

- Master Thesis for 6 months -

Microfluidic synthesis approach to generate magnetic core-shell nanoparticles for nanomedicine

Due to their plethora of applications in diagnostics and therapeutics, magnetic nanoparticles (MN) have a tremendous potential.¹⁻² The core-shell formation, with MN as core and silica or proteins as shell, allows stable, biocompatible and multi-functional nanoparticles.³⁻⁴ For sustainable and cost-effective synthesis processes, precursors with an aqueous environment will be preferred. A challenging field is the combination of an exact and fast adjustment of the different parameters during the synthesis processes with an *in-situ* detection *via* microfluidics to control product generation.

Aim of the master thesis:

The thesis focused on the synthesis of core-shell magnetic nanoparticle (CSMAG) *via* batch and microfluidics. To improve the diagnostic usage, the magnetic particle will be functionalized with different proteins like human serum albumin or fibronectin and monoclonal antibodies. The bioavailability and toxicity will be checked with cell labeling of cancer and blood platelets.

Work packages of the master thesis:

- Synthesis of core-shell magnetic nanoparticle (CSMAG) with optimized stability and strong magnetic properties (MPI, MRI) in batch and microfluidics.
- Labeling with different proteins like human serum albumin (HSA) or fibronectin for the subsequent labeling of different cell-types (cancer/blood platelets).
- Physicochemical characterization of the synthesized MNs by dynamic light scattering (DLS), confocal scanning electron microscope (CLSM) and *in-situ* infrared-spectroscopy (FT-IR)
- The magnetic properties included transmission electron microscopy (TEM), magnetic particle imaging (MPI, relaxivity) and x-ray based characterization (XPS) will be realized with collaborators (University of Mainz and nanoPET GmbH, Berlin).

Profile of qualification and further requirements

Student of chemistry, biology, biochemistry or biotechnology with a strong tendency to work with technical platforms and nanoparticles. **Deadline for the application is 31.03.2021.** It is possible to be financed by iba.

Contacts

Dr. Jörg Schemberg
Department Bioprocess Engineering

Tel.: 03606-671-440
Fax: 03606-671-200
Mail: joerg.schemberg@iba-heiligenstadt.de

References

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