Engler-Bunte-Institut|
Wasserchemie und Wassertechnologie

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Thermal CFD simulation of a heat-transfer sensor applied for biofilm monitoring

Problem:

Biofilm monitoring in technical systems has reached increased attention in the strive for the optimization of cleaning processes. Therefore, on-line, in-situ and non-destructive detection of biofilms by sensors are required, to provide precise and representative information of the state of biofilm in the technical system. Among the various suggested methods, biofilm monitoring by means of heat-transfer sensors such as DEPOSENS (Lagotec GmbH, Germany) has shown to be a flexible option in different technical systems. For a purposeful use of the biofilm sensor profound knowledge of the sensor sensitivity to biofilms needs to be characterized.

However, biofilm research is highly time-intensive to characterize the impact of various process and biofilm parameters on the sensor measurement. A thermal CFD simulation would allow for an easier approach for the investigation.

Tasks:

Main goal of this work is the development of a 3D model (COMSOL) for a thermal CFD simulation of the heat-transfer biofilm sensor DEPOSENS integrated into a cylindrical pipe as well as a meso-fluidic flow cell regularly used for laboratory biofilm investigation. The model shall be used to analyze the impact of various process parameters and biofilm characteristics on the sensor signal. In detail:

- Impact of geometrical heat transfer regime
- Impact of flow velocity
- Impact of substratum material properties (thermal conductivity, roughness)
- Limits of the applicability of the biofilm sensor
- Perform a sensitivity analysis of biofilm parameters (thickness, biofilm composition, substratum coverage, …) on sensitivity of biofilm sensor

Results of the simulation shall be compared and discussed with existing results from lab-scale experiments in pipes and flow cells.

The results of the simulation are to be documented in written form and presented in a public lecture (e.g., institute's seminar).

Type: Study Project or Master Thesis

Starting date: immediately, by appointment

Supervisor: M.Sc. Andreas Netsch