INTERNSHIP PROPOSAL

Laboratory name Matière et systèmes complexes (MSC)
CNRS identification code: UMR 7057
Internship director'surname: Alain Ponton
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Internship location: Laboratoire MSC, Université Paris Cite, Campus des grands moulins, bâtiment Condorcet, 10 rue A. Domon et L. Duquet, 75013 Paris

Thesis possibility after internship: YES
Funding: NO If YES, which type of funding:

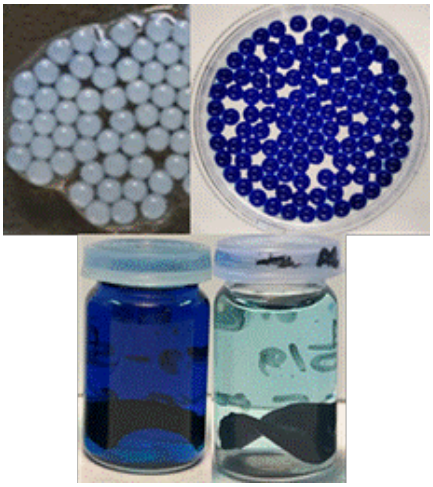
Smart hydrogels for the remediation of organic pollutants and heavy metals

Background

Faced with the growing demand for water and with pollution by heavy metals, dyes and toxic organic pollutants from industrial activity, the **treatment of contaminated** water is a major challenge that calls for innovative solutions. Hydrogels described as three-dimensional polymer networks with very high absorption capacities, strong hydrophilicity and selective permeability are promising candidates. Their often insufficient mechanical properties, however, limit their applications.

Objectives & Methods

To address this, the internship aims to implement a **multidisciplinary scientific strategy** combining **physics**, **artificial intelligence**, **modeling** and **mechatronics**, in order to develop crosslinked or interpenetrated biopolymer networks forming hydrogels shaped as membranes or microbeads with tunable properties, and to study these properties.



The biohydrogels will be characterized by FTIR and XPS spectroscopies. Their adsorption potential will be assessed on an innovative platform at the MSC laboratory combining computer vision, artificial intellignce-based image processing, digital colorimetry and real-time kinetic monitoring; and the mechanical, morphological and structural properties of the best performers will be studied by rotational rheology, uniaxial compression, electron microscopy and small-angle X-ray scattering. Beyond synthesis, the project includes **a theoretical and modeling component** to predict the relationships between the structure of the networks, their mechanical properties and their adsorption efficiency.

Why this internship?

- ✔ Multidisciplinary approach (physics, AI, modeling, mechatronics)
- ✔ Environmental impact (circular economy)
- ✔ International collaboration
- ✔ Innovation

Collaborations: laboratories in the Paris region + University of A Coruña (Spain)
https://msc.u-paris.fr/stage-m2-2027-hydrogels-et-composites-modulables-pour-une-remediation-selective-et-circulaire-des-metaux-toxiques/

Please, indicate which speciality(ies) seem(s) to be more adapted to the subject:

Condensed Matter Physics: NO Soft Matter and Biological Physics: YES
Quantum Physics: NO Theoretical Physics: NO