

## **Fixed-term contract proposal (18 months) - Institut Charles Gerhardt Montpellier**

### **1. Subject**

Actinide decontamination using functional polymeric hydrogels (CATCH)

### **2. Context**

Nuclear terrorist attacks are becoming a growing concern throughout the world, forcing countries (including France) to consider new measures to deal with potential threats, in particular by guaranteeing the safety of the population. The latter must be effectively protected and rescued. So, solutions in the event of contamination, whether external (healthy skin without adsorption) or internal (healthy skin with adsorption, injured skin, inhalation, ingestion) must be found. Nuclear terrorism involves the use of radioactive materials or nuclear explosives, or attacks on nuclear facilities by individuals with the aim of intimidating or spreading terror by creating a threat. The most accessible nuclear weapon for a terrorist group is the radiological bomb, also known as the "dirty bomb". Additionally, alongside the dirty bomb, the range of means that can be used for terrorist purposes has been expanded in recent years to include the possible use of radioactive products in an attempt to contaminate soil, water, air, vegetation, livestock, buildings, materials, installations, equipment, infrastructures, etc. In addition to the terrorist threat, radionuclide contamination of humans can also occur within nuclear facilities, through malicious acts, climatic events or technical failures. For example, nuclear safety must be ensured at reactors during reprocessing, fuel fabrication, the transport of nuclear materials and during dismantling operations (civil or military), all of which present a risk of contamination.

In this context, the aim of the CATCH project is to develop relevant hydrogels based on functional copolymers for effective decontamination. The development of hydrogels capable of treating both healthy and, above all, damaged skin represents a breakthrough compared with existing solutions. This original galenic form (hydrogel) will enable greater local efficacy (no run-off). The non-toxicity of the complexing copolymers developed, their multi-functionality (high complexation capacity), and their inability to cross the skin barrier (due to the high molar mass of the polymers) have enabled us to overcome a number of scientific hurdles in the field of external and internal actinide decontamination of the body. The hydrogels developed could be used in any field situation, generating little radioactive waste by volume.

### **3. Research objectives**

- 1) Synthesis of functional copolymers able to efficiently complex radionuclides and leading to hydrogels in water;
- 2) Study of complexing properties of the new copolymers developed in solution with respect to radionuclides of interest (elements at risk);
- 3) Study of the biocompatibility of optimized copolymers, development of hydrogels, study of their spreading, adhesion and skin penetration properties.

### **4. Host team contact details**

The host team for the position is the Chemistry and Macromolecular Materials Department (Department D2) of the Institut Charles Gerhardt de Montpellier (ICGM), UMR 5253 CNRS. Copolymer characterization and physicochemical studies will be carried out in collaboration with the Institut des Biomolécules Max Mousseron (IBMM) in Montpellier. The study of the complexation of elements at risk will be carried out in collaboration with the Institut de Chimie Séparative de Marcoule (ICSM).

### **5. Candidate profile / Required skills**

Research developments require the employment of a researcher for 18 months, who will be in charge of the experimental work. The researcher main skills will deal with the synthesis and characterization of organic polymers. Experience in the study of metal complexation (in particular by isothermal calorimetric titration (ITC) and inductively coupled plasma emission spectroscopy (ICP) techniques) will be appreciated. Autonomous, rigorous and keen on experimental sciences, he/she must also have good writing (French and English) and interpersonal skills.

### **6. Application: send CV and covering letter by e-mail to**

Prof. Sophie MONGE (sophie.monge-darcos@umontpellier.fr)

Dr Vincent DARCOS (vincent.darcos@umontpellier.fr)

Deadline : february, the 16th, 2024