A Centrifugal Microfluidic Platform Using SLM Extraction
for combined sample clean-up and enrichment of trace analytes

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Citation (APA):
Here we present a pump-less microfluidic platform which performs sample clean-up and enrichment in a single step, by integrating Supported Liquid Membrane (SLM) extraction. Our platform offers a simple, yet very efficient, method for achieving sample pre-treatment and enrichment of rare analytes, in an easy to use and highly efficient device.

**Working principle: Separating & trapping of weak acids (or bases)**

**EXPERIMENT START:** Non-porous extraction of analyte; only small molecules, on their neutral form, can pass through the oil film, separating the donor flow from a stagnant acceptor buffer. The oil is kept in place by a 25 µm thick nanoporous polypropylene membrane.

**EXPERIMENT ONGOING:** By choosing a pH above (below) the pKₐ of the acid (base) in the acceptor buffer, the analyte is trapped. While continuing to pass the donor, both separation and enrichment of the target analyte is possible.

**Real application:** Screening production of genetically modified bacteria strains:

E. coli bacteria genetically modified to convert tyrosine to p-coumaric acid (an important precursor for a number of drugs). E. coli bacteria providing tyrosine to eventually be able to distinguish between the two compounds. Both compounds can be detected by colorimetry, but unfortunately the sensitivity of the two compounds are not overlapping (see figure below). Making quantitative measurements difficult. In this case, SLM with oil is very powerful to separate the two (flow right - below).

**Flow chips for testing extraction during flow:**

**On-disc extraction w. enrichment:**

In order to have efficient and reproducible SLM extraction is a good and reliable control of the microfluidic flow is needed. Instead of centrifugal pumping, an electrical flow rate control is used. Instead of centrifugal pumping, an electrical flow rate control is used. The SLM extraction on disc is a challenge to achieve reproducible, but flow, flow cell. A new flow cell is required for two reasons: 1) the mass transport from the donor to the acceptor side, through the oil membrane, is difficult and thus harder. 2) the amount of oil volume that can be used is a 10-20 µL for each donor sample. However, with our disc we have been able to the volume around 60 µL, and achieved enrichment factors of 4 (as well as the purification of the sample).

**On-disc flow control: A challenge!**

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