Université Paris Cité

MATIÈRE et SYSTÈMES COMPLEXES UMR 7057

# Hydrogels and composites with optimal efficiency and minimal environmental impact for adsorption of toxic metals

## Context

With the advancement of technology and industrial activity, the demand for water for daily use is increasing day by day. Water is easily polluted because it has the ability to dissolve more substances than any other solvent. The main contaminants come from different industries containing heavy metals, dangerous dyes, radioactive pollutants, toxic chemicals, etc.

To address this problem, it has been shown that hydrogels can be used to treat these waters. Indeed, these three-dimensional networks of polymer chains crosslinked by covalent bonds, hydrogen bonds, van der Waals interactions or physical entanglements have low interfacial tension, good elasticity, high hydrophilic properties, selective permeability and very high absorption capacities. However, the mechanical properties of hydrogels are often weak, which limits their applications. Recently, much research has been devoted to improve the mechanical performance of hydrogels by either introducing fillers (particles, fibers, etc.) into polymer networks to create composites or by linking several polymers together to combine different properties as required.

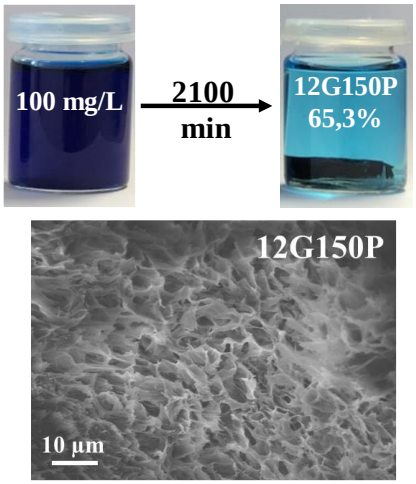


**Fig** Dye adsorption by graphene oxide-based PVA composite with porous structure observed by electron microscopy

## Description

The aim of this project is to acquire new knowledge in the field of design and optimisation of **environmentally friendly materials** in order to develop an innovative and original technology for the **selective adsorption of toxic heavy metals**. It is based on the wide range of bioadsorbents consisting of networks of cross-linked or interpenetrated biopolymers that can form hydrogels with flexible properties. The main tasks are

**T1** Design, development and physico-chemical characterisation by Fourier transform infrared spectroscopy (FTIR) and X-ray induced photoelectron spectroscopy (XPS) of biohydrogels based on semi-interpenetrating or cross-linked polymer networks and eventually nanofillers such as graphene oxide

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**T2** Evaluation of the potential of biohydrogels developed for the adsorption of heavy metals from water contaminated by these metals using laser-induced plasma atomic emission spectroscopy in collaboration with University of A Coruna (Spain).

**T3** Study of the mechanical, morphological and structural properties of biohydrogels with the best adsorption capacity by rotational rheology, uniaxial compression, electron microscopy and small angle X ray scattering.

The internship will be mainly managed by MSC laboratory in collaboration with Spain (University of A Coruna). The master's internship may be followed by a PhD.

## Profil required

second-year Master's student or 3rd year of engineering school in physics or materials science with a strong background in physical chemistry and a keen interest in experimental work

## Duration

four to six months

## Contacts

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