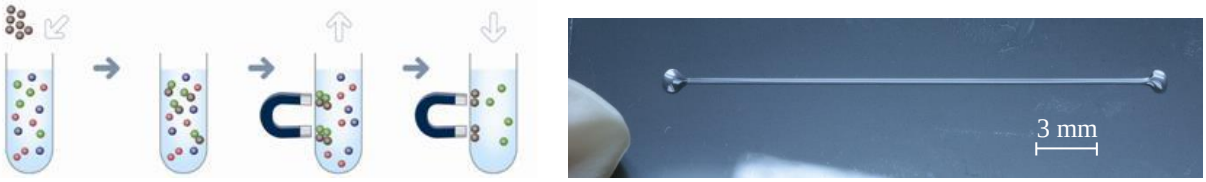
25.08.2015

(Bachelor)-/Master thesis

Background: Microsystems engineering/Life Science

Protein purification and analysis using magnetic beads in open microfluidic structures

Magnetic beads have already been evolved to complement the commercial portfolio of protein or nucleic acid purification techniques. To date its use is the most flexible and fast approach. However, even magnetic bead based purification still requires several steps of manual pipetting but (full) automation might be possible. The application of magnetic beads for purification is relatively easy (Fig. 1, left): surface modified beads in the size of some 10 nm are mixed with the sample (e.g. blood serum or cell lysate) and incubated for a while to allow sufficient binding of target molecules to the surface. Beads are thereafter separated from liquid (waste) by the application of an outer magnetic field followed by washing the beads from unbound sample several times. The isolated target could now be analyzed directly (bound to beads) or after elution by e.g. immunoprecipitation.



http://www.chemagen.com/uploads/pics/FZ_Karlsruhe_1.jpg

Figure 1: Principle of magnetic bead based separation (left) and open microfluidic channel (right).

The idea of this project is to evaluate the use of magnetic beads for protein purification and analysis in so called open microfluidic structures (Fig. 1, right). Such structures are generated at a recently developed 3-axis robotic platform equipped with piezo-driven microdispenser modules. Two dispensing modes allow either to apply continuous liquid structures onto a substrate or to place droplets (non-contact) of volumes down to 5 nl. The aim of the project includes four major steps. Firstly, liquid components like protein binding buffer needs to be adapted to a substrate or vice versa enabling the generation of stable fluidic structures. In a second step, beads and sample at volumes in the lower nl-range are mixed within the structure by non-contact droplet injection. Thirdly, followed incubation, the beads should be moved through a liquid channel for washing using an axis mounted magnet or electromagnet. Finally, the beads should be moved into a reservoir where analysis could take place by non-contact injection of e.g. a fluorescent labeled antigen.

Requirements:

- Interested in handling and developing complex systems spanning interdisciplinary applications
- Basic to good knowledge of chemistry (organic & inorganic), biochemistry and technical affinity

Please don‘t hesitate to contact us for further information regarding the project or in other context. Of course it will be possible to adapt the concrete work related to your interests and preferences.
Planned start date: 01.10.2015.

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