

Postdoctoral position

Life Adsorb project

Paris, France - 15 month

File: Leesu-ENPC-Postdoc-Internship-Position-MCG-En-2019-08-09.docx

Research subject

Experimental assessment of innovative substrates for the filtration and adsorption of micropollutants in road runoff

Short description

École des Ponts ParisTech - Leesu is seeking a postdoctoral fellow to take part to a research project funded under the EU's funding instrument for the environment and climate action - LIFE program, project Life-Adsorb LIFE17 ENV/FR/000398. The postdoctoral fellow will be mainly in charge of the implementation of lab scale studies for the performance assessment of adsorbent substrate that are intended to be implemented inside a reed bed filter treating urban runoff or road runoff.

The post-doctoral fellow will be recruited for a 15 month contract, by École des Ponts ParisTech. He will be based at École des Ponts ParisTech (<http://www.enpc.fr/en>), in Paris conurbation, within Leesu research laboratory <https://www.leesu.fr/>.

École des Ponts ParisTech is a French higher education institution that trains high-level engineers and doctors. Research at Leesu focuses primarily on urban waters and is organized around two main issues: adaptation to change and resilience of urban systems, preservation of ecosystems and natural resources.

The postdoc will be carried out in collaboration with the municipalities of Paris who is coordinating the Life-Adsorb project and several other research institutions that are partners of the project.

Start date: December 2019

Qualifications needed

- Hold a PhD , or possibly a Master Science with two years' work experience
- Training in Process Engineering, or Geochemistry and Soil Sciences
- A first experience of column tests is desired

How to apply?

Send all the following documents in one PDF file to marie-christine.gromaire@enpc.fr

1. Cover letter stating your experience in relation to the subject of the postdoc
2. Curriculum vitae including a list of your scientific publications
3. Names and addresses of two referees for professional references

Detailed description of the research subject

Context

Road runoff, and in particular runoff from heavily trafficked roads such as urban outskirts, is an important vector of organic or metallic micropollutants that contributes to the degradation of aquatic environments and undermines the achievement of good ecological status under the European Water Framework Directive. In order to limit these loads to the natural environment, while contributing to the establishment of a hydrological cycle close to the natural state, solutions based on the temporary storage of runoff and its treatment in vegetated filters have been developed. They allow both the improvement of runoff water quality and the reduction of peak flow.

Among the solutions based on ecological engineering, reed bed filters, initially developed for extensive wastewater treatment, offers interesting prospects for the depollution of these stormwaters. Its effectiveness has been demonstrated for metals and nutrients, and more broadly for pollutants associated with the particulate phase. The behaviour of organic micropollutants in these structures is still relatively undocumented, and the treatment of some of these compounds seems limited by their more dissolved nature and by their possible association with colloids or dissolved organic matter.

One of the objectives of the LIFE-ADSORB project (LIFE17 ENV/FR/000398), in which this post-doctoral topic is included, is to implement and test a vertical flow reed bed filter, whose innovative design allows mechanical filtration and adsorption of dissolved micropollutants on a specific substrate, thus promoting their subsequent degradation. The focus of the project is on reducing organic and mineral micropollutants in road runoff, especially suspended solids (SS), metals, hydrocarbons and other environmentally toxic substances (phthalates, alkylphenols, perfluorinated compounds, etc.).

Objectives

The post-doctoral fellowship focuses on the laboratory evaluation of the performance of various adsorbent materials that can be used in a planted filter to maximize micropollutant retention. It is structured around three main tasks:

- 1 - Better characterize the adsorbent material (RainClean® marketed by Funke) used in the LifeAdsorb project full scale prototype, both in terms of its hydrodynamic behaviour and its physico-chemical properties, and in particular assess the evolution of these properties over the lifetime of the material;
- 2 - Propose a simplified test protocol to be applied to a panel of alternative absorbent materials to Rainclean®. The qualification of materials should result in the evaluation of as few parameters as possible to describe the reactive transfer of water and pollutants through a layer of material used in a filter. It aims to parameterize a model to assist in the design of filtering structures.
- 3 – Analyse field data from the Life-Adsorb reed bed prototype in order to assess the treatment performance of the RainClean® layer under full scale implementation.

Methodology

This work will be carried out in the lab using column tests.

The RainClean® substrate will be tested in order to measure, under operating conditions representative of the real case, parameters such as permeability, advection/dispersion, isotherms and adsorption kinetics for a panel of organic and mineral micropollutants, as well as parameters describing the filtration of suspended solids. Accelerated ageing tests (accelerated supply of synthetic or real runoff water to the column) will be carried out in order to evaluate the temporal evolution of the material properties. The new and saturated material will also be subjected to leaching tests to assess the risks of release in the

event of rapid change in the characteristics of the feed water (case of clear water inflows, effects of winter salting).

In order to facilitate the transposition of the proposed treatment solution to other contexts and water types, the use of other adsorbent materials should be considered, and their description made possible in a design aid tool. On the basis of the tests carried out on the Rainclean® material, a "degraded" version (column or batch) with an operational purpose of the test protocol will be proposed. It should allow the characterization of the key parameters mentioned above. This protocol will be tested/validated for Rainclean® and then applied to a first selection of relevant materials. It will be designed to be easily applicable by future users of the tool.

The postdoctoral fellow will be in charge of:

- Definition of column test protocols for the different objectives. It will be based on a preliminary analysis of the methodologies found in the literature. It must ensure that the test conditions are representative in terms of column construction, feed water quality and feed dynamics. In particular, he will ensure that the risk of bias or contamination due to the flow conditions in the column or the materials used is minimized;
- The design and implementation, with the support of Leesu and Cerema technical staff, of the experimental system;
- Carrying out the tests, with the support of Leesu and Cerema's technical staff;
- Exploitation of the results, including the implementation of inverse modelling approaches for the calculation, based on experimental results, of key parameters conditioning reactive transport.