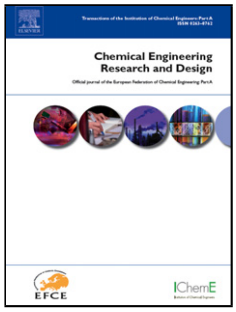

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Comparison of solvents for the recovery of low-molecular carboxylic acids and furfural from aqueous solutions

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A B S T R A C T

Liquid-liquid extraction of formic acid, acetic acid and furfural from an aqueous synthetic acid hydrolysis process stream is studied. Different types of extractants are first evaluated and two solvents that can efficiently recover the compounds, 2-methyltetrahydrofuran (2-MTHF) and tri-n-octylamine in toluene (Alamine 336-toluene) are then studied further. Important considerations in solvent selection were the efficiency of solvent regeneration and the recovery of the extractives from the loaded solvents. Solvent regeneration experiments were carried out under a vacuum in a spinning band distillation unit. Both solvents showed good regeneration characteristics. The rate of phase separation for Alamine 336 increased, without the formation of an emulsion, when performing extractions at low mixing rates. The use of toluene as a diluent for Alamine 336 prevented the formation of a third intermediate phase. In general, the equilibrium favors the extraction of formic acid for Alamine 336 and the extraction of furfural for 2-MTHF. For acetic acid there was only a small difference in the distribution coefficients for both solvents.

Keywords: Extraction; Solvent selection; Solvent regeneration; Formic acid; Acetic acid; Furfural

1. Introduction

Interest in renewable feedstocks for the chemical industry has increased considerably over the last decades, mainly due to environmental concerns related to the use of fossil raw materials. Lignocellulosic biomass is an abundant, readily-available source of bio-based raw material for chemicals production. Several processes have been proposed for treatment of biomass, including pyrolysis, aqueous phase reforming and acid hydrolysis. Acid hydrolysis is a process that has shown great potential for the conversion of biomass into valuable chemicals. Acid hydrolysis produces sugars as the main components and, if the sugars are hydrolyzed further, furfural, hydroxymethyfurfural, levulinic acid and formic acid. Carboxylic acids are typically present in aqueous streams of processes treating biomass. Several authors have considered the recovery of different carboxylic acids. For instance, Rasrendra et al. (2011) have used tri-n-octylamine in 2-ethylhexanol to extract acetic acid from an aqueous phase derived from pyrolysis oil. According to a review paper by Kumar and Babu (2008) focusing on reactive extraction, organophosphorus derivatives and long-chain aliphatic amines are effective extractants for separation

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