

Turkish Journal of Chemistry

Turkish Journal

of

Chemistry

Supercritical CO₂ Extraction of Ethanol

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Abstract: Extraction of ethanol was studied from both synthetic ethanol solution and fermentation broth using supercritical CO₂ in an extraction apparatus in ranges of 313 to 333 K and 80 to 160 atmospheres, for varying extraction times. The experimental system consists mainly of four parts: a CO₂ storage system, a high-pressure liquid pump, an extractor and a product collection unit. Samples were analyzed by gas chromatography. Effects of temperature, pressure, extraction time, initial ethanol concentration and consecutive solvent feeding on extraction yield were investigated. It was found that increasing the initial ethanol concentration and extraction pressure and decreasing the extraction temperature increased the extraction yield. In addition, it was observed that consecutive solvent feeding affected the extraction yield positively. With the Box-Wilson experimental design method, optimum extraction conditions in a batch system for 15% (v/v) ethanol solution were found to be 313 K, 133 atmospheres and 30 minutes. Extraction yields were found to be 5.8% for one-step and 19.2% for three-step extraction of fermentation broth.

Key Words: Ethanol, Supercritical Fluid Extraction, Supercritical CO₂

Turk. J. Chem., **23**, (1999), 285-292.

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