Development and characterization of milli devices for membrane-supported LLE in the manufacturing of biologics and botanicals

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While devices based on micro effects are increasingly accepted in reaction engineering, there is still no breakthrough for separation applications like liquid-liquid extraction (LLE). Additionally, the limited throughput potential, mostly caused by complex fluid dynamics and difficult phase separation, is problematic[1,2].

The implementation of milli-scale devices in engineering processes is a new and steadily growing field. In contrast to conventional industrial techniques, a milli process is characterized by improved mass and heat transfer and small equipment size. The majority of current applications are established in the field of reaction technology. However, the transfer of knowledge from these scientific focuses to separation technology is performed hesitantly. For the transfer of milli technology to separation processes like liquid/liquid extraction (LLE), a combination of efficient mass transfer and fast phase separation is necessary[3].

In this work, a liquid/liquid extractor in milli-scale is introduced and characterized in terms of mass transfer efficiency for throughputs up to several liters per hour. This concept offers several advantages like small void volume and less required effort for piping and utility space. For different process conditions like changing solvent ratios and throughput, the influence on phase separation and mass transfer efficiency is determined. The extraction efficiency is evaluated based on the concentration change in both phases. Finally, integration into production scale is discussed for different fields of application like the manufacturing of biologicals and botanicals.

References

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