REVIEW OF RESEARCH

EXCESS ACOUSTICAL PARAMETERS STUDY IN LIQUID MIXTURES CONTAINING ETHANOL AND ETHYLENE GLYCOL AT DIFFERENT TEMPERATURES

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ABSTRACT:

Excess parameters like excess freelength (L_f^E), excess adiabatic compressibility (β^E) and excess Gibb's free energy (G^{*E}) have been measured from measured values of densities(ρ),ultrasonic velocities(u) and viscosities(η) in binary liquid mixtures containing ethanol with ethylene glycol at temperatures T=(298.15,303.15,308.15,313.15 and 318.15)K. These results are fitted to the Redlich-Kister polynomial equation.These results have been explained on the basis of intermolecular interactions in liquid mixtures.

KEYWORDS: *excess adiabatic compressibility, ethanol,ethylene glycol.*

INTRODUCTION

These interactions influence the structural arrangement and shape of the molecules. Study ultrasonic velocity and their derived excess parameters investigations in liquid mixtures finds eminent applications in explaining physico-chemical behavior and non-ideal behavior·Excess parameters study is useful in understanding the strength of the molecular interactions in binary liquid mixtures[1-5] In the present research work the authors reported the variations of excess acoustical parameters such as excess intermolecular freelength (L_f^E), excess adiabatic compressibility (β^E) and excess Gibb's free energy(G^{*E}) in binary liquid mixtures of ethanol with ethylene glycol at temperatures T=(298.15,303.15,308.15,313.15 and 318.15)K over the entire molefraction range of ethanol.

EXPERIMENTAL

The chemicals used in the present investigation are of AR grade and they are purified by standard procedure. The different concentrations of the liquid mixture are prepared by varying mole fractions with respect to Job's method of continuous variation. Stoppard conical flasks are used for preserving the prepared mixtures and the flasks are left undisturbed to attain thermal equilibrium. Ultrasonic pulse echo interferometer (Mittal enterprises, India) is used for ultrasonic velocities measurements and all these measurements are done at a fixed frequency of 3MHz.The temperature of the pure liquids or liquid mixtures is done by using temperature controlled water bath. Specific gravity bottle is used for the measurement of densities of pure liquids and liquid mixtures. An electronic weighing balance (Shimadzu AUY220, Japan), with a precision of + or - 0.1 mg is used for the measurements of mass of pure liquids or liquid mixtures.

THEORY

Excess acoustical parameters are evaluated by using the following equations[3-5],

$$\beta^E=\beta_{exp}-(x_1\beta_1+x_2\beta_2) \qquad m^2N^{-1} \qquad \text{------(1)}$$

$$L_f^E=L_{f(exp)}-(x_1L_{f1}+x_2L_{f2}) \qquad Å \qquad \text{------(2)}$$

$$G^{*E}=G_{exp}-(x_1G_1+x_2G_2) \qquad J \qquad \text{------(3)}$$

where β^E, L_f^E and G^{*E} are the excess values of adiabatic compressibility, intermolecular freelength and Gibb's free energy. Here x is the molefraction and 1, 2 represent 1st and 2nd component respectively.

RESULTS AND DISCUSSION

The excess acoustical parameters play an important role in studying the nature of molecular interactions in liquid mixtures. The variations of the above excess acoustical parameters such as excess adiabatic compressibility (β^E), excess intermolecular freelength (L_f^E) and excess Gibb's free energy (G^{*E}) with the molefraction of ethanol at temperatures T=(298.15,303.15,308.15,313.15 and 318.15)K are represented in the figures from **Fig-1** to **Fig-3** respectively

Fig-1: Variation of β^E with molefraction of ethanol

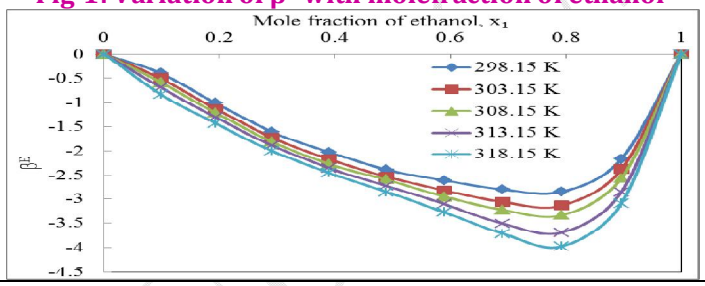


Fig-2: Variation of L_f^E with molefraction of ethanol

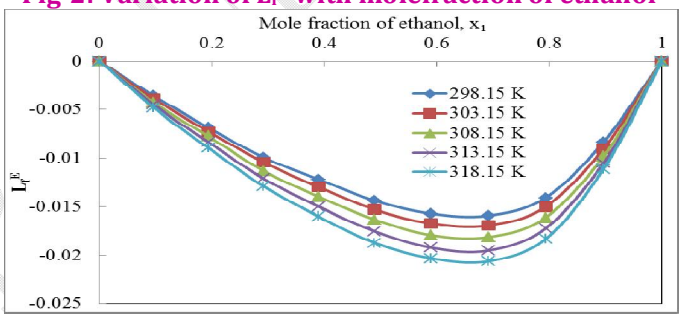
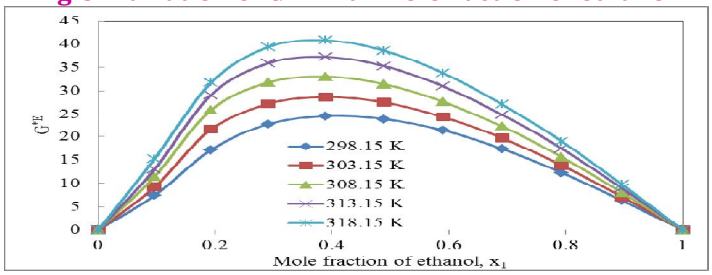


Fig-3: Variation of G^{*E} with molefraction of ethanol



From the **Fig-1** ,It is observed that in the liquid mixtures at each temperature, as the mole fraction of ethanol increases, β^E values of the mixtures attain a more negative value between the mole fractions, x_1 = 0.6 to 0.8. These observations support the view point that the mixtures have a tendency for closer packing and hence are in a decreased compressibility phase in the intermediate composition range and also observed that the molecular interactions are stronger.According to ***Fort and Moore***[6] a negative excess compressibility is an indication of strong hetromolecular interaction in the liquid mixtures.

Fig-2 indicates that the excess free length (L_f^E) values are negative for the mixtures over the entire range of composition. The negative excess free length indicates that the sound wave needs to cover a large distance[7-9].This may be attributed to dominant nature of interactions between unlike molecules.

From the **Fig-3** It is observed that the G^{*E} values are positive in the mixtures. Similar like observations are made by **Rathnam et al.[10] and Chorazewski[11]** and concluded, the positive values of G^{*E} show strong interactions.

CONCLUSIONS

By using the values of measured values of ultrasonic velocity,density and viscosity, excess acoustical parameters such as excess adiabatic compressibility (β^E), excess intermolecular freelength (L_f^E) and excess Gibb's free energy (G^{*E}) are obtained over the entire molefraction range of ethanol. An analysis of these results suggests the presence of strong intermolecular interactions in the present binary liquid mixtures.

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