Microfluidic extraction chip using aqueous two-phase system with three-layer flow

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With the rapid development of integrated microfluidic analysis system, efficient micro-extraction devices are in need. Microfluidic extraction is advantageous because it dose not require conventional mixer-settler. Only with careful geometrical design, it is possible to achieve efficient extraction with very small amount of sample. Aqueous two-phase system is useful in concentration and separation of various chemicals and biomolecules It can be fabricated using not only glass but also polymeric materials. We demonstrate microfluidic extraction with 3-layered laminar flow in aqueous two-phase system. Microfluidic extraction of methyl orange was performed within the aqueous two-phase system which was formed by dissolving two different salts, tetrabutylammonium bromide and ammonium sulfate, in water. Efficiency of extraction was better in 3-layered flow than that of general 2-layered flow devices. Effects of pH and salt concentration on the efficiency of the extraction are examined. And design variables for micro-extractor such as viscosity, flow velocity, residence time are also discussed.