2-year postdoc offer: Clogging a flexible pore

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Profile: Soft matter physicist or mechanical engineer
Keywords: fluid-structure interactions, clogging, filtering

Starting date: January 2025
Duration: Up to 2 years

Context: From hairs on our skin to the microscopic cilia inside our respiratory tract, large aggregates of thin deformable elastic structures in contact with fluids are ubiquitous. When these elastic hairs are tightly packed, they form a porous media which can act as a particle filter (Fig. 1a). However, here the pores are deformable. The elastic hairs can bend in response to the flow (Fig. 1b), altering the pore size and geometry, as well as the overall porous media dimensions. Understanding this flexibility based poroelastic material and its potential for filtration is the goal of the ANR JCJC Filthair funding this position.

Goal: Within the ANR project, the postdoc will focus on a pore scale approach and investigate how a single or a few hairs can trap particles (Fig. 1c,d). Using experiments with individual particles larger than the pore throat at rest, the candidate will first determine the critical conditions allowing a particle to pass through the pore and rationalize them with fluid-structure interaction models. Then, the candidate will explore collective effects. For rigid pores, particles smaller than the pore throat at rest would not clog individually. Yet, in a dense suspension they can form stable arches that eventually clog the pore. The candidate will explore experimentally the effect of pore flexibility in this arch formation process and on the particle flowrate. These results will then be rationalized with tools from the physics of granular media.

Profile: We are seeking a candidate with a strong background in soft matter physics and/or mechanical engineering. The candidate should have a strong interest for laboratory experiments. Experience in fast prototyping, image analysis and particle tracking are particularly welcome. Additionally, a taste for modelling and theoretical skills is also appreciated. Do not hesitate to contact *etienne.jambon-puillet@polytechnique.edu* for details or if you are unsure you are a good fit.

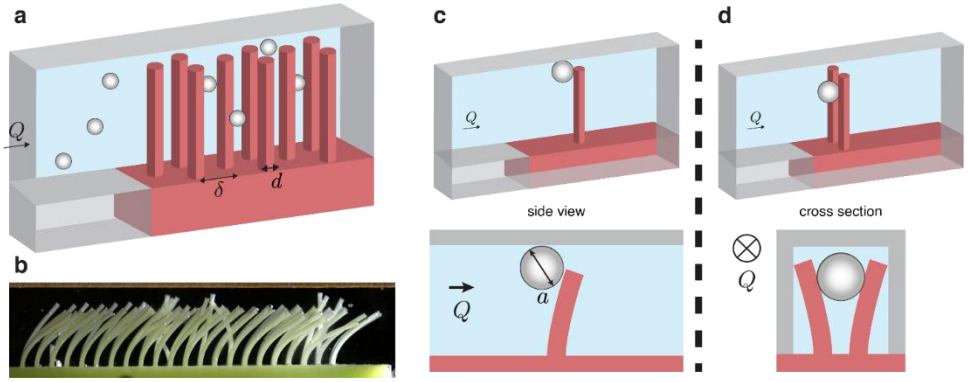

Figure 1: ***a.*** *Schematic of an array of elastic hairs acting as particle filter.* ***b.*** *Preliminary experiment showing flow induced hair deformation.* ***c-d.*** *Schematic of the proposed pore scale experiments.*