

PhD CONTEXT

TITLE: Analytical development for compound-specific stable isotope analysis (CSIA) applied to organic emerging contaminants

ABSTRACT:

The increasing contamination of aquatic systems by micropollutants and emerging contaminants has become one of the major issue in the management of ecosystems from local to global scale. At present, the origin and the transformations of the micropollutants is poorly understood, i.e. the identity of their degradation products and the transformation processes. Available methods to investigate micropollutants origin and degradability in the environment, however, are limited: mass balances are difficult to close, metabolites are not always detectable and changes in concentrations alone do not provide conclusive evidence. The most interesting approach to provide relevant evidence is currently the development of isotopic fingerprinting analytical methods and their application. Compound-specific isotope analysis (CSIA) of natural stable isotopes could improve knowledge of both the origins of contaminants and the processes responsible for their degradation the environment. Isotope ratios at natural abundance can be used (i) as fingerprints to distinguish sources and commercial products and (ii) due to the isotope effects associated with environmental transformations, enrichment of heavy isotopes in the original micropollutant reflects its degradation, even if degradation products are not detected. The combination of the isotopic fractionation of elements of interest within a molecule can provide a new insight in identifying degradation pathways and distinguishing products of different origins.

By coupling multi-isotopic fingerprinting analysis of organic micropollutants, the challenge is to provide new promising investigation tools for the allocation of micropollutant sources, for identifying in situ transformation processes and/or for the characterization of the degradation mechanisms that are involved, or for the monitoring of transport and transfer of emerging micropollutants in the aquatic environment.

Keywords: Micropollutants, mass spectrometry, separation techniques, isotopic fractionation, biotic and abiotic degradations

WORKING ENVIRONMENT AND CONDITIONS

Laboratory:

Institut des Sciences Analytiques et de Physico-chimie pour l'Environnement et les Matériaux (IPREM UMR 5254)
The thesis will take place on two sites : Anglet and Pau.

IPREM: <https://iprem.univ-pau.fr/fr/index.html>

Environment and Microbiology

Analytical and bioinorganic chemistry

PhD Supervisor: Mathilde Monperrus

PhD co-supervisor: Mathieu Sebilo

The proposed PhD is part of the project 'MICROPOLIT' (Emerging micropollutants in aquatic ecosystems) funded by E2S-UPPA from 2020 to 2023. MICROPOLIT, is a collaborative and transdisciplinary project involving chemists, microbiologists, biologists,.... The objective of the project is to propose multidisciplinary approaches to face challenges and develop solutions from the river to the coast towards micropollutants.

Starting Date: Mid October

Duration: 3 years

Employer: Université de Pau et des Pays de l'Adour (UPPA)

Monthly salary before taxes: 1878 € (doctoral contract UPPA, according to E2S scientific challenges project, including 96h of teaching during the three years)

HOST LABORATORY PROFILE

Analytical chemistry, mass spectrometry, Environmental chemistry and reactivity

MISSION – PRINCIPAL ACTIVITIES

The PhD student will be in charge of the measurement of isotope ratios of different elements in individual organic compounds and degradation products, both abiotic and biotic (strains or enrichments) by developing analysis methods. The student will have access to the IPREM strain collection able to degrade emerging pollutants. The student will have access to gas or liquid chromatography coupled to isotope ratio mass spectrometry (IRMS) to identify compounds with a clear isotopic fingerprinting related to (bio)transformation processes. Original results will allow to reveal the life history of organic emerging contaminants measured in surface water.

- He/she will have to select micropollutants of interest and perform a state of the art on current knowledge in terms of reactivity and isotopic fractionation.
 - He/she will develop analytical methodologies to analyse micropollutants by GC or LC MS
 - He/she will develop analytical methodologies to analyse the isotopic composition of micropollutants by GC or LC IRMS
 - He/she will apply the developed methodologies to synthetic and real samples be strongly involved in the identification of thiols ligands by HPLC-ESI-MS/MS.
 - He/she will also be involved in abiotic and biotic experiments to study degradation pathways
 - He/she will be in charge of the analysis, data treatment and article writing.
- He/she will work with another PhD student in microbiology involved in the degradation of micropollutants and a post-doc, involved in the implementation of experimental devices to simulate the behaviour of micropollutants found in estuarine environments and to better understand the biotic (biotransformations) and abiotic phenomena governing their transformations.

The PhD student will also participate to teaching activities at the undergraduate level (96h/3 years).

REQUIRED COMPETENCES

Skills in MASS SPECTROMETRY, SEPARATIVE TECHNIQUES (GC, HPLC), (BIO)GEOCHEMICAL ISSUES

The candidate should have a strong predilection for laboratory work.

The ideal candidate has a master degree in analytical chemistry and/or environmental chemistry. He/She is rigorous and highly motivated. He/she must have a good English level and the capacity to work autonomously. Knowledge on isotopic fractionation would be a plus. It will also be possible for the doctoral student to spend a stay abroad.

SELECTION CRITERIA

Two steps selection process:

1st step:

- Evaluation of the applicants cv
- Selected candidates will be contacted by mail before the **30/09/20**

The candidates selected after this first step, will be interviewed then

2nd step: **October 2020**

- Candidates will have 5 min to present their CV, 5 min to present their Master2 thesis and 5 min to present the PhD subject.
- 2/3 key articles dealing with the thesis subjected will be sent before the audition
- This presentation will be followed by questions and discussion.

Criteria used in selection of the candidate:

- The candidate's motivation, scientific maturity and curiosity.
- Candidate's knowledge.
- Candidate's marks and rankings in Licence/undergraduate, M1 and M2.
- English proficiency
- Candidate's ability to present his/her work
- Professional experience of internship (s) in laboratory or other; any research work already carried out (reports, publications).

APPLICATION , DEADLINE

Application should be send by e-mail. The application should contain:

- ☐ CV
- ☐ Cover letter detailing candidate's motivations
- ☐ Candidate's Licence and MSc marks and ranking
- ☐ Reference letters
- ☐ Contact details (for 2 referees)

DEADLINE: 25/09/2020

CONTACT

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