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Solubility of *n*-octadecane in supercritical carbon dioxide at 310, 313, 333, and 353 K, in the range 10–20 MPa

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Abstract

The optimization of temperature and pressure conditions for the extraction of *n*-octadecane with supercritical CO_2 has been investigated. This work presents experimental phase equilibria results of the study carried out at supercritical conditions for the system $CO_2 + n$-octadecane in the temperature range 310–353 K, and in the pressure range 10–20 MPa. The experimental work was carried out in a semi flow-type apparatus constructed in our laboratory, the amount of the extracted solute was determined gravimetrically. The equipment and experimental procedure were tested by performing measurements of the solubility of *n*-decane in supercritical CO_2 at 344.15 K, and the solubility of *n*-hexadecane in the same solvent at 308.15 K. The solubility of *n*-octadecane in supercritical CO_2 increases as the pressure increases but the functionality with temperature shows a maximum solubility value at 313 K. The system pressure was measured to ±2 kPa, temperature was measured to ±0.05 K and the composition was determined to ±0.0002 in mole fraction.

Keywords: CO_2; *n*-Decane; *n*-Hexadecane; *n*-Octadecane; Solubility; Supercritical extraction

1. Introduction

The advantage of supercritical extraction is, among others, its selectivity to dissolve different substances depending on pressure and temperature. Solvent recovery is not necessary, because extracts are separated completely from solvent by only decreasing pressure. A lot of solvents can be used in supercritical extraction processes like CO_2, methane, ethane, propane, *n*-hexane, propylene, and water, etc. Supercritical fluid extraction (SFE) is a technology with high potential of applications: extraction of natural products like flavors, fragrances and preservatives; oil removal from tar sands; deasphalting of heavy oils, recovery of alcohol from aqueous solutions, etc. In particular, supercritical CO_2 has been shown to be an excellent solvent. It has been used by the food industry since the late 1970s, recently Ferreira et al. [1,2] used it to extract carotenoids and lipids from a fruit and black pepper from essential oil. Then, the use of CO_2 allows to substitute harmful substances that are carcinogenic, explosive, and environmentally harmful,

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