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Several Properties Viscosities and Densities of Ethanolamine - water systems at 25ºC

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Abstract

Precise Viscosities and Densities for Ethanolamine-water mixtures containing 15, 30, 50, 60, 70, 80 % by weight have been determined at 25ºC where possible the data are compared with previously reported values. The use of mixed solvents enables the variation in properties such as dielectric constant and Viscosity and therefore, the ion-ion and ion-solvent interactions can be better studied.

Key words : Viscosities, Densities, Ethanolamine, dielectric constant, ion-ion, ion-solvent.

Introduction

The viscosity and density measurement gives us much information regarding the ion-ion and ion-solvent interactions. The data Presented here were accumulated during the course of an Extensive investigation[1] of the transport behavior of dilute solution of symmetrical electrolytes in mixed solvents. With the help of mixed solvents one can enables the variation in Properties such as Viscosities and Densities[2-4]. Ethanolamine or Monoethanolamine (EA) is an organic solvent and has both a primary amine and primary alcohol (due to a hydroxyl group), which acts as a weak base like other amines. It is composed of a polar hydroxyl group and a polar amino group joined by a two carbon alkyl chain.

Aqueous binary mixtures of organic solvent with its varying range of composition are most frequently investigated solvent media[5-11].

The viscosity and density property is very important in many practical problems concerning

Table 1. Physical Properties of E.A. + H_2O Mixtures at 25°C

Wt. %	Density ρ $g.cm^{-3}$	Viscosity η cP	Dielectric Constant D
15%	1.0030 (1.0029)*	1.41 (1.40)*	76.5
30%	1.0103 (1.0104)*	2.39 (2.38)*	74.2
50%	1.0206 (1.0207)*	5.26 (5.27)*	72.7
60%	1.0240 (1.0244)*	8.20 (8.21)*	64.9
70%	1.0258 (1.0259)*	11.97 (11.98)*	60.8
80%	1.0243 (1.0244)*	16.13 (16.14)*	53.8

* Reported values of density and viscosity of solvent mixtures are given in parenthesis; Ref: [14].

energy transport, mass transport fluid flow. The viscosity and density data has proved to be very useful elucidating the structural properties of the molecule[12].

Materials

A sample of EA (Laboratory grade, E. Merck) is subjected to fractional Distillation[13] (at 171.1C and 760 mm Hg) and kept in air tight bottle to prevent the absorption of carbon-dioxide, potentiometer titration of EA against standard hydrochloric acid using Methyl-orange indicator EA solvent of 99.96% purity.

The specific conductance of pure EA was found to be (11.1-11.5) x 10^{-6} S cm^{-1}in good agreement with the literature value [14] of (11.3 - 11.6) x 10–6 S cm^{-1}. At 25°C the density of pure EA was found to be 1.0119g cm^{-3} and viscosity 18.12 cP Previous values 14 for the density of pure EA at 25°C 1.0118 g cm^{-3} and viscosity 18.10 cP.

Experimental

Measurement Of Density and Viscosity :

The viscosities and densities of the various solvent systems were measured at 25°C. The viscosity measurements were made using the ubbelohde type viscometer while the density measurements were carried out with pyknometer. First of all both the Viscometer and Pyknometer were cleaned with chromic acid twice so that drainage of the solution became Proper. Afterthis**,** we calibrate these Instruments with distilled water.

Results and Discussion

The densities (ρ) and viscosities (η) of the various solvent systems were measured. EA+H_2O solvent mixtures of varying dielectric constants have been measured as a function of weight percent (wt.%) of Ethanolamine at 25°C are listed in Table 1.

The densities and viscosities of solvent mixtures are found to increase with the increase in wt. % of EA.

Since mixed solvents offer a wide range of desired properties, they are frequently used as reaction media for many chemical, industrial and biological processes[15].

Conclusion

Water is designated as “universal solvent” due to its physical and chemical attributes. Water

becomes attracted to different types of molecules due to the polar arrangement of oxygen and hydrogen atoms having partial negative and positive charges[16].

This paper discusses the viscosities and densities of Ethanolamine + water mixures at different concentrations for mass % 15, 30, 50, 60, 70, 80.

The density of the mixtures was measured in the temperature range 25ºC. The density of the mixtures increased with the increasing concentration of Ethanolamine. The viscosity of the mixtures was measured in the temperature range 25ºC. The viscosity of the mixtures increased with the increasing of concentration of Ethanolamine in the mixtures and this is in agreement with earlier findings[17-19] in several mixed solvents. Binary solvents rather than pure liquids have industrial applications, as mixing the solvents gives flexibility to the solution by altering their properties, either by varying the composition or by varying the concentration of solvents or both. Moreover the mixing of liquids introduces some extra degree of freedom and results in a new phenomenon that is not present in pure liquids, such as complex formation, association, dissociation *etc*.[20]

Partial molar volume and viscosity data provide valuable evidence about different types of forces of attractions present in the solutions. The volumetric and viscometric studies of solutions help us illustrate solutes organization and properties in mixed solvents.[21]

As Ethanolamine is used as feedstock in the production of detergents, emulsifiers, polishes, corrosion inhibitors as well chelating agent; therefore it, would be of great interest to undertake the measurements of Densities and Viscosities values for Researchers.

References

1. M. M. Ansari, Transport behavior of dilute electrolytic solution electrolytes in mixed solvents. Ph. D. Thesis, D A V V Indore, India (2015).
2. Wadi R. K..Vinita and Kakkar R., Partial molar volumes and viscosities of some monovalent ions in ehanolamine and water ehanolamine mixtures at 298.15K. *Indian J. of Chem.*, *39A,* 598-602 (2000).
3. Bhattarai A. and Neupane S., Effects of concentration and solvent composition on the electrical conductivity of sodium bromide in pure water and ethanol - water mixed solvent media. J. of Science, Engineering and Technology, *8,* 1-6 (2012).
4. Bhattarai A., Raut J. (2011) Conluctometric studies of potassium bromide in pure water and ethanol - water mixed solvent media. J. of Alpine Chemistry, *2,* 44 (2011).
5. Chatterjee A. and Das B., Electrical conductances of Tetrabutylammonium bromide, sodium tetraphenylborate and sodium bromide in methanol + water mixtures at (298.15, 308.15 and 318.15k.) J. Chem. Eng. Data, *51,* 1352 (2006).
6. Mukhopadhyay A. and Pal M., Ion association and solvent interaction – conductance of 1-ethyl– 4- cyanopyridinium iodide in aqueous – binary mixtures containing acetone and 1,4 - dioxane at different temperatures, *Indian J. Chem., 41A,* 1120 (2002).
7. Sarkar B. K. Roy M. N. and Sinha B., Conductance studies on some alkali metal acetates in aqueous glycerol solutions *Indian J. Chem., 48A,* 63 - 68 (2009).
8. Roy M. N. Sinha B. and Dakua V. K., Electrical Connductances of some ammonium and tetraalkylammonium halides in aqueous binary mixtures of 1,4 – dioxaneat 298.15K. *Pak J. sci. Ind. Res. 49,* 153 (2006).
9. Ansari A. A. and Islam M. R., *Conductivity and ionic association of tetra- alkylammonium halides in tert– BuOH – water mixtures at* 25ºC*Can. J. Chem.*, *66,* 1223 (1988).
10. Islam N. Zaidi S. B. A. and Ansari A. A., Conductimetric studies of ionic- association of *tetra- alkylammonium halides and tetra phenyl borate in MEK-DMF mixtures at* 25ºC *Bull. Chem. Soc. Japan, 62,* 309 (1989).
11. Islam M.R. Ahmad I. and Ansari A.A., Applicability of Fuoss Conductance equation to Dilute Electrotylic Solutions in aqueous, non – aqueous and aquo-organic mixtures at 25ºC *J. Electrochem. Soc. (U.S.A.) 136,* 1303 (1989).

12. Kadam A.V.V., Nikumbh A.B. and Pawar T.B., Density and viscosity studies of lithium Halides in water – methanol mixtures at 308.15K. J. Chem. Bio. Phy. Sci. Sec. A, 10,135-142 (2020).
13. "A Review of MONOETHANOLAMINE CHEMISTRY" M.A.Scheiman, *U.S. Naval Research Laboratory,* Washington, D.C. (1962).
14. R. K. Wadi and P. Saxena, *Indian J. of Chemistry, 34A,* 273-277 (1995).
15. Warminska D., Smiectowski M., Thermophysical study of the Binary mixtures of triethyl phosphate with N- Methylformamide, N, N- dimethylormamide and N,N- dimethyl acetamide- experimental and theoretical approach. J. of Mol. Liquids, 304 (2020).
16. Pradhan S., Ranjan Mishra S., Mishra S., experimental and theoretical insights to Physicochemical Properties of Aqueous Solutions of 1,2- Ethanediol and 1,2,3- Propanetriol at Different Temperatures. Biointerface Research in applied Chemistry, *10,* 649-6512 (2020).
17. Lolo W.A. and Obunwo C.C., Conductance studies of alkali iodides in mixed organic solvents I: Conductance measurements in N, N-dimethylformamide Acetonitrile mixed solvents. Indian J. of Chemistry *38A,* 939-942 (1999).
18. Islam M.R., Ansari A.A., Densities and viscosities of tetra- ethylammonium bromides in isopropanol water mixtures. Indian J. chem. *21A,* 1057 (1982).
19. Reddy G.S., Reddy V.N., Sultana N., Dhakale D., Reddy J. Reddy N.K., Thermo Physical and Transport Properties of Acetone - water mixtures at 303.15, 308.15, 313.15 and 318.15K. J. of Critical Reviews, 7 (2020).
20. Kaur M., Thermodynamic and Physicochemical properties and the excess functions of binary mixtures of Dimethyl sulfoxide with pyridine and nitromethane at variable temperatures-298 to 318K. J. of Material science and Engineering, 1033 (2021).
21. Pattnaik S. S., Nanda B., Dalai B., Nanda B.B. Effect of Temperature and Solvents on the solvolysis of Barium Bromide in aqueous organic solutions: Volumetric and Viscometric study. Biointerface Research in Applied chemistry *12,* I, 339-350 (2022).