

Structure and composition of a *Sphingomonas paucimobilis* biofilm

J. Azeredo, R. Oliveira

Centro de Engenharia Biológica – IBQF, Universidade do Minho, 4700 Braga, PORTUGAL

Keywords: *biofilm, exopolymeric matrix, polysaccharides*

Biofilms can be undesired structures in health and in some technological processes, but they have been successfully used in waste water treatment. To optimise the operatory condition of a waste water plant treatment, it is very important to determine the composition and structure of biofilms^[1]. Biofilms are formed by microbial cells embedded in a exopolymeric matrix^[2]. The polymeric matrix is mainly composed by polysaccharides, although other compounds can be found in smaller amounts such as proteins, DNA and humic substances^[3]. There are several models to describe the structure of biofilms: previously biofilms were considered to have an homogenous and continuous structure^[4], recently, with the advent of confocal Scanning Laser Microscopy (CSLM) a new model was developed that considers biofilms as clusters separated by water channels, the so called mushroom shape^[5]. However CSLM techniques only enable observation of very thin biofilms (200 μm) and most waste water biofilms have a thickness of 0.5 to 2.0 mm.

In this work a thick biofilm of *Sphingomonas paucimobilis* (high polysaccharide producer) was formed on glass cylinders and its structure and composition was studied by obtaining layers of biofilm detached under different rotation speeds.

The results showed that with a lower shear stress (500 rpm) 58% of the total biofilm mass was removed, 1000 rpm removed 37% and finally with a high shear stress the remaining part was detached. The inner layer of the biofilm was the most difficult to remove, suggesting that the forces of cohesion were very strong, moreover this part presented the greatest density and the smallest percentage of water. Figure 1 shows the composition in polysaccharides, proteins, DNA and cells of the removed fractions. The obtained profile points to a stratified structure: the exopolymeric substances (EPS) are more concentrated in the upper layers as well as the cells. The decrease of polysaccharide content from the top to the inner layer follows the same tendency of cells, suggesting that the rate of production is the same in each layer of the biofilm. The protein content found in the exopolymeric matrix was greater than the polysaccharide and it increased very through the biofilm layers, the same behaviour was followed by DNA. The higher ratios protein/cells and protein/polysaccharide found in the inner layer were probably due to cell lysis that occurred in a larger extent in the inner layer and these were probably responsible for the strength of the biofilm in this layer.

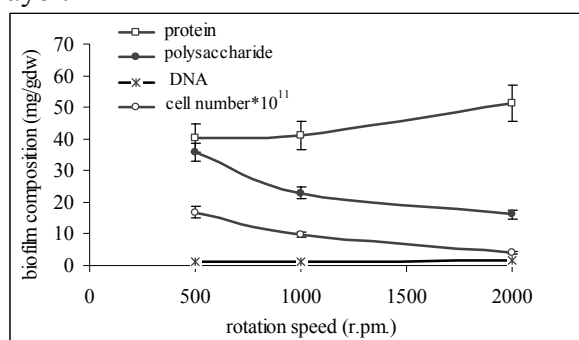


Figure 2: *Sphingomonas paucimobilis* biofilm composition

- [1] Lazarova, V. and Manem, J., *Wat. Res.*, **29**, 2227-2245, 1995.
- [2] Characklis, W. G., Wilderer, P. A., *Structure and Function of Biofilms*. John Wiley & Sons, Chichester, 1989.
- [3] Nielsen, P. H.; Jahn, A.; Palmgren, R., *Proceedings of the 3rd International IAWQ Special Conference on Biofilm Systems*. Copenhagen, Denmark, 1996
- [4] Characklis, W., Marshall, K. *Biofilms*. John Wiley & Sons Inc., N. York, 1990.
- [5] De Beer, D., Stoodley, P., *Water Sci.&Technol.*, **32**, 11-18, 1995.