以 冷 媒 R134a 萃 取 乙 醇

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摘 要

蒸餾濃縮乙醇是個非常昂貴的操作方法，因為乙醇和水會有共沸的現象，因此會增加純化上的成本及困難度，加上近幾年來，有許多學者研究利用超臨界二氧化碳(SF-CO_2)來萃取水溶液中的乙醇，所以，本實驗嘗試以液態 1,1,1,2-tetrafluoroethane (R134a)取代SF-CO_2來萃取濃縮乙醇，操作壓力比SF-CO_2降低約 100 個大氣壓以上，實驗中並嘗試加入甘油 (glycerol)、乙二醇 (ethylene glycol)、丙二醇 (1,3-propanediol)、丙二醇(propylene glycol)等修飾劑於萃取中來提升萃取率，但其實驗結果證明加入此四種修飾劑於R134a中，並不能增加乙醇萃取的回收率，同時，我們也測量乙醇於R134a中不同溫度下的溶解度。另外，在 60 ^{o}C下且分別在 20 bar和 50 bar時，當乙醇水溶液的初濃度超過 84 wt%，可以將乙醇水溶液濃縮至共沸組成濃度 (95.57 wt%)以上。

Extraction of ethanol using Refrigerant R134a

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Abstract

Production of absolute ethanol using distillation is a high energy-consuming process. Due to the formation of the azeotrope, it complicates the final purification to make absolute ethanol. In recent years, researchers have investigated in using supercritical fluid carbon dioxide (SF-CO_2) to extract ethanol from aqueous solutions. In this study, we attempted using 1,1,1,2-tetrafluoroethane (R134a) in substituting SF-CO_2 as the extraction solvent due to the much lower operational pressures of R134a. Experiments were carried out under various pressures and temperatures to optimize the process. The extraction recoveries of ethanol were found higher than those of using SF-CO_2, based on the same extraction volumes. However, the enrichment of ethanol has not been as good as in using SF-CO_2 due to the higher solubility of water in R134a. Even so, concentration of ethanol exceeding the azeotropic composition, i.e., 95.57 wt%, could still be achieved while the initial sample concentration was above 84%. In addition, four organic compounds

(glycerol, ethylene glycol, 1,3-propanediol and propylene glycol) were added to the sample solutions in order to increase the recovery rates. The outcome showed that the extraction recoveries decreased with the addition of these compounds.