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# Diplomarbeit / Masters Project

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| **Project Summary** | **Influence of natural organic matter characteristics the removal of 17β-estradiol by ultrafiltration membrane – carbon-based nanoparticle composites (UF-CNPs)** |

Micropollutants, such as hormones in waters even at very low concentrations can cause endocrine disorders. It is a difficult task to remove hormones, especially with high-permeability membranes. Meanwhile, carbon-based nanoparticles (CNPs) are effective adsorbents for many micro-pollutants. However, the adsorption capacity of CNPs is affected by natural organic matter (NOM), especially the high molecular weight (MW) fractions, while concerns arise over the toxicological effects of CNPs.

Research at IFG-MT incorporates CNPs into ultrafiltration (UF) membranes (Figure 1), to efficiently remove micropollutants. Such composite materials (UF-CNPs) will be evaluated for the treatment of realistic water conditions (e.g. NOM). Since high MW fractions of NOM can be retained by UF, their competition with hormone for CNP adsorption sites may be reduced in the UF-CNP concept.
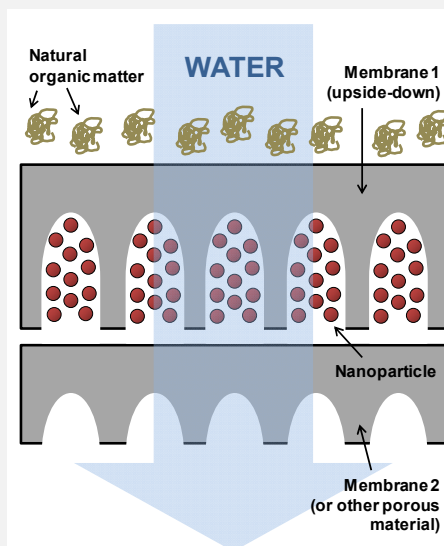


Figure 1: A schematic of the UF-CNP composite set-up. The top membrane shields NOM from interacting with the incorporated CNPs.

This Masters project will examine this shielding role of the UF membrane in UF-CNP composite concept while different types of commercial CNPs will be evaluated. The methods for CNP static adsorption, membrane incorporation and hormone breakthrough have already been developed. NOM interference will be analyzed in detail with Liquid Chromatography – Organic Carbon Detection (LC-OCD).

Specifically, the following tasks will be performed as part of the masters project;

- Literature review on the topic (natural organic matter, adsorption, endocrine disrupting chemicals (EDCs), adsorption processes, fouling)
- Hormone breakthrough experiments with various CNPs in the presence of NOM (in the form of humic acid and/or alginate
- Hormone breakthrough experiments with varying water conditions (NOM concentration, pH and ionic strength) and organic content analysis using a novel technique (LC-OCD)
- Analyse experimental data and write/co-author a research publication (in English)

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| **Required Skills** | **Studies in Chemical/Process Engineering or equivalent (Uni, TH)** |
| | Basic knowledge in polymer chemistry, water treatment technologies, membrane technology. Evidenced writing skills in English language, proficiency with Origin Labs software for data analysis and graphing, willingness to lead or contribute to the writing of a scientific publication. |
| **Host Dept.** | Institute for Functional Interfaces (IFG) / Membrane Technology Department |
| **Start Date** | Flexible/negotiable |
| **Application Procedure** | Please email CV, transcripts and motivation letter with available time period for evaluation. |
| **Project Advisor(s)** | **Minh Nguyen: minh.nguyen@kit.edu**<br>Prof. Dr.-Ing. Andrea Schäfer: Andrea.Iris.Schaefer@kit.edu; http://mt.ifg.kit.edu/ |

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