543f Mixing Size Control and Mass Transfer Performance in a Micromixing Process

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Today's microchemical system is no longer in its infancy. Some microfabricated reactors have been proven to provide excellent mass and heat transfer properties because of uniform flow patterns and residence time distributions in these reactors. Some of these devices even are available commercially. Most of them are for chemical reaction. But we still can find numerous investigations in microsepration processes.

In our group a membrane dispersion micromixing extractor has been developed. In this extractor a microfiltration membrane was used as the dispersion media, and the drop size of the dispersed phase can be controlled by the membrane structure, two-phase flow conditions, working system properties and so on. The performance of the new extractor was tested with different experimental systems. The results declared that the contact time could be less than 0.2 s and the capacity of the extractor could reach around 500 m3/(m2h). Almost one theory stage was achieved after a single contactor.

In order to predict the mass transfer performance of the micromixing process, the total and individual mass transfer coefficients were calculated with some traditional mass transfer models. The results show that the main effects on the mass transfer coefficients are the parameters of retention time and droplet size. The two parameters can be controlled very well in the micromixing process. The mass transfer coefficients increase with the reduction of the retention time. The mass transfer coefficient can reach as much as 1.2×10-4 m2/s, which is about 10-100 times higher than that in traditional column extraction processes. The mass transfer performance can be predicted neither with the model in which the mass transfer resistance of any one phase is ignored, nor with the simplified average equations. Our results show that the mass transfer coefficients can be predicted with the two-film mass transfer model but the effect of the retention time should be considered. The calculated values with the model are in good agreement with the experimental values.

Key words: Microfiltration membrane, Membrane dispersion, Micromixing, Mass transfer, mass transfer model

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