Distribution and phase-separation of immiscible polymer solutions in microfluidic device

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Abstract

A microfluidic device is a miniaturized analytical device integrates all of the procedures for the analysis of molecules. The conventional procedures for the analysis are pretreatment, reaction, separation and detection and an appropriate separation technique is one of the most important procedure.

Aqueous two-phase system (ATPS) is a well known extraction technique for the separation and fractionation of biomolecules, because high water content (approx. 65-90%) in ATPS gives favorable condition to the stability.[1)] ATPS is a promising separation technique in microfluidic device.

In this study, the effects of volumetric flow rates infused in microfluidic device on phase-separation and distribution of the molecule were surveyed. Poly(ethylene glycol)(PEG) (M.W. 35,000, 15% w/w), dextran (M. W. 40,000, 15% w/w) and FITC was used. The phase separation occurs above certain concentrations of polymers.[2)] The volumetric flow rates of immiscible polymer and sample solutions defines the concentrations of polymers in micro-channel.

The residence time of the solutions is another important factor affecting the complete distribution of polymers and molecules in each phase. The optimum ratio of flow rates for PEG, sample and dextran was 1, 1, 2. Larger total flow rate needs longer flow path for complete separation of the phases and distribution of the molecule, because contact time between two phases is important in this diffusion-based mixing system. The better understandings on the behavior of immiscible polymer solutions in micro-channel would contribute to the larger application of ATPS extraction in Lab-on-a-chip technology.

References

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