BIOFOULING IN MICRO DEVICES: A NUMERICAL STUDY WITH OPENFOAM

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Biofouling in microstructures has been responsible for severe infections in body regions like eyes (by contact lenses usage), kidney and bladder (catheter-associated urinary tract infections). Despite the strong impact in the subject health, there is a lack of knowledge about the biofouling formation at microscale. For that reason, a comprehensive understanding of the initial stages of fouling formation such as initial cell adhesion could lead to new and improved engineering solutions.

In this work, experimental and numerical tests of cell adhesion were carried out mimicking the in vivo body temperature and focus was put in the adhesion of cells in the bottom walls of a micro device (Fig. 1). The experimental tests considered a diluted *E. coli* suspension [1]. Moreover, the cell adhesion was studied for a range of operating conditions characteristic of biomedical devices. The numerical studies followed a Eulerian-Lagrangian approach (‘*icoUncoupledKinematicParcelFoam’* solver), assumed the particles equivalent to cells and considered a one-way coupling schemes between the particles and the fluid flow [2]. Furthermore, a new particle-surface interaction and lift force were added to the existing solver. Open Source software were used in all the design procedure steps (e.g. OpenScad and R).

The numerical approach predicted well the cell adhesion rate for low shear rates (lower than 0.03 Pa). Promising results have been obtained for the highest values of shear rates.

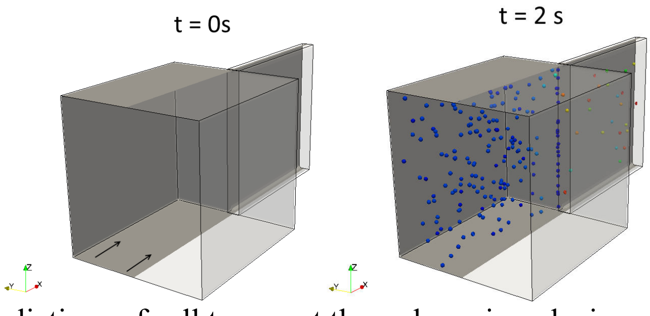

Figure 1: Numerical predictions of cell transport through a micro device section at different times

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