A Microfluidic assay to test the adhesion of the marine bacterium *Cobetia marina* under dynamic shear conditions

J. Schwarze, K. Nolte, A. Rosenhahn

Analytical Chemistry – BioInterfaces, Ruhr-Universität Bochum, D-44801 Bochum jana.schwarze@rub.de, tel.: 0234 / 32-24202

**Introduction**
- *Cobetia marina* as model bacteria for marine biofilm formers
- Accumulation of *Cobetia marina* under dynamic shear conditions using a parallel microfluidic setup
- Measurement of four different surfaces simultaneously by using a parallel setup
- Identify a suitable shear stress range to perform microfluidic attachment assays by looking at the attachment behavior of *C. marina* at different surface chemistries and at different shear.

**Cobetia marina**
- Marine bacteria with gliding motility and exopolysaccharide production which makes them interesting for microfluidic attachment assays
- Tend to adhere best on hydrophobic coatings
- Growth state of the marine agar plate influences the attachment behavior in a laminar flow system

**A parallel microfluidic attachment setup**
- Parallel microfluidic setup under laminar flow conditions: Based on a setup of Nolte et al.
- The bacteria solution is flushed through the channels with constant shear by using syringe pumps
- The shear force was determined using the Purday approximation.
- To prevent sedimentation, the bacteria solution was constantly agitated during the measurement
- Reservoir and channels have to be arranged horizontally to prevent accumulation in dips

**Experiments with *C. marina* – Defining a shear stress range**

**Experiments with *C. marina* – Discrimination of attachment on different surface chemistries**

**How to handle the bacteria culture**
- After one night growth, pick colonies from agar plate and keep in a freezer at - 80 °C.
- Change medium to nutrient free medium (artificial sea water).
- Let grow overnight.

**Surface chemistries are:**
- DDT: 1-Dodecanethiol
- HUDT: 11-Hydroxy-1-undecanethiol
- EG: Polyethylenglycol
- OH and PEG.

**Surface chemistry**
- *DDT*: 1-Dodecanethiol
- *HUDT*: 11-Hydroxy-1-undecanethiol
- *EG*: Polyethylenglycol
- *OH* and *PEG*.

**Results:**
- High number of attached *C. marina* on hydrophobic surfaces like DDT
- Low number of attached *C. marina* on hydrophobic and protein resistant surfaces like EG:OH and PEG.
- Difference between hydrophobic DDT surface and hydrophobic HUDT surface is significant but smaller than the difference between DDT and EG:OH
- All surfaces can be discriminated significantly

**Summary and Outlook**
- Discrimination between different surfaces is possible
- *C. marina* can be used to characterize fouling-release properties of different surfaces
- Further validation of the setup is planned with model chemistries and industrial samples
- The validated setup should be modified that an electrochemical connection of the microfluidic channel is possible and reactive species can be produced

**Literature**

