Liquid–liquid equilibria of aqueous two phase system containing of PEGDME $_{2000}$ and $(NH_4)_2$ SO_4 at different temperatures and its application in partitioning of lactic acid

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ABSTRACT

In this work, the liquid-liquid equilibria (LLE) of (PEGDME$_{2000}$ +ammonium sulphate + water) was studied at T= (298.15, 308.15 and 318.15) K. Furthermore for this system the free energies, enthalpies and entropies of cloud points were calculated at the mentioned temperatures in order to investigate the driving force for the mentioned two-phase system.

For representing the experimental binodal data the Merchuk equation in the original form and with the temperature dependency and an empirical equation were used. Othmer-Tobias and Bancraft, a temperature dependent Setschenow and osmotic virial equations were used to fit the tie-line data. Moreover, the effect of temperature on the binodal curves and the tie-lines for the investigated aqueous two-phase system have been studied. In addition the partitioning behaviour of the lactic acid molecule on the investigated aqueous two-phase system was studied.

Keywords: (Liquid–liquid) equilibrium, The partition coefficient, Setschenow equation, Polyethylene glycol di-methyl ether, Lactic acid.

1. INTRODUCTION

ATPSs have been recognized as an economical and efficient downstream processing method, and widely used for recovery and purification of various biomolecules [1]. In this work liquid-liquid equilibrium (LLE) of aqueous two-phase systems containing PEGDME$_{2000}$ and ammonium sulphate has been studied.

Lactic acid is one of important carboxylic acids in chemical industries. Partitioning of lactic acid in the above two phase system has also been studied.

1.1 Liquid–liquid equilibria of aqueous two phase system

The aim of this work is to investigate of aqueous two phase system containing Poly ethylene glycol di-methyl ether 2000 and ammonium sulfate at different temperatures and applications in separation of lactic acid.

1.1.1 Determination of bimodal data and tie-line compotation and its application in partitioning of lactic acid

The obtained binodal data were fitted to the following empirical relationship developed by Merchuk: [2]

$$w_p = a.\exp(bw_s^{0.5} - cw_s^3) \qquad (1)$$