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WORKING PAPER

LLE in Microchannels: A Mini Review.

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Title: LLE in Microchannels: A Mini Review.

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Abstract (150 words, Font 12): In liquid-liquid extraction (LLE), the volumetric mass transfer coefficients ($K_L a$) in micro-channels are two orders of magnitude higher than in conventional extraction equipment. In this review, we provide the state of the art information of LLE systems in micro-channels. In the present review, the research works of experimental studies for mass transfer in non-reactive and reactive systems are summarized. Experimental investigations available in reported literature show that $K_L a$'s are affected by geometric and operating parameters, fluid properties and material of construction. Two empirical correlations relating the Sherwood number(Sh), Reynolds number (Re), Capillary number (Ca) and Schmidt number (Sc) have been developed for Re<10 and 10<Re<200. The j-factor decreases with increase in Re. The j-factor is a strong function of Capillary number for 10 < Re <200. Recommendations for future work have been presented based on the review in the present work.

Purpose: Review the literature on LLE in micro-channels

Design/Methodology/ Approach: Collect the data from the literature and correlate with dimensionless numbers for important transport coefficients.

Findings: Two correlations for predicting $K_L a$ has been developed relating dimensionless numbers Sh, Re_M, Ca_M and Sc_M. The correlation predicts within 10% deviation for Re_M <10 while it predicts with a deviation of 15% for 10 < Re_M < 200.

Research Limitations/ implications: The research depends on literature data

Originality/ Value: Research will be helpful in understanding the effect of flow on transport coefficients in liquid-liquid extraction

Keywords:
Microchannels, liquid-liquid extraction, mass transfer, CFD, mass-transfer coefficient, analogy

Description:

The objective of the present review is to analyze the effect of different parameters (capillary size, shape, flow ratio, presence of additives, presence of wall film etc) on $K_L a$ both reactive and non-reactive LLE systems. The data was chosen for low and high Reynolds numbers (Re_{sl}<10; 10 < Re_M < 200) and Capillary numbers in the range (0.0002 < Ca < 0.001). Another objective is to analyze the reliability and predictability of different correlations available in the literature, and develop a better correlation for $K_L a$ from the data available in the literature .A related objective is to develop a modified analogy, similar to Chilton-Colburn analogy, for microchannels.