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Short Communication

Viscosities and Densities of Acetonitrile-water systems at 25ºC

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Abstract

Precise Viscosities and Densities for Acetonitrile-water mixtures containing 10, 20, 30, 40, 50, 60, 70% 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.

Keywords: Viscosities, Densities, Acetonitrile, 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].

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 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 and methods

Laboratory grade acetonitrile (E. Merck) was used for preparation of solvent mixture. Water easily removed with activated silica gel than dried over phosphorous pent oxide and was distilled twice. (b.p. 81-820C) /760 mm Hg[13]. Finally, the acetonitrile was distilled and the middle fraction was collected. Its specific conductance was found to be $(0.5\text{-}1)\times10^{-7}$ Scm^{-1} in good agreement with the literature value[14] of $(0.3\text{-}1)\times10^{-7}Scm^{-1}$. At 25ºC the density of pure AN was found to be 0.7767 g cm^{-3} and viscosity 0.346 cP. Previous values[14] for the density of pure AN was at 25ºC 0.7768g cm^{-3} and viscosity 0.347cP.

Measurement of Density and Viscosity: The viscosities and densities of the various solvent systems were measured at 25^0C. 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. After this, we calibrate these Instruments with distilled water.

Results and discussion

The viscosities (η**)** and the densities (ρ**)** of AN water solution having varying dielectric constants have been measured as a function of weight percent (wt.%) of acetonitrile at 25^0C and are listed in Table- I. The observed values of density and viscosity of AN are 0.7767g cm^{-3} and 0.346 cP respectively and are comparable with those of the reported values[15] ($\rho_=$ 0.7768g cm^{-3} η=0.347cP). The densities and viscosities of solvent mixtures are found to decrease with the increase in wt% of acetonitrile.

Since mixed solvents offer a wide range of desired properties, they are frequently used as reaction media for many chemical, industrial and biological processes[16].

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[17].

This paper discusses the viscosities and densities of acetonitrile + water mixures at different concentrations for mass % 10, 20, 30, 40, 50, 60 and 70.

The density of the mixtures was measured in the temperature range 25ºC. The density of the mixtures decreased with the increasing concentration of acetonitrile. The viscosity of the mixtures was measured in the temperature range 25ºC. The viscosity of the mixtures decreased with the increasing of concentration of acetonitrile in the mixtures and this is in agreement with earlier findings[18-20] in several mixed solvents.

Table-1: Physical Properties of A.N. + H_2O Mixtures at 25^0C.

Wt. %	Density ρ $g.cm^{-3}$	Viscosity η cP	Dielectric Constant D
10%	0.9802 (0.9800)*	0.982 (0.980)*	74.66
20%	0.9588 (0.9586)*	0.973 (0.971)*	70.50
30%	0.9380 (0.9388)*	0.910 (0.912)*	65.78
40%	0.9134 (0.9135)*	0.8841 (0.8843)*	60.20
50%	0.8920 (0.8922)*	0.753 (0.752)*	55.68
60%	0.8664 (0.8666)*	0.656 (0.657)*	50.77
70%	0.8443 (0.8445)*	0.574 (0.573)*	46.52

* Reported values of density and viscosity of solvent mixtures are given in parenthesis[15].

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