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STUDY OF PHYSICAL PROPERTIES OF POLAR LIQUIDS

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ABSTRACT:

Physicochemical properties like Density (ρ), Viscosity (η) and refractive index n_D of Ethanol and Water have been measured over entire volume concentration range at 308K. These Measured properties are further used to determine excess parameters like excess molar volume, excess viscosity, excess refractive index. The deviation of the excess properties specifies the strength of interactions in the pure and mixed component and also predicts the nature of intermolecular interactions.

Keywords: Excess molar volume, Excess viscosity, excess molar refraction

I.INTRODUCTION

The physicochemical or thermodynamic properties of polar binary mixtures such as density, viscosity, refractive index are significant from practical as well as theoretical aspect to recognize liquid mixture theory [1-5]. These properties are really enormously used in the design of process equipment in various chemical industries. In chemical process industries materials are generally used in liquid mixture form and as a consequence, the physical, chemical, and transport properties of liquid mixture assume great significance[5-8]. Thus the data of the properties associated with the pure liquids and also of liquid mixtures like density, viscosity , refractive index find broad application in solution chemistry and molecular dynamics. Such results are necessary for interpretation of data obtained from thermochemical, electrochemical, biochemical, and kinetic studies. The present paper deals with measurement of thermodynamic properties of binary liquid mixtures. The liquids were chosen in the present investigation on the basis of their industrial importance. Alcohols are widely used as hydraulic fluids in various pharmaceutical and also cosmetics, in medicines for various animals, in manufacturing of perfumes, paint removers, flavours and dyestuffs, as defrosting and as an antiseptic agent. The experimental results have been used to discuss the nature of interaction between unlike molecules in terms of hydrogen bonding, dipole-dipole interaction, specific acid-base interaction and dispersive forces.

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II.EXPERIMENTAL

2.1 Chemicals: In the present system of Ethanol+ Water binary mixture and Ethanol is of HPLC grade. Ethanol liquids are used without further purification. The liquid mixtures of different composition were prepared by measuring appropriate volumes of each composition.

2.2 Density Measurement: The Density measurements were carried out by specific gravity bottle of volume 10ml. Each measurement is taken thrice and average reading is recorded. Accuracy of the weighing balance instrument used is =0.0001 g.

2.3 Viscosity Measurements: Viscosity of the sample in the present study was measured by using Ostwald viscometer. Each measurement is taken thrice and average reading is recorded

2.4 Refractive Index Measurements: Abbeys Refractometer is used for measurement of refractive index.

III. THEORY

The general formula for calculating the excess parameters is given below

(1)

Where, A^E is the excess parameter such as excess molar volume x_1 mole fraction. And the excess parameters are fitted by R K Fit equation

IV.RESULT AND DISCUSSION

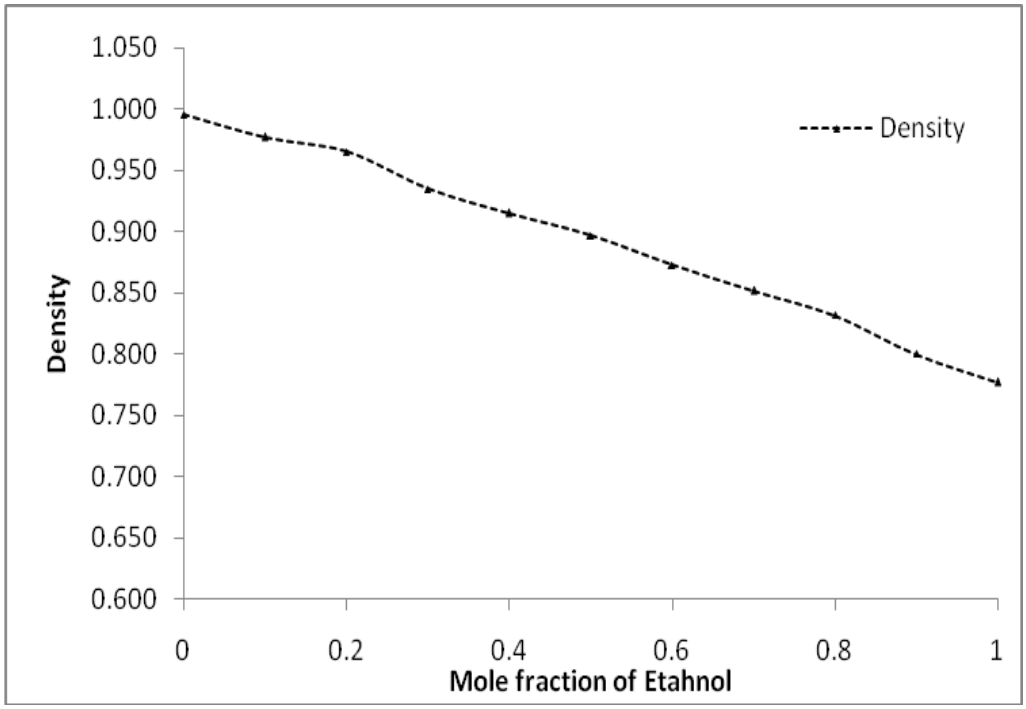

Fig. 1: Density of Ethanol+Water at 308K

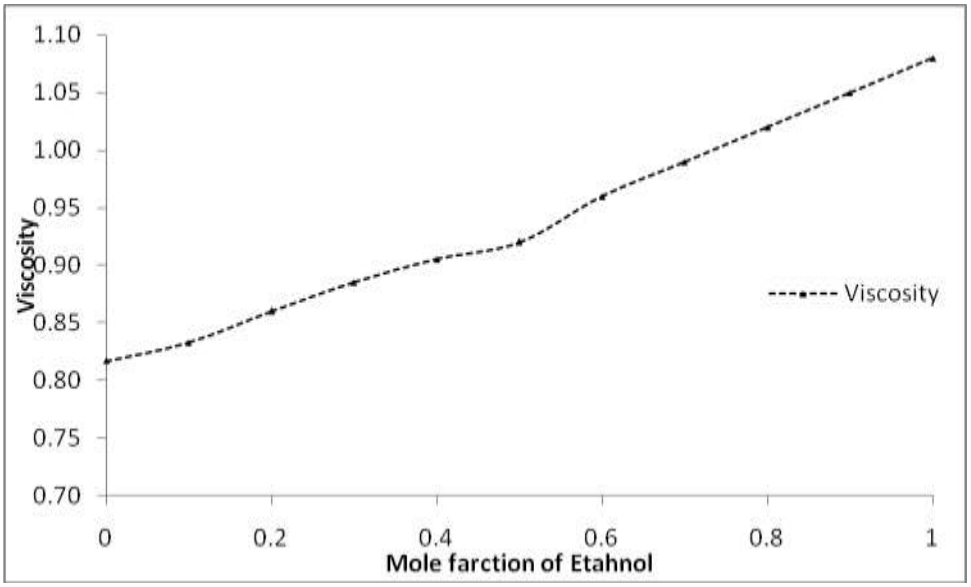

Fig. 2 : Viscosity of Ethanol+Water at 308K

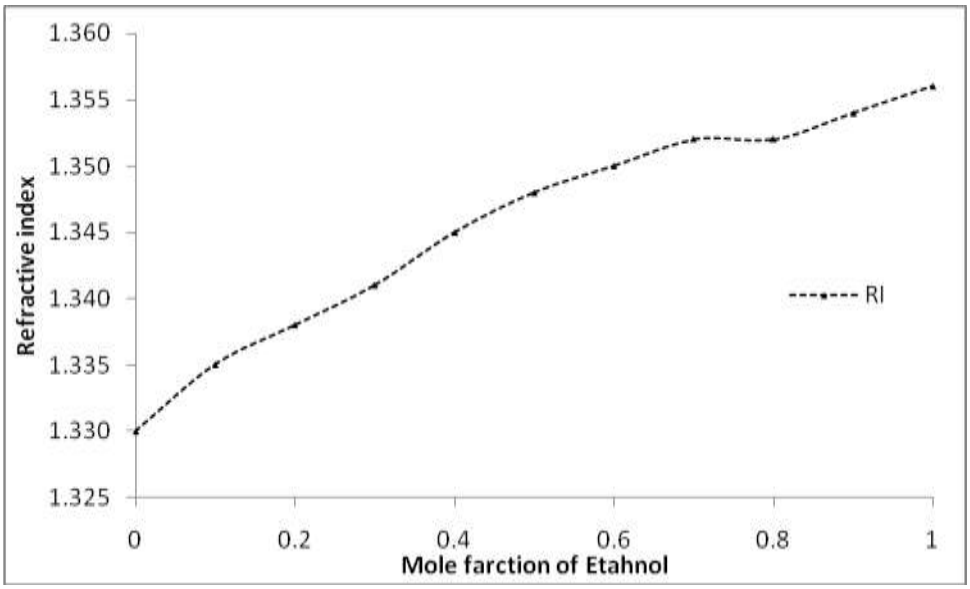

Fig 3 Refractive index of Ethanol+Water at 308K

Figures 1, 2,3 givenonlinear deviation in density, viscosity, refractive index respectively it indicates presence of solute solvent interaction between the complex systems.

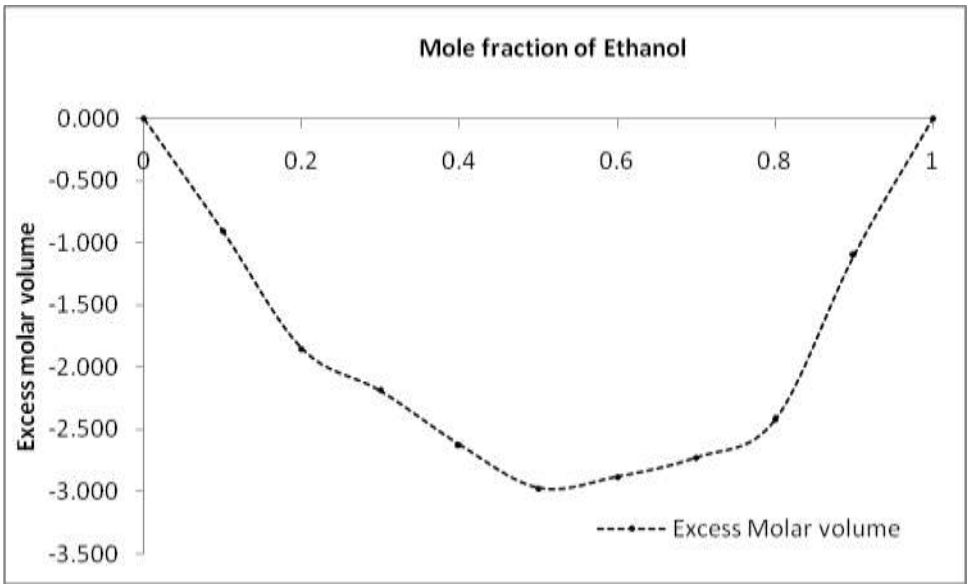

Fig. 4:Excess molar volume of Ethanol+Waterat 308K

Figure 4 shows negative deviation of excess molar volume. Negative values attributed to strong hydrogen bonding between unlike molecules. Negative values are also attributed contraction of volume which results in hydrogen bonding. Molecules of Ethanol cooperates with molecules of water hence its attraction increases and effective radius decreases.

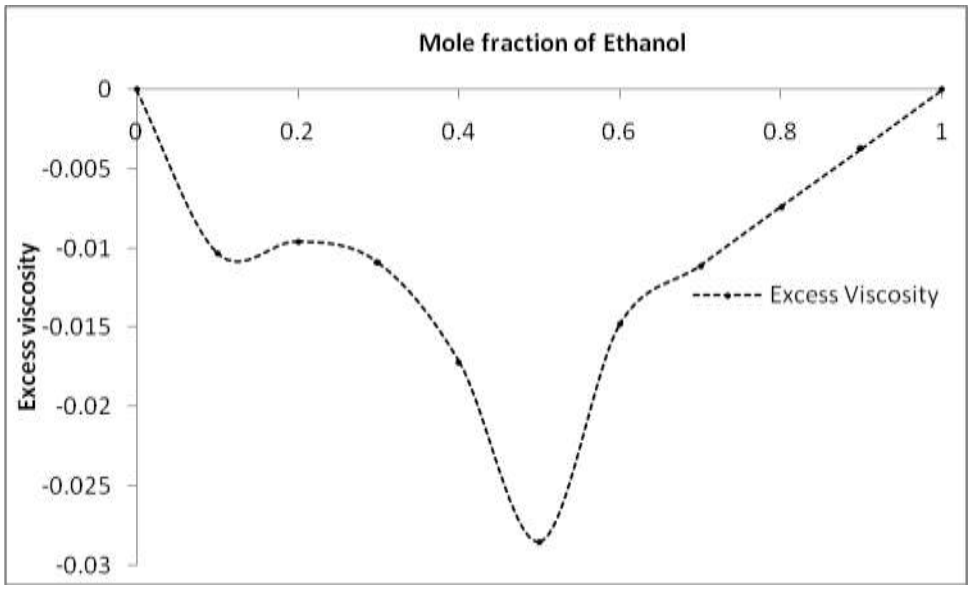

Fig. 5. Excess viscosity Ethanol+Water at 308K

Figure 5 shows negative deviation of excess viscosity. Negative values of excess viscosity for mixture may be attributed to presence of specific interaction through hydrogen bonding.

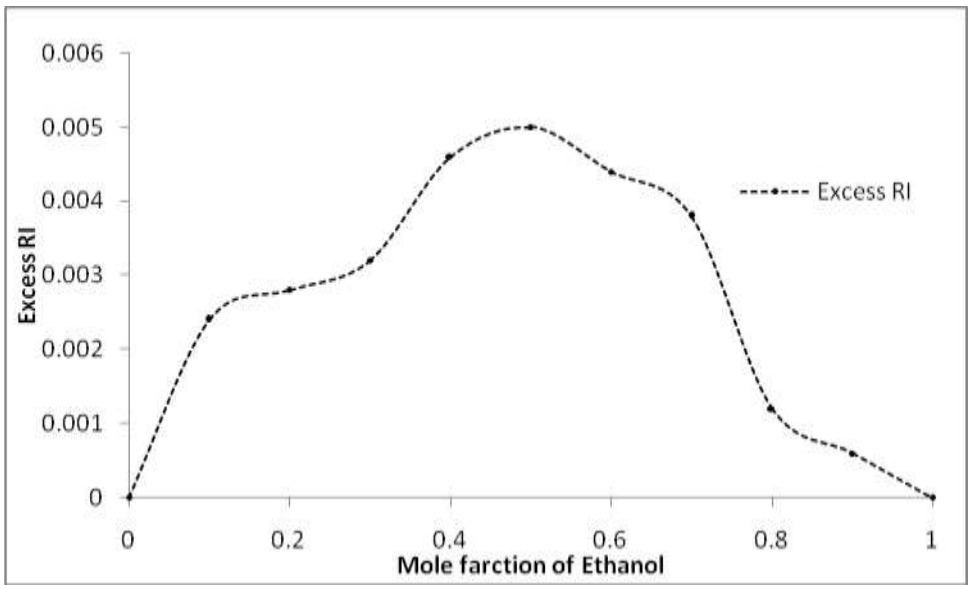

Fig.6 :Excess Refractive index of Ethanol+Water at 308K

Figure 6 shows positive deviation of excess refractive index. Positive values are due to closed packed molecules, which accounts for the existence of strong molecular interaction between unlike molecules.

V.CONCLUSION

In this study, the measurement of density, viscosity, refractive index of Ethanol in Water solution was studied in different concentrations at 308 K. The experimental measurement data parameters contain valuable information regarding the solute-solvent interactions in the measurements, it can be concluded that the concentration of the ethanol affects the hydrogen bonding. The concentration, nature of the solvent, nature of the solute and its potion play an important role in determining the interactions occurring in the solutions.

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