914	0.06504	-0.18075
0.8229	0.1771	1.0052	1.2018	1099	18.38	0.6244	0.02879	0.03265	1104.715	8.2367	1.1072	0.0452	-0.13063
0.9354	0.0646	1.0036	1.2132	1000	17.99	103.67	0.00534	0.74627	1003.6	9.9641	1.1087	0.01005	-0.09517
1	0	1.0015	1.1948	1106	16.61	0	0	0	1107.659	8.1628	1.1197	0	0

Table.2.Thermo physical properties of aniline with water at temperature 313.15K

40													
X_1	X_2	ρ	n_D	u	σ	Δu	Δn_D	Δσ	Z	$\beta X10^7$	H	Δη	V^E
0	1	1.0089	1.3321	970	25.44	0	0	0	978.633	1.0534	0.7942	0	0
0.119	0.881	1.0065	1.3345	975	25.49	-4.9708	-0.00267	0.85716	981.3375	1.0451	0.7959	-0.0341	-0.00628
0.253	0.748	1.0047	1.3412	980	25.13	-11.21	-0.00168	1.407	984.606	1.0363	0.838	-0.0323	-0.01129
0.368	0.632	1.0034	1.3431	983	24.58	-17.895	-0.00471	1.64104	986.3422	1.0313	0.8969	-0.0081	-0.00833
0.489	0.511	1.0029	1.3442	989	24.01	-22.093	-0.00879	1.89656	991.8681	1.0194	0.8974	-0.0441	-0.02469
0.597	0.404	1.0021	1.3451	990	23.05	-30.106	-0.01247	1.6662	992.079	1.0181	1.0812	0.10733	-0.02019
0.606	0.394	1.0019	1.3465	1008	22.99	-12.929	-0.01149	1.67284	1009.915	9.8232	1.0825	0.10568	-0.0141
0.714	0.287	1.0009	1.3531	1012	21.09	-17.934	-0.00947	0.5018	1012.911	9.7554	1.0836	0.07449	0.00778
0.823	0.177	1.0007	1.3635	1015	20.36	-24.124	-0.00374	0.51572	1015.711	9.6998	1.0842	0.04214	-0.00272
0.935	0.065	1.0005	1.3648	1028	19.96	-20.574	-0.00724	0.88072	1028.514	9.4579	1.0851	0.00916	-0.01201
1	0	1.0001	1.3748	1054	18.64	0	0	0	1054.105	9.0006	1.0954	0	0

Table.3.Thermo physical properties of aniline with water at temperature 318.15K

45													
X_1	X_2	ρ	n_D	u	σ	Δu	Δn_D	Δσ	Z	$\beta X10^7$	H	Δη	V^E
0	1	1.0019	1.3221	972	23.44	0	0	0	973.8468	1.0564	0.81769	0	0
0.119	0.881	1.0015	1.3245	979	23.49	-0.4781	-0.00267	0.73846	980.4685	1.0418	0.81956	0.044	-0.00192
0.253	0.748	1.0013	1.3212	987	23.13	-0.9075	-0.01168	1.1545	988.2831	1.0251	1.0794	0.16404	-0.00657
0.368	0.632	1.0012	1.3231	989	23.58	-6.1714	-0.01471	2.27324	990.1868	1.0211	1.0879	0.12794	-0.01123
0.489	0.511	1.0011	1.3342	991	23.01	-11.82	-0.00879	2.40736	992.0901	1.0171	1.0889	0.08198	-0.01533
0.597	0.404	1.001	1.3351	998	22.05	-11.58	-0.01247	2.0697	998.998	1.003	1.1795	0.13108	-0.01767
0.606	0.394	1.0009	1.3365	1005	21.99	-5.1969	-0.01149	2.06654	1005.905	9.8918	1.1802	0.12799	-0.01401
0.714	0.287	1.0008	1.3431	1014	20.09	-2.9505	-0.00947	0.7883	1014.811	9.718	1.1824	0.08872	-0.01501
0.823	0.177	1.0006	1.3535	1021	19.36	-2.8427	-0.00374	0.69282	1021.613	9.5871	1.1901	0.0541	-0.01017
0.935	0.065	1.0004	1.3548	1023	18.96	-7.9302	-0.00724	0.94532	1023.409	9.5515	1.1954	0.01589	-0.00368
1	0	1.0003	1.3648	1035	17.64	0	0	0	1035.311	9.3323	1.2045	0	0

4. CONCLUSION

The system Aniline with water has been studied by measuring density, viscosity, ultrasonic velocity, refractive index and surface tension at the temperatures 308.15 K, 313.15 K, 318.15 K. These experimental data and the derived properties have been analyzed in terms of specific interaction and molecular interaction due to electron donor-accepter complex between the component molecules and also determined best temperature for the organic solvent. The important fact is that the new equations developed for density, viscosity, refractive index, ultrasonic velocity and surface tension has been found to fit well as compared to the existing equations. So based on the above results, the best temperature is 308.15K for Aniline-water mixture.

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Nomenclature

Excess molar volume	V^E
Viscosity deviation	Δη
deviation in refractive index	Δn_D
Deviation in ultrasonic velocity	Δu
isentropic compressibility	B
acoustic impedance	Z
deviation in acoustic impedance	ΔZ

Degree of intermolecular attraction	δ
Deviation in surface tension	$\Delta\sigma$
Density	ρ
Viscosity	η
Refractive Index	n_D
Ultrasonic Velocity	u
Surface Tension	σ

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