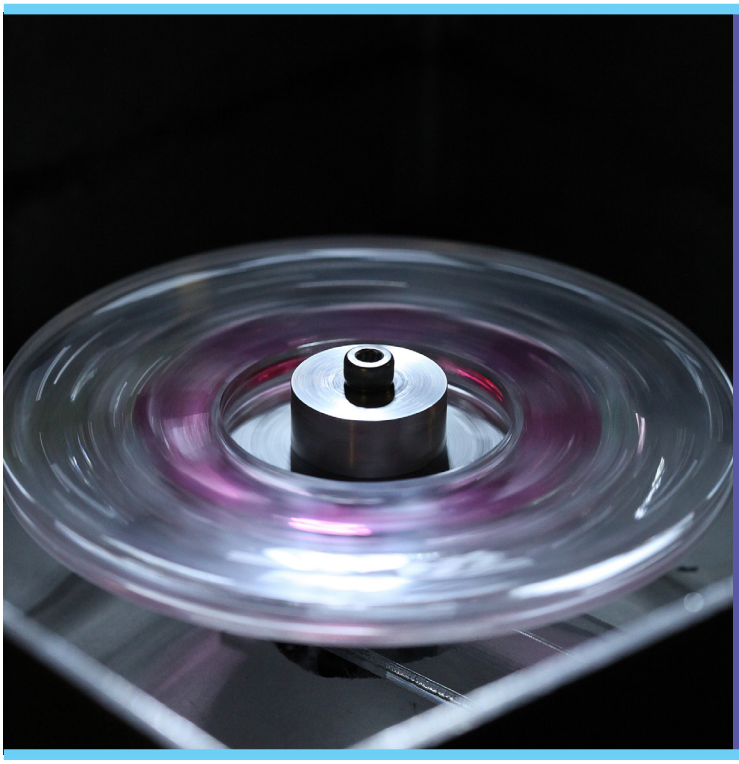

Towards a fully automated lab-on-a-disc system integrating sample enrichment and detection of analytes from complex matrices

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Abstract
Lab-on-a-chip systems (LoC) has been actively researched and developed for at least the last 25 years, yet integration of an efficient and robust sample pretreatment method still proves to be a challenge in the field. This lack of sample pre-treatment methods in LoC platforms prevents the technology on a large scale from fulfilling its potential for maturing into applied technologies and products. In this work, we have taken the first steps towards realizing a capable and truly automated “sample-to-answer” analysis system, aimed at small molecule detection and quantification from a complex sample matrix. The main result is a working prototype of a microfluidic system, integrating both centrifugal microfluidics for sample handling, supported liquid membrane extraction (SLM) for selective and effective sample treatment, as well as in-situ electrochemical detection. As a case study, the system is used to extract and quantify p-coumaric acid, a phenolic metabolite, produced by bacterial factories. The bacterial culture supernatant is a particularly challenging sample matrix as it contains both molecules that are derivatives of the target molecule, and therefore highly interfering for the analytical procedure, as well as a range of other compounds, e.g. vitamins, proteins, and salt ions. However, with the SLM extraction applied here, very clear and enhanced signals, with no sign of contaminants, is demonstrated. The strategies developed for the integration of the SLM extraction on the centrifugal platform, as well as the design, fabrication and optimization steps, are presented and discussed in this thesis.

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