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"Gheorghe Asachi" Technical University of Iasi, Romania

MASS TRANSFER IN SOLID-LIQUID EXTRACTION AT HIGH SOLUTE CONCENTRATIONS

Marcela Popa, Eugenia Teodora Iacob Tudose*, Ioan Mamaliga

"Gheorghe Asachi" Technical University of Iasi, Faculty of Chemical Engineering and Environmental Protection, Chemical Engineering Department, 73 Prof. dr. docent Dimitrie Mangeron Street, 700050 Iasi, Romania

Abstract

The solid-liquid extraction process and some of its influencing factors such as solid-liquid ratio, temperature and salt initial amount have been investigated. Also, mathematical modeling for mass transfer coefficients calculation was applied.
An inert porous solid material (coal), impregnated with 10% and 20% mass NaCl or 15% and 30% mass $CaCl_2$, was used. The leaching was conducted in a fixed bed column, in laminar flow. The $CaCl_2$ impregnated samples were investigated in a column with a height/diameter ratio of 2.5, at 20ºC, 30ºC, and 40ºC and the NaCl samples, in a 4.16 height/diameter ratio column, at 30ºC, 40ºC, 50ºC, 60ºC. In both cases, liquid flow rates of 3.8 L/h, 7 L/h, 10.6 L/h, 13.3 L/h were used.
An increase of the extraction degree with the washing liquid flow rate (up to 10.6 L/h) indicated that the solid-liquid ratio is a crucial factor. Temperature increase has a positive influence on the extraction degree.
At the beginning of the process, the salt quantity extracted from the high salt amount sample, using the lowest water flow rate has a similar value to the one extracted from the low salt amount sample, using the highest flow rate. At larger time values ($t > 500$ s), the extraction degree dependence on the liquid flow rate is similar for the high and low salt samples.
Based on the proposed mathematical model, mean time mass transfer coefficient values $k \cdot a$ were calculated and compared to the experimental obtained data.

Key words: diffusion, porous materials, kinetics, liquid- solid extraction, mass transfer coefficient

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* Author to whom all correspondence should be addressed: e-mail: etudose@ch.tuiasi.ro; Phone: +40 232278683; Fax: +40 232271311