

Research Topic for the ParisTech/CSC PhD Program

Field : *Physical chemistry, Chemical engineering*

Subfield: material sciences, mechanics, fluids

Title: Bio inspired hydrogels for water filtration

ParisTech School: ESPCI Paris

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Research group/Lab: *SIMM, Soft Matter Science and Engineering*
(Lab/Advisor website):

Short description of possible research topics for a PhD: Hydrogels are polymer based materials composed of a network of polymer chains in water, which are covalently or physically bound. In nature, some bio-hydrogels have outstanding filtration properties. As an example, mucus prevents the entrance of toxic nanoparticles into the lungs. In the kidney, the glomerular barrier, which is composed of collagen fibers, filters proteins and nanoparticles. Such hydrogels are highly permeable to water but very efficiently filter nanoparticles. Our goal is to conduct a biomimetic approach to design bioinspired hydrogels that present similar properties to natural hydrogels. Our challenge will be to tune the toughness of the hydrogels so that they can sustain high filtration pressures. Indeed we expect that the deformation of hydrogels under pressure and their eventual compression may lead to a permeability decrease. Moreover we will design hydrogels with controlled spatial heterogeneity to control the water permeability.

Required background of the student: background in chemical engineering or materials science

A list of 5(max.) representative publications of the group:

Foaming of Transient Polymer Hydrogels, Deleurence, R., Saison, T., Lequeux, F. & Monteux*, C. *ACS Omega* **3**, 1864–1870 (2018). [10.1021/acsomega.7b01301](https://doi.org/10.1021/acsomega.7b01301)

Cross-flow filtration for the recovery of lipids from microalgae extracts: membrane screening and filtration of model and real products, E. Claveijo, C. Monteux, E. Couallier*, *Process Biochemistry*, in press ([10.1016/j.procbio.2019.10.016](https://doi.org/10.1016/j.procbio.2019.10.016))