

Validation of multidimensional modelling of biofilm structure

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Description

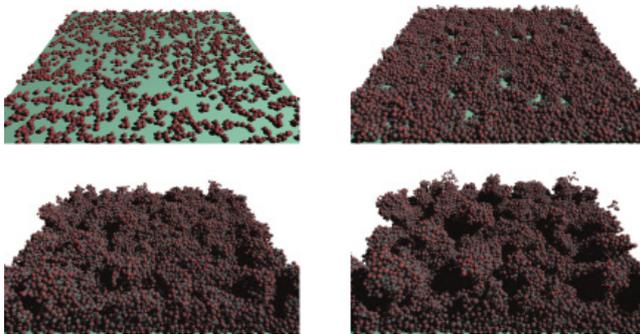


Figure 1. Results from 3D simulations. Rough biofilm obtained for a biofilm of single species EPS producer

This post-doc project was carried out in the course of two years at the Environmental Biotechnology Group of Professor Mark van Loosdrecht, at the Department of Biotechnology of the Delft University of Technology.

In the course of this period, modelling biofilm structure developed previously at the group was assessed using three-dimensional data from confocal laser scanning microscopy (CLSM) of biofilm imaging for the comparison with structure predicted by models [1].

Other activities were centred in progressing the modelling approaches with new developments. In particular, a general framework for the modelling of multispecies biofilms was created together with a software package implementing its concepts [2]. This software package was also made available on the internet at <http://www.biofilms.bt.tudelft.nl/frameworkMaterial/>

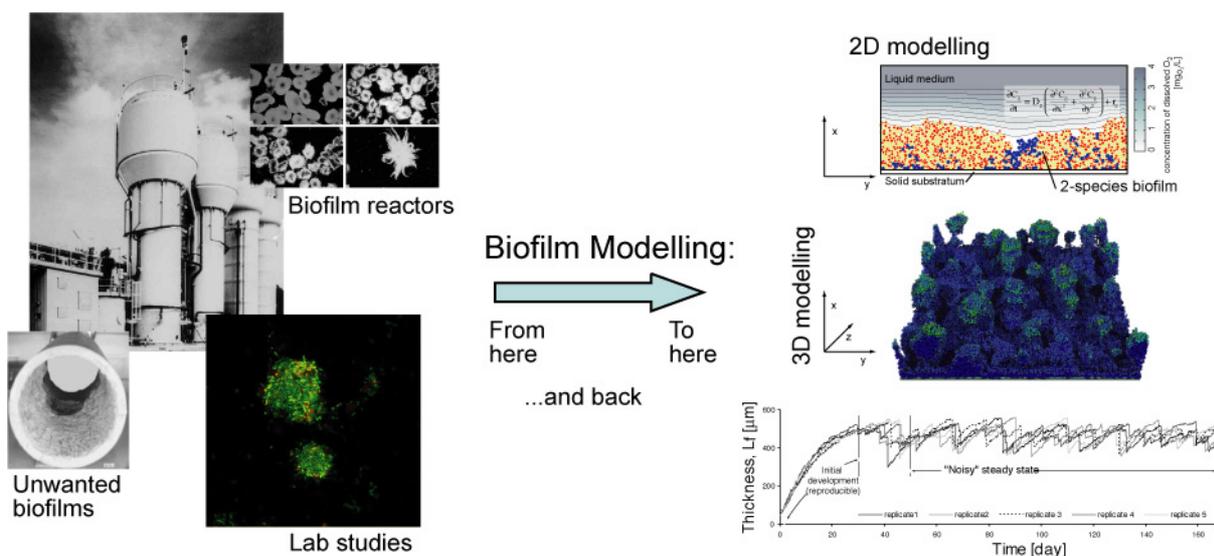


Figure 2. Modelling biofilm structure for biofilm processes, removal of unwanted biofilms and as a complement to experiments

The program allows the definition of multispecies multidimensional (i.e. 2D or 3D) models of biofilm structure with any number of solute species and biochemical reaction occurring in the system. See the electronic poster "Dynamic Multidimensional Modelling of Structure and Activity in Multispecies Multisubstrate Biofilm Systems" available at <http://www.biofilms.bt.tudelft.nl/bloomingtonPoster/> for a multimedia demonstration.

Other studies included the development of a novel method for the modelling of biomass detachment in biofilms [3], a study on the activity and structure of biofilms in biological reactors [4] and novel applications of biofilm modelling using structured biomass descriptions [2], i.e. including biomass components such as extracellular polymeric substances (EPS), internal storage polymers or inert materials.

Web resources:

Many of the results produced from the work carried out may be viewed through our web page on biofilm modelling at <http://www.biofilms.bt.tudelft.nl/>

Project Outcome:

[1] Xavier JB, Picioreanu C & van Loosdrecht MCM. 2004. Assessment of three-dimensional biofilm models through direct comparison with confocal microscopy imaging. *Water Sci Technol.* 49 (11-12) p177-185.

[2] Xavier JB, Picioreanu C & van Loosdrecht MCM. 2005. (*In press*) A framework for multidimensional modelling of activity and structure of multispecies biofilms. *Env Microbiol.*

[3] Xavier JB, Picioreanu C & van Loosdrecht MCM. 2005. (*In press*) A modelling study of the activity and structure of biofilms in biological reactors. *Biofilms.*

[4] Xavier JB, Picioreanu C & van Loosdrecht MCM. 2005. (*Accepted*) A general description of detachment for multidimensional modelling of biofilms. *Biotechnol Bioeng.*