

170f Micro-Structured Membrane Dispersion Mixer and Its Characteristics

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Since 1990s a lot of new structured chemical devices such as micro-mixer, micro-reactor, micro-heat-exchanger, micro-extractor, micro-pump, micro-valve and so on become new members of the family of micro-chemical system. It is proved that the chemical reaction conversion, selectivity, and mass transfer performance can be improved greatly. The micro-structured chemical system may provide a deep-set base for the development of green chemical process. This paper presents a new membrane dispersion micro-structured mixer for chemical reaction and separation. And the mixing characteristics of the micro-mixer were determined with four experimental approaches. The measured residence time distribution (RTD) curves for determining the macromixing characteristics showed that the axial mixing coefficients are very small and the fluid flow in the micro-mixer can be considered as an ideal plug flow. The mixing performances of the water/water homogeneous mixing systems were characterized with the typical Villermaux/Dushman method and with the precipitation reaction of BaSO₄. A dye extraction method and the precipitation reaction of BaSO₄ were applied to measure the mixing performances of the liquid-liquid phase mixing system. The micro-mixer can provide high mixing performances in the two kinds of the mixing systems. The mixing performances can be improved by increasing the feed flux or by decreasing the membrane pore size. The mixing time of about 10ms was reached. The micro-environments for chemical reaction and mass transfer in the micro-chemical system can be controlled in a micro-scale size. The energy is input on the reactants directly. Therefore, the high efficiency and low energy consumption can be reached in a compact mini-system. The new micromixer has the characteristics of high mass transfer efficiency, high throughput, low-energy consumption, and well-controllability. Just for these characteristics the new micromixer may be applied to multi-phase chemical reaction, separation processes, and nano-particle preparation.

Key words: micro-mixer, mixing characteristics, reaction, separation