XVIII International Conference on Water Resources
CMWR 2010
J. Carrera (Ed)
CIMNE, Barcelona 2010

EFFECT OF BIOFILM FORMATION ON PARTICLE TRANSPORT AND DEPOSITION IN POROUS MEDIA

George E. Kapellos[*], Terpsichori S. Alexiou[*†], Stavros Pavlou[*†] and Alkiviades C. Payatakes[*†]

[*] Department of Chemical Engineering
University of Patras, GR-26504 Patras, Greece
web page: http://www.chemeng.upatras.gr

[†] Institute of Chemical Engineering and High Temperature Chemical Processes (ICEHT)
Stadiou Str., Platani, P.O. Box 1414, GR-26504 Patras, Greece
web page: http://www.iceht.forth.gr

Summary. Understanding of the mechanisms of particle transport and deposition in porous media enables reliable prediction of particle dispersion, and contamination risk assessment for particles which either are hazardous (e.g., pathogenic bacteria, viruses, hormones) or carry sorbed contaminants. In this work, we investigate the role of biofilm accumulation on the fate and transport of particles in porous materials via experiments and computer simulations. Specifically, we performed experiments in model porous media etched in glass, which permit direct observation of pore-scale phenomena. Bacteria of the Pseudomonas *fluorescens* species were seeded in the porous medium, and gradually formed biofilms. At a given time, a suspension of latex microspheres (model particles) was infiltrated through the porous medium and the deposition pattern was recorded using time-lapse microscopy. In addition, we performed computer simulations using an improved version of the recently developed hierarchical simulator HiBioSim-PM (*Kapellos et al.*, Adv. Water Res., 30:1648-1667, 2007), which predicts: (i) the structural and biological heterogeneity at the biofilm scale, and (ii) the pattern of evolution and the rate of growth of heterogeneous biofilms within the pore space of porous media (core scale). At various stages of biofilm formation, a Lagrangian-type simulation is used to predict the movement, attachment, and possible re-entrainment of a large number of particles. Preliminary results show that as biofilms grow, they modify particle-collector interactions and, further, alter the geometrical and topological characteristics of the pore structure and the flow field, which in turn strongly affect the fate of moving particles within the porous medium.