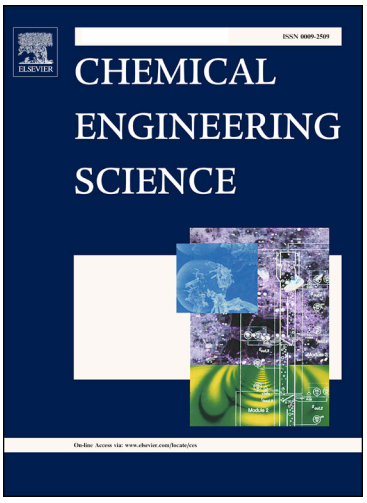

Vapor pressure, vapor-liquid equilibria, liquid-liquid equilibria and excess enthalpy of the system consisting of isophorone, furfural, acetic acid and water.

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Vapor pressure, vapor-liquid equilibria, liquid-liquid equilibria and excess enthalpy of the system consisting of isophorone, furfural, acetic acid and water.

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Abstract

In this work, the phase equilibria of the system comprised of isophorone, furfural, water and acetic acid were studied from the viewpoint of the extraction process. Equilibrium vapor pressure of pure isophorone was measured at sub-atmospheric pressure. Isobaric (at 40 kPa) isophorone-furfural vapor-liquid equilibria, the excess enthalpy of isophorone-furfural mixture (at 323 K) and isophorone-acetic acid vapor-liquid equilibria (from 322 K to 342 K) were investigated and compared to the available literature data. Liquid-liquid equilibria of systems comprised of isophorone-furfural-water (from 303 K to 343 K) were measured for the first time. The experimental results of this study and the literature values were utilized for optimizing the parameters for UNIQUAC model. The model was validated against the measured liquid-liquid equilibrium of the quaternary system isophorone-furfural-acetic acid-water (from 298 K to 343 K). Isophorone was found to be a favorable solvent for furfural extraction from its aqueous solutions.

Keywords

KEYWORDS: Vapor-liquid equilibrium, liquid-liquid equilibria, furfural, isophorone, acetic acid, water, UNIQUAC model

Introduction

Furfural is a top high value[1] green chemical utilized in the petroleum refining industry as a solvent and in the chemical industry as an intermediate for synthesizing solvents, adhesives, textile fibers (Nylon) and plastics[2] . Many other industries such as pharmaceutical, pulp and paper and food industries involve the usage or the formation of furfural.

Furfural is produced by the hydrolysis of renewable pentosan-rich agricultural resources and forest residues in the presence of mineral acid[3], i.e. sulfuric or hydrochloric. In this process the diluted aqueous solution of furfural and acetic acid is produced and the products are recovered from the reaction mixture by steam distillation. During the high temperature furfural production, considerable product loss occurs due to polymerisation or polycondensation reactions[2] , thus furfural must be separated from the aqueous effluent as soon as it is formed.

Furfural is also formed as a by-product during other industrial processes[4] , such as wood pretreatment in pulp mills or biomass hydrolysis for cellulosic ethanol production. The sulfite pulping