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Ultra Sonic Studies on Behavior in of Some Binary Mixture of Polyethylene Glycol and KI Salt

Abstract

The ultrasonic study of some binary mixture such as density (□)viscosity (η), surface tension (T), refractive index (□) and specific conductance have been measured in binary liquid mixtures containing pure polyethylene glycol and Polyethylene glycol + KI salt at room temperature. The result is interpreted in terms of molecular interaction such as dipole-dipole interaction through hydrogen bonding between components of mixtures. The dependence of excess properties of mixture compositions were compared and discuss in terms of the intermolecular free length and other factors affecting the solvation and self association effect. The excess values of these indicate dipole-induced dipole interaction complexity in the binary liquid mixture.

Keywords: PEG, KI Salt, Viscosity, Specific Conductance.

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Introduction

The ultrasonic studies are extensively used to estimate the thermodynamic properties and predict the intermolecular interactions of binary mixtures. Polyethylene glycol, PEG with the structural formula as $HO–(CH_2CH_2O)_n–H$, is a linear polyether compound, soluble in water and most of the organic solvents [1]. Materials with molecular weight less than 100,000 are usually called PEGs while higher molecular weight polymers are classified as PEOs [2]. PEG is loaded with variety of properties with various applications from industrial manufacturing to medicine. Its interesting properties include non- toxicity, easy recyclability, formation of aqueous two phase system with aqueous solutions of other polymers and salts [3,4], formation of complexes with metal cations and so forth. PEG is used in areas like catalysis [5]. However, the use of aqueous PEG solutions and related materials in chemical reactions is not focused much in review articles. Unlike VOCs, low molecular weight liquid PEGs are non-volatile. Poly(ethylene glycol) (PEG) is highly flexible, and its hydrophilicity can improve the solubility in water. The nontoxicity, nonimmunogenicity, and biocompatibility as well as solubility in water and in many organic solvents make it an ideal choice for various biological, chemical, biomedical, and pharmaceutical applications [6, 7].The present study is aimed at measuring the various properties of the pure PEG and PEG+KI salt.

Expermental

Different concentration solution have prepared by weighing 0.025g, 0.05g, 0.1g .0.25g, 0.5g, 0.8g 1.0g 1.1g and 1.5 g of potassium iodide and made the solution with 0.2g PEG using water as a solvent in separate 100ml volumetric flask. The same concentration of PEG solution is also prepared to compare the results. The density of pure liquids and mixtures are measured using a 10ml specific gravity bottle. The specific gravity bottle with the experimental liquid is immersed in a temperature controlled water bath. The densities of pure liquids thus obtained are found to be in good agreement with standard values. The measured density was measured using the formula,

$$\rho_2 = \frac{W_2 \rho_1}{W_1} \qquad (1)$$

Where, W_1, is the weight of the distilled water. W_2, that of weight of the experimental liquid ρ_1, is the density of water. ρ_2 that of the experimental liquid.

The binary mixture measure viscosity using Ostwald viscometer. The viscosities of two liquids or the same liquid at different temperature. The viscometer is place in thermostat to maintain the constant temperature after attaining a constant temperature. The time taken by the liquid level to fall from the fixed mark. The viscosities calculate the following relation.

$$\eta = \rho t \qquad (2)$$

where ( ) is density of liquid and t is time taken to fall the liquid.

The surface tension is determined by the drop number method using stalagometer. The stalagometer is filled with reference liquid again the number drop is noted. The surface tension calculates the above relation.

$$\frac{T_1}{T_2} = \frac{n_2\rho_1}{n_1\rho_2} \qquad (3)$$

where T_1 is surface tension of reference liquid, T_2 is surface tension experimental liquid, n_1 is number of drop in reference liquid n_2 is number of drop in experimental liquid, ρ_1, is density reference of liquids and ρ_2 is density of experimental liquid. The volume of both liquid is same.

The refractive index of liquid can be determined with help of instruments called Abbe's refractometer.

Conductance of solution is determined by conductivity bridge methods. Know amount of the solution for which the conductance is to be determine is taken in a beaker. The platinum electrode is dipped into the solution so that the electrodes must be completely immensed in the solution.

Results

Fig 1 show that density verses concentration of polyethylene glycol and polyethylene glycol salts complex solution KI. From fig 1 show that density pure PEG and PEG+KI linear increases with increases in concentration solution. This increases in density due to increases in mass of PEG and PEG+KI solution and decrease in volume [8,9].

Fig 2 shows that viscosity against concentration of pure PEG and PEG + KI . From Fig 2 shows the pure PEG solution reduced viscosity decreases suddenly for low concentration and then gradually decreases for high concentration. For KI salts reduced viscosity increases to maximum and decreases and almost constant it becomes independent of concentration of the salts for KI[10].

Surface tension verses pure PEG and PEG+KI depicted Fig 3. The fig 3 show that the surface tension first decreases and increases and for mediate concentration become constant. For KI salts first increases than decreases [11].

Refractive index verses concentration for pure PEG and PEG +KI is show in Fig 4. It is reveals refractive index increases with increases in concentration[12,13].

The plots 5 show that the specific conductance variation with concentration of the PEG and PEG + KI salt solution. For pure PEG solution at low or high concentration the specific is not linear with concentration, but it is linear for intermediate concentration. For KI salt solution the specific conductance show linear relation with the concentration for the solute as PEG concentration is same[14].

1. Conclusion:

In the present work macromolecular behaviour of PEG and salts complex KI. I have studies both solutions. In solution state density, viscosity, surface tension, refractive index and specific conductance are study. It is observed that KI solution decreases when compared to the pure PEG solution. The density and refractive index increases with addition of salt to the PEG solution linearly. The surface tension also increases by incorporating the salts to the PEG solution.

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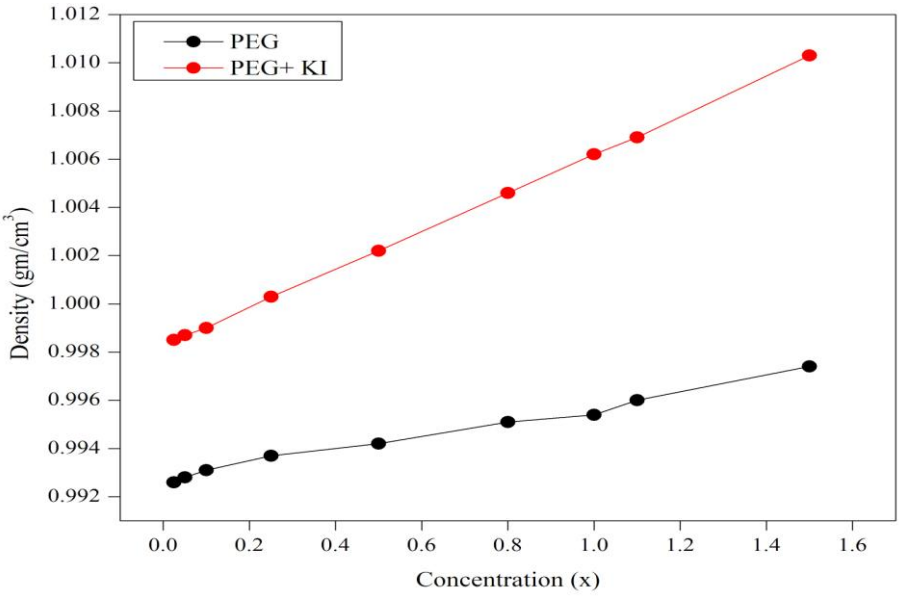

Fig 1. Density of Pure PEG and PEG+KI salt with different concentration at room temperature.

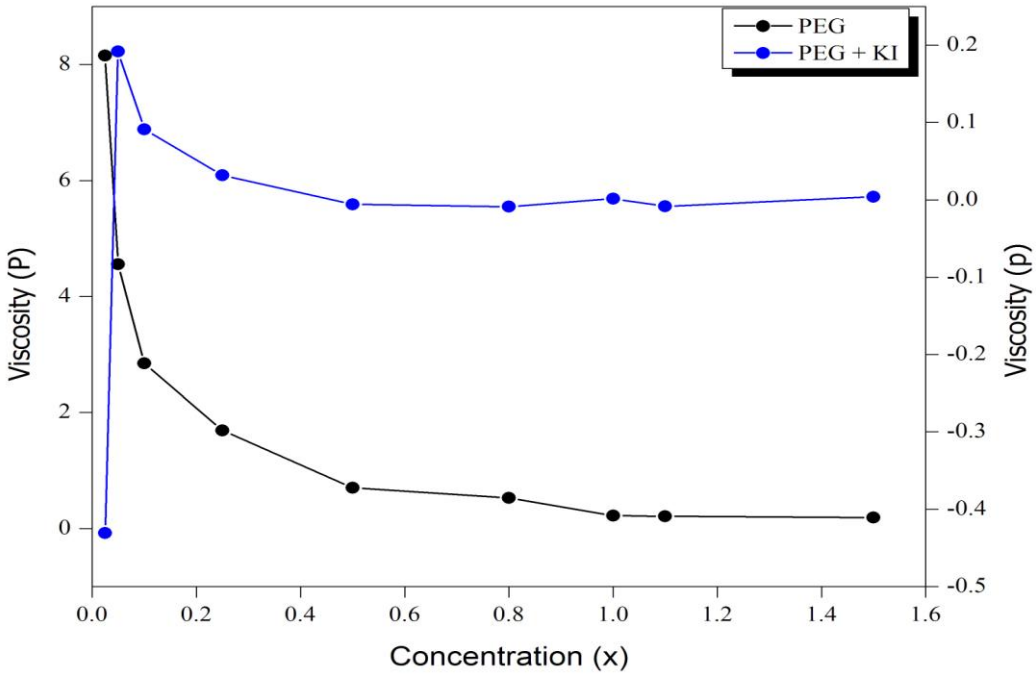

Fig 2. Viscosity of Pure PEG and PEG+KI salt with different concentration at room temperature.

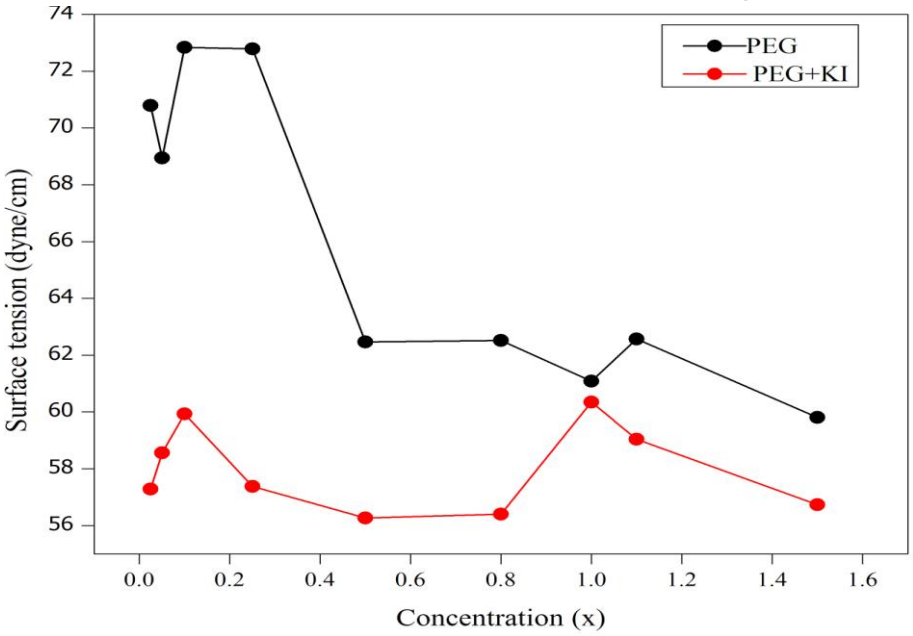

Fig 3. Surface tension of Pure PEG and PEG+KI salt with different concentration at room temperature.

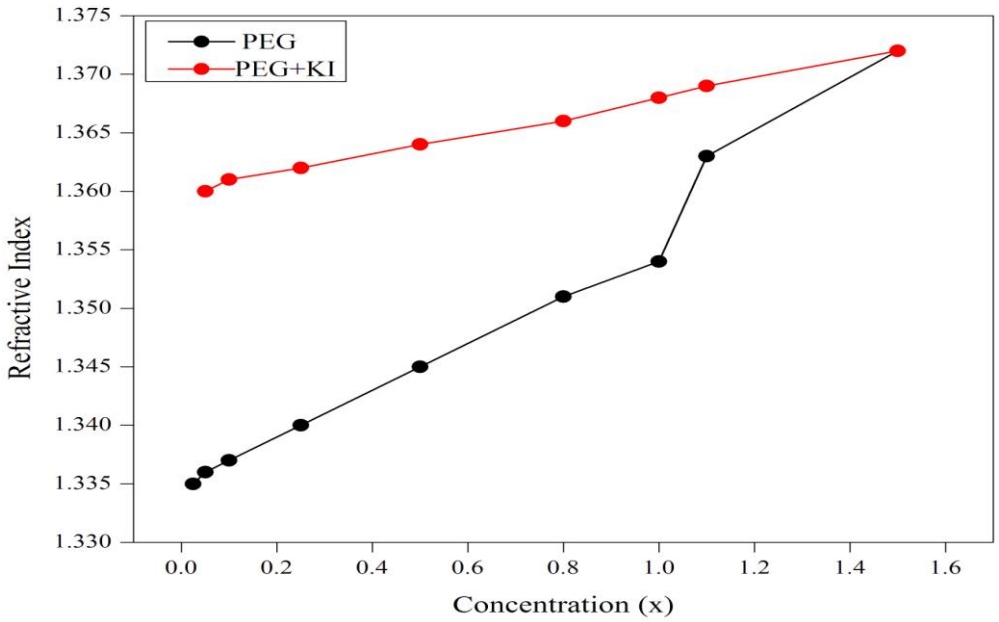

Fig 4. Refractive index of Pure PEG and PEG+KI salt with different concentration at room temperature

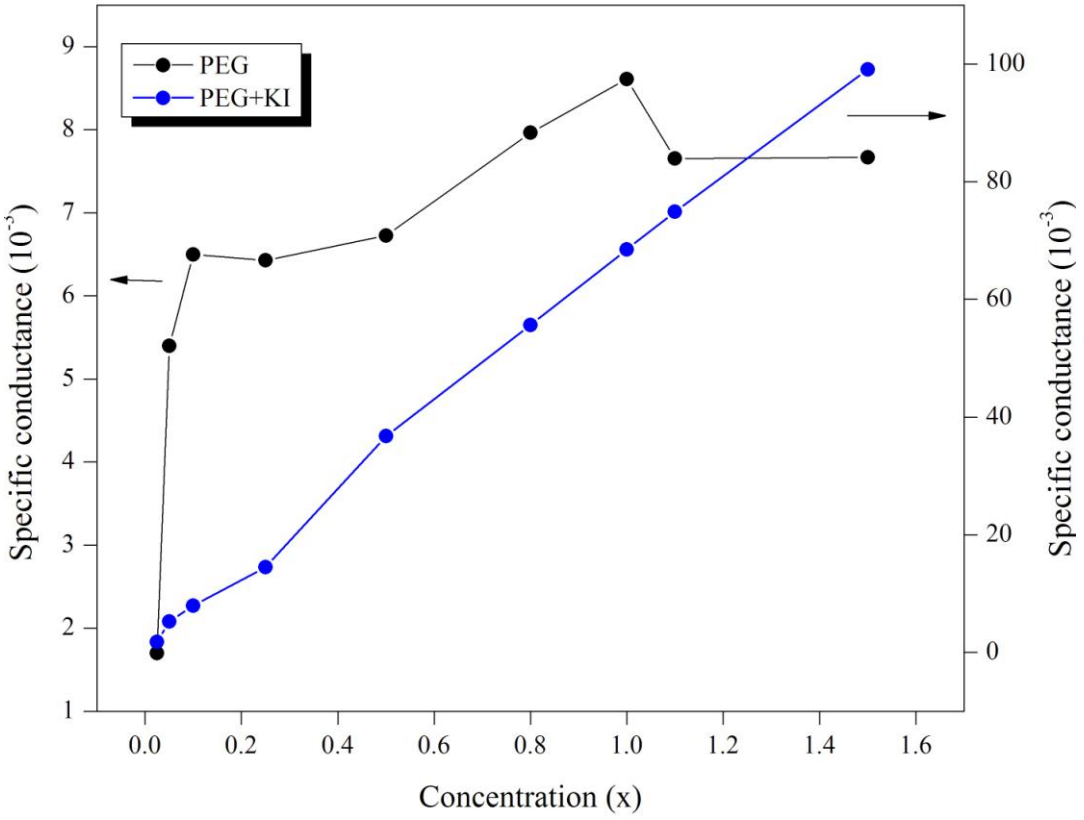

Fig 5. Specific conductance of Pure PEG and PEG+KI salt with different concentration at room temperature