



## Postdoc Position

Institute of Analytical Sciences and Physico-Chemistry for Environment and Materials (IPREM)

2 Avenue Pierre Angot 64 053 PAU Cedex – France

## Postdoc SUBJECT

### Potential of single-particle ICP-MS (spICP-MS) and ICP-MS techniques for micro/nano plastics and nanoparticles characterization in solutions

#### **ABSTRACT:**

In petrochemical plants, the careful monitoring of wastewater quality must be addressed to avoid any pollution and undesired rejection of chemicals to prevent environmental issues. Among possible contaminants, metallic species can be found at trace levels (ppm to ppt) and are usually well monitored, but the presence of micro to nano-plastics, especially in waste waters from plastics production plants is a major issue that should be evaluated. Especially, both the qualification (type of plastics, size) and concentration of these particles are needed to ensure that our wastewaters are not polluted with any plastics and if so, to fully characterize their type and size to be able to filter them prior to wastewater rejection.

Due to the low concentrations, the diversity of plastics, and the small particle sizes, the range of analytical techniques available to characterize and quantify these particles is quite limited. Among them,  $\mu$ -Raman or  $\mu$ -IR spectroscopies are currently used to identify the different types of plastics as well as providing size estimation with dedicated instrumentation but are limited to micro-plastics as the minimum achievable resolution is respectively 10 and 0.3  $\mu\text{m}$  for  $\mu$ -IR and  $\mu$ -RAMAN. Otherwise, gas chromatography hyphenated to mass spectrometry used with pyrolyzer unit (Py-GC/MS) is also used but is quite limited for nanoplastics quantification due to detection limits issues, interferences from organic matter also found in wastewater that require additional digestion of the samples prior to analysis and finally does not give indication on the size of the particles.

In this context, the objective of this study is to evaluate the potential of single-particle ICP-MS as a tool to characterize directly these micro- to nano-plastics in wastewater from polymers production plants or other origins. Due to the very high sensitivity of this technique, very low detection limits can be achieved as well as possible polymer speciation depending on analytical strategies for preparation or detection. In addition, it has been shown that the theoretical smallest particle detected with this technique should be 135 nm while largest molecule should be around 3  $\mu\text{m}$ , closing the bridge with Raman or IR technique limited to  $\mu\text{m}$ -range.

As a first step, the synthesis of appropriate nanoplastics or the choice of dedicated metallic proxies should be performed to target specific polymers among those produced in our production plants to provide polymer speciation (mainly PE, PP, PS but will also be extended to other type of polymers). As a second step, the development of sp-ICPMS or ICP-MS methods for each type of polymer should be carried out and optimized for 1) each type of polymer, 2) both micro- and nano-plastics with the aim to provide 1) particle size distributions and 2) quantification. To that end, additional characterizations might be performed such as DLS, A4F and/or Py-GC/MS to help with the identification of unknown plastic types and size estimations. The third and final step consists in the implementation and internalization of the developed methodologies in the elemental laboratory in TOTB at Feluy.

**Keywords :** nanoplastics, microplastics, waste water, mass spectrometry

## WORKING CONDITIONS

**Laboratories :** Institute of Analytical Sciences and Physico-Chemistry for Environment and Materials (IPREM), a Joint Research Unit CNRS / UPPA (UMR 5254). The postdoc position will include a minimum of 3 months stay at the Elemental Laboratory at TotalEnergies OneTech Belgium (TOTB) in Feluy (Belgium).

**Site web :** <https://iprem.univ-pau.fr/fr/index.html>

**Supervisors :** Javier Jiménez / Bruno Grassl / Julie Guillemant

**Place :** IPREM, UMR 5254

**Starting date:** 01/12/2023

**Duration:** 12 months

**Employer:** ADERA

**Monthly salary before taxes:** 2700 €

## HOST LABORATORY PROFILE

The Institute of Analytical Sciences and Physico-Chemistry for Environment and Materials (IPREM) is a Joint Research Unit CNRS / UPPA (UMR 5254).

IPREM members are interested in the development of fundamental knowledge in physico-chemistry, analytical chemistry and microbiology, in relation to applications concerning the structure of the living, the management of the environment and the functional properties of different classes of materials.

Their skills are based on analytical strategies, modeling, physico-chemical approaches, fine studies of structures and reactivity, development, characterization and implementation at different scales.

They make it possible to display an original position in the field of applications in many industrial sectors both at national and international level.



## CONTACTS

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