# Plugging by spherical microparticles

E. Climent[1,3], C. Agbangla[2,3] and P. Bacchin[2,3]

[1] Institut de Mécanique des Fluides – Université de Toulouse, INP-UPS – France
[2] Laboratoire de Génie Chimique – Université de Toulouse, INP-UPS – France
[3] Fédération de Recherche FERMAT – CNRS – Toulouse - France

We investigate by means of numerical simulations and videomicroscopy experiments the dynamic formation of 3D structures of microparticle aggregates blocking the flow through microchannels. Both the geometries of a straight channel and a sudden reduction of section are analyzed.
We use the Force Coupling Method (Climent & Maxey, 2010) to handle simultaneously multi-body hydrodynamic interactions of a confined flowing suspension together with particle/particle and particle/wall surface interactions leading to the adhesion and aggregation of particles. The basic idea of the Force Coupling Method relies on multipole expansion of velocity perturbations induced by the presence of particles in the flow.
Simulation results show that varying the magnitude of DLVO interparticle and particle/wall interactions leads to distinct scenarios of pores clogging. We investigate the kinetics of the microchannel occlusion (corresponding to a temporal decrease of the bulk permeability of the channel). We identify the nature of the fouling mechanism: deposition, interception, bridging … (see the papers of Sharp & Adrian (2005), Ramachandran & Fogler (1999) and Marshal, 2007).

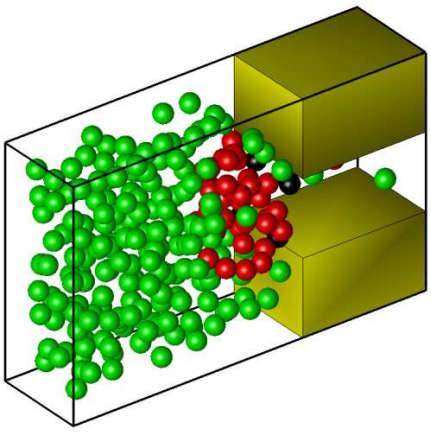

**Figure 1**: Pore blockage by microparticles aggregate.

**References**

E. Climent & M.R. Maxey, The Force Coupling Method: A flexible approach for the simulation of particulate flows, (2010) inserted in “Methods for creeping flows”, Ressign Press, Eds F. Feuillebois and A. Sellier.

K. V. Sharp & R. J. Adrian. On flow-blocking particle structures in microtubes. Microfluid Nanofluid (2005) 1, 376–380.

J.S. Marshall. Particle aggregation and capture by walls in a particulate aerosol channel flow. Aerosol Science (2007) 38 , 333 – 351.

V. Ramachandran & H.S.Fogler. Plugging by hydrodynamic bridging during flow of stable colloidal particles within cylindrical pores. J. Fluid Mech. (1999), 385, 129-156.