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Contribution ID: **163**   Type: **Oral Presentation**

The relevance of simple probabilitic models for deposition, accumulation and transport of colloidal particles proved by real time, internal observations (MRI, confocal microscopy)

Thursday, 3 June 2021 19:15 (15 minutes)

Colloidal particles from industrial or natural sources propagate and may deposit and alter the environment they flow through. Predicting particle transport and deposition in these porous media is key to solve these problems. Deposition models generally propose empirical corrections of the common advection/diffusion system of equations to take into account the different types of interactions between the particles and the solid walls of the porous structure, generally through a modification of the adsorption kinetic constant. However, the validity of these approaches is often only indirectly tested through the analysis of the breakthrough curve, corresponding to the exited concentration as a function of time.
Here we review the conclusions of a series of experiments [1-4] with model materials in which it was possible to observe directly the deposit, possible accumulation, or transport of the colloidal particles inside the material. The internal observations are carried out thanks to confocal microscopy or Magnetic Resonance Imaging measurements. The results tend to show that whatever the mechanism of deposition (size exclusion effect or bridging, adsorption on pore walls, aggregation with other particles) rather simple models taking into account a deposition probability are sufficient to describe the whole process of transient deposition and transport throughout the sample. This in particular makes it possible to show that the propagation of particles takes the form of travelling waves [1]. It is also shown that similar approach with now two different probabilities can be appropriate to describe the transport and deposition properties in more complex media with two pore sizes [1].

[1] G. Gerber, D. A. Weitz, and P. Coussot, Propagation and adsorption of nanoparticles in porous medium as traveling waves, Phys. Rev. Research 2, 033074 (2020)
[2] N. Bizmark, J. Schneider, R.D. Priestley, S.S. Datta, Multiscale dynamics of colloidal deposition and erosion in porous media, Sciences Advances, 6, eabc2530 (2020)
[3] G. Gerber, M. Bensouda, D.A. Weitz, P. Coussot, Self-Limited Accumulation of Colloids in Porous Media, Physical Review Letters, 123, 158005 (2019)
[4] G. Gerber, S. Rodts, P. Aimedieu, P. Faure, P. Coussot, Particle-size exclusion regimes in porous media, Physical Review Letters, 120, 148001 (2018)

Time Block Preference

Time Block A (09:00-12:00 CET)

References

[1] G. Gerber, D. A. Weitz, and P. Coussot, Propagation and adsorption of nanoparticles in porous medium as traveling waves, Phys. Rev. Research 2, 033074 (2020)
[3] G. Gerber, M. Bensouda, D.A. Weitz, P. Coussot, Self-Limited Accumulation of Colloids in Porous Media, Physical Review Letters, 123, 158005 (2019)

[4] G. Gerber, S. Rodts, P. Aimedieu, P. Faure, P. Coussot, Particle-size exclusion regimes in porous media, Physical Review Letters, 120, 148001 (2018)

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