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Vapor-Liquid Equilibrium Studies of the Binary Liquid Mixtures of Ethyl lactate with Amino-, Chloro- and Phenyl-ethanols

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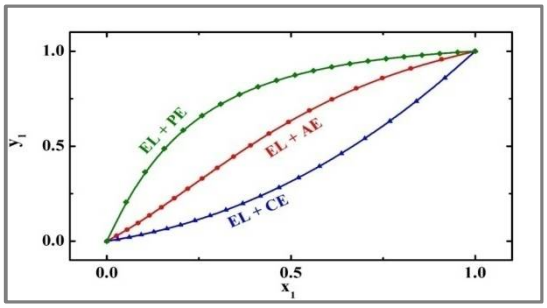
ABSTRACT

For the binary mixtures of ethyl lactate + aminoethanol, + chloroethanol and + phenylethanol, isobaric vapor-liquid equilibrium (VLE) data is experimentally determined at 95.3 kPa over the entire composition range using a Swietoslawski type ebulliometer. Densities at 303.15 K are reported for the pure liquids. The activity coefficients are correlated with the mole fraction using Wilson, nonrandom two-liquid (NRTL), van Laar and Margules liquid-phase equations and the corresponding binary interaction parameters are reported. The liquid phase activity coefficients are estimated considering the non-ideal behavior of the mixtures. The computed vapor phase mole fractions, activity coefficients, and Gibbs energy values along with optimum Wilson parameters are presented and the results are correlated to the molecular interactions between the dissimilar molecules of the binary mixtures. The studies indicate that all three binary systems are non-ideal liquid mixtures deviating from Raoult's law exhibiting negative values of excess Gibbs energies due to intermolecular hydrogen bonding between unlike molecules and also the non-formation of azeotropic mixtures is observed. The observed trend in the Gibbs energies indicates that the interactions between ethyl lactate and substituted ethanol molecules follow the order: ethyl lactate + aminoethanol>ethyl lactate+ chloroethanol>ethyl lactate+ phenylethanol.

Graphical Abstract



x_1-y_1 phase diagram for the binary mixtures of ethyl lactate + aminoethanol, ethyl lactate + chloroethanol and ethyl lactate + phenylethanol systems

Keywords: Vapor liquid equilibrium, Hydrogen bonding, Liquid phase equation, Gibbs energy.