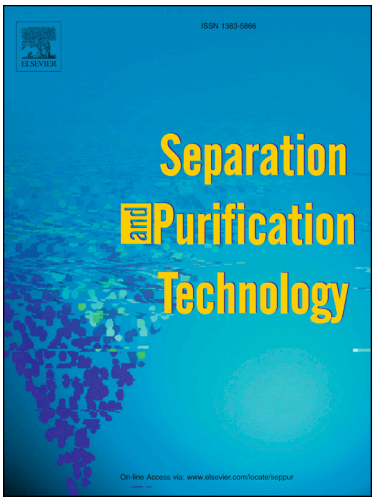

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Influence of ethanol and temperature on adsorption of flavor-active esters on hydrophobic resins

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Abstract

Flavor-active esters, produced during fermentation, are vital components and important contributors to the aroma of beer. In order to separate trace amounts of esters, their adsorption behavior in the presence of high concentrations of ethanol and their thermodynamic behavior under the influence of temperature needs to be understood. This study reports the influence of temperature on single component adsorption isotherms of four esters (i.e. ethyl acetate, isopentyl acetate, ethyl 4-methylpentanoate, and ethyl hexanoate) on two hydrophobic resins (i.e. Amberlite XAD16N, and Sepabeads SP20SS) and the estimation of heat, entropy, and Gibbs energy of adsorption. Higher heat and entropy of adsorption are obtained for ethyl hexanoate and ethyl 4-methylpentanoate in comparison, due to their higher hydrophobicity, stronger binding, and the exothermic nature of their adsorption. A higher concentration of ethanol (tested from 1 to 30% (v/v)), lowers the activity coefficient of esters in the aqueous phase, and subsequently lowers adsorption and Langmuir affinity parameters. Increase of temperature from 284.15 to 325.15 K shows a reverse influence on maximum adsorption capacity and Langmuir affinity parameters. Langmuir affinity parameters are obtained at various ethanol concentrations and temperatures. The reported parameters and thermodynamic properties in this paper, are essential for designing an industrial scale adsorption step for separation of flavor-active esters under non-isothermal conditions.

Keywords: Flavor-active esters, Adsorption, Ethanol, Temperature, Isosteric enthalpy

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