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Densities Of Tris-(Hydroxymethyl)Amino Methane Hydrochloride In 20 %(V/V) Binary System At 303.15ºK.

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Abstract: Densities of Tris-(hydroxymethyl)amino methane hydrochloride is measured in20 %(v/v) acetone-water system 303.15 ºK. These studies are of great help in characterizing the structure and properties of solutions. The addition of an organic solvent to water brings about a sharp change in the solvation of ions. The peculiarities of the water and organic mixtures are well reflected in dramatic changes in the reaction rate also. The related parameters of density, like apparent molar volume (ϕ_v), apparent molar volume at infinite dilution (ϕ_V^*), experimental slope (S_V^*), and excess molar volume (V^E) are calculated and reported. The large and positive values of apparent molar volume (ϕ^0_v) suggests the presence of strong solute – solvent interaction.
Key words: Density, molar volume, acetone, apparent molar volume, excess molar volume.

Introduction And Experimentation

It is well known that the reaction medium plays an important role in determining reactivity which reflected in thermodynamic, transport and spectral properties[1]. In order to gain insight into the mechanism of such interactions, thermodynamics and transport studies involving one or more solutes in mixed solvent systems are highly useful. The volumetric studies in solution provide an excellent method for obtaining data on solute-solute and solute - solvent interactions in solution. Extensive work has been carried out on the volumetric of solution of electrolytes in aqueous, nonaqueous and aquo-organic solvent [2-5]. The densities and excess molar volumes of liquids and their mixtures are required, for example, for relating the excess enthalpy and excess Gibbs energy. From a practical point of view, the data are useful for the design of mixing, storage, and processing equipment. In the present investigation Tris-(hydroxymethyl)amino methane hydrochloride is measured in20%(v/v) acetone- water system 303.15 ºK. Densities of the compound and other related parameter are determined in order to study interaction between solute and solvent.

Apparatus used are Double armed pycnometer,beaker, volumetric flask, Digital analytical balance etc. Acetone, Tris-(hydroxymethyl)amino methane hydrochloride and doubled distilled water are reagents**.** A stock solution of 0.100M Tris-(hydroxymethyl)amino methane hydrochloride is prepared in 20 %(v/v) acetone-water solvent by direct weighing. Mass dilution technique used for preparation of other concentrations. The concentration of the solutions involved in the experiment was taken in range from 0.010M to 0.100M. Mass dilution technique was appliedto prepare the solution of different concentration. Densities of solutions of Tris-(hydroxymethyl)amino methane hydrochloride in 20%(v/v) ethanol-water at 303.15°K are determined using $10cm^3$ double armed pycnometer. The pycnometer was calibrated

at these temperatures with doubled distilled water and benzene. The estimated accuracy of density measurement of solution was 0.00003 g cm^{-3}.

Results and discussion

Densities of Tris-(hydroxymethyl)amino methane hydrochloride in 20%(v/v) acetone-water system calculated by the following equation [6]

$\rho/\rho_1 = W/W_1$ (1)

Where, W and W_1 are weight of Tris-(hydroxymethyl)amino methane hydrochloride in acetone-water respectively. ρ is density of Tris-(hydroxymethyl)amino methane hydrochloride and ρ_1 is density of ethanol-water solution . Densities of stannous chloride solutions, determined as a function of their concentration at 303.15 $^{\circ}$K temperature in 20 %(v/v)acetone-water solution . The densities of solute were obtained as an intercept of plot between concentration and density of solutions (using Microsoft Excel). The data is reported in **Table -1.**

Table-1. Densities, ρ, Tris-(hydroxymethyl)amino methane hydrochloride is measured in 20 %(v/v) acetone- water system 303.15°K.

Concentration (Mol.L^{-1})c	**Density (Kg.M^{-1})** ρ
0.0100	0.9436
0.0200	0.9446
0.0300	0.9458
0.0400	0.9466
0.0500	0.9476
0.0600	0.9493
0.0700	0.9506
0.0800	0.9528
0.0900	0.9542
0.1000	0.9551

Apparent molar volume, ϕ_v, is calculated by following the equation [7]

$\phi_v = (\rho_1-\rho)/c\rho\rho_1 + M/\rho$ (2)

Where, c is Morality of the solution, M is Molar mass of the solute,ρ andρ_1 Density of solution and solute. The result of ϕ_v of Tris-(hydroxymethyl)amino methane hydrochloride are reported in Table- 2. The apparent molar volume at infinite dilution ϕ_V^0 were calculated by the method of least square and fit to plot of ϕ_v vs $c^{1/2}$ in accordance with the Masson's empirical relation[8],

$\phi_v = \phi_V^0 + S_V^* c^{1/2}$ (3)

Where, S_V^* is experimental slope. The slope is calculated by the extrapolation of the plots to zero concentration (using Microsoft excel). The negative values of experimental slope is very less. It is generally associated with the solutes showing an overall hydrophilic character as in the present investigation. The values of apparent molar volume are reported in Table-2.

The molar volumes of solutions are derived from the following expression [9],

$V = (X_1M_1+X_2M_2)/\rho$ (4)

Where, X_1 and X_2 are Mole fraction of mixed solvent and Mole fraction of solute.M_1 and M_2 Molecular weight of solvent and Molecular weight of solute ρ is density of solution respectively. The data of molar volume of solution is reported in Table-3. The molar volume of acetone-water is 20.3438 .The molar volume of Tris-(hydroxymethyl)amino methane hydrochloride is 167.4191respectively.

The excess molar volume (V^E) for these solutions are obtained by the given expression[9],

$$V^E = V - (X_1 V_1 + X_2 V_2) \qquad (5)$$

Where, V, V_1 and V_2 are the molar volume of solution, mixed solvent and solute respectively. Positive excess molar volume arises due to increased interaction between the unlike molecules. All the values are positive. The data of compound is reported in Table -4.

Table-2. Apparent molar volume ϕ_v, apparent molar volume infinite dilution, ϕ_V^0 and experimental slope, S_V^* Tris-(hydroxymethyl)amino methane hydrochloride is measured in20 %(v/v) acetone- water system 303.15 ºK

Concentration	**Apparent molar volume**	**ϕ_V^0**	**S_V^***
0.0100	167.1350		
0.0200	167.0737		
0.0300	166.9522		
0.0400	166.8917		
0.0500	166.7716	167.6525	-23.3587
0.0600	166.4487		
0.0700	166.1870		
0.0800	165.7010		
0.0900	165.3791		
0.1000	165.1369		

Table-3. Molar volume of Tris-(hydroxymethyl)amino methane hydrochloride is measured in20 %(v/v) acetone- water system 303.15 ºK

Concentration (Mol.L^{-1})c	**Molar volume V (M^3.Mol^{-1})**
0.0100	22.5581
0.0200	21.5730
0.0300	21.5651
0.0400	21.5663
0.0500	21.5629
0.0600	21.5420
0.0700	21.5301
0.0800	21.5007
0.0900	21.4890
0.1000	21.4861

Table-4. Excess molar volume of Tris-(hydroxymethyl)amino methane hydrochloride is measured in20 %(v/v) acetone- water system 303.15 ºK

Concentration (Mol.L^{-1})c	**Excess molar volume V^E**
0.0100	1.2691
0.0200	0.2639
0.0300	0.2360
0.0400	0.2169
0.0500	0.1936
0.0600	0.1527
0.0700	0.1207
0.0800	0.0714
0.0900	0.0396
0.1000	0.0166

Conclusion

The data of densities increases as function of concentration. The positive value of ϕ_v indicate greater solute-solvent interactions. The values of ϕ^0_v are large and positive for Tris-(hydroxymethyl)amino methane hydrochloride in 20%(v/v)acetone-water solution, suggesting the presence of strong solute–solvent interaction. The excess molar volume for this systems are positive and this means that dispersion forces are dominant, and in some systems a complex formation by hydrogen bonds is obtained, collaborated by other thermodynamic properties.

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