

What is the ExposUM Doctoral Nexus?

The Doctoral Nexus proposed by the ExposUM Institute are networks of 3 to 4 PhD students from different disciplines and affiliated to at least two different research units.

Compared with a traditional PhD, taking part in a Doctoral Nexus will encourage the ability to work in a team and to design projects in a transdisciplinary way while deepening one's own field of expertise.

A specific teaching programme will be offered and the doctoral students concerned will also have the opportunity to organise a seminar within the Nexus network.

These are funded from the outset for 4 years, including the PhD student's salary and an environmental allowance.

Summary of the overall project

Integrated approach to Persistent, Mobile and Toxic pollutants in water resources: assessment of their contribution to EXPOsome, recommendation of adaptation solutions - EXPO-PMT

Water intended for human consumption (EDCH), because of its direct contribution to the exposome, is currently causing concern for human health due to the growing number and diversification of toxic anthropogenic pollutants it contains. Among these, the 'Persistent, Mobile and Toxic Pollutants' (PMT) constitute a heterogeneous group of micropollutants recently classified by the European Union, under the REACH regulations, as 'extremely worrying'. Recent studies highlighting the presence of certain PMTs in drinking water [1] have raised questions about their impact on human health via the aquatic exposome, and the action that needs to be taken. Adapting treatment processes therefore becomes a possible response to micropollutant pollution [2] and in particular to PMT, the fate and impact of which are not yet fully understood. The few studies available on the ozonation or activated carbon (AC) adsorption processes currently used in drinking water treatment plants have shown that, for targeted PMTs, ozonation appears to be less effective for polar substances, and that the effectiveness of AC depends on both the specific characteristics of the substances and the type of carbon used [3,4].

The EXPO-PMT project brings together researchers from five ExposUM laboratories with complementary skills: targeted and non-targeted monitoring of organic molecules present in water at trace levels, and more specifically PMTs (HSM); fate of emerging contaminants in aquatic environments (HSM/IEM); treatment of micropollutants present in water by adsorption and ozonation processes (IEM); evaluation and spatio-temporal modelling of toxicological impacts (LBE/ITAP); management of public water services and EDCH resources and on decision support models for water services (GEAU); link between LCA and decision-making by water service managers (GEAU/ITAP).

PhD project (PhD1)

Contribution of PMTs to aquatic exposome: diagnosis and treatment of water resources intended for human consumption

Objectives

The objectives of this thesis (PhD1, carried out at IEM/HSM, Montpellier University) are:

Exploring the fate of PMTs in water source and within drinking water treatment systems, by adapting analytical approaches based on high-resolution mass spectrometry to quantify trace concentrations and their impact in collaboration with PhD 2.

Defining the effectiveness of the refining treatment processes in drinking water treatment plants and their possible synergy (adsorption on activated carbon (AC) +/- pre-ozonation of clarified water) under various operating parameters of the ozonation or adsorption on activated carbon processes.

Providing recommendations on the most interesting processes and treatment conditions for the elimination of PMT, as well as an estimate of the associated costs, thus enabling a link to be made with PhD 3.

Methodology:

The first step will be to update of knowledge on the presence of PMT in drinking water, the processes used for their complete or partial remediation, and analytical techniques through scientific literature and establish a diagnosis of PMTs in the drinking water supply chain of several sites of the Montpellier Water Board (Lez springs and BRL canal) and the drinking water production units (Arago and Valedéau). Secondly, the results of these analysis will be used to study of the refining treatment of PMT in drinking water, focused on the choice and characterization of activated carbon and on the ozonation of clarified water, to then study of the performance of refining treatment in laboratory columns. Finally, an estimate of the costs of the processes (innovative coupled treatment compared with conventional treatment) will form part of the performance analysis, as will their feasibility in interaction with thesis 3.

Expected results:

Assessment of the improvement in drinking water quality:

Mapping of the fate of PMTs in drinking water treatment plants, with an overview of the presence of PMTs in raw water resources; identification of the critical stages in treatment plants where PMTs are poorly or not at all eliminated; creation of a database on PMTs and identification of priority substances for regulatory and environmental monitoring in the light of the expertise produced in PhD 3.

Choice of 2 'optimal' CAs. Determination of optimum doses of O₃, degradation kinetics, estimation of R_{ct} and reaction pathways. Monitoring of MON during ozonation and identification of by-products for adsorption on activated carbon in a dynamic column. Establishment of pollution profiles during ozonation. Performance of O₃+CA coupling in terms of removal of PMT and other molecules, estimation of costs, and identification of PMT removal trends via non-targeted analysis.

References

- 1- Huang et al. (2025). J. Hazard. Mat. Letters, 2, 100026.
- 2- Fourcade et al. (2024). Prévenir et maîtriser les risques liés à la présence de pesticides et de leurs métabolites dans l'eau destinée à la consommation humaine. Rapport n°015411-01 IGEDD.
- 3- Schumann P. et al. (2023). Wat. Res. 235, 119861.
- 4- Neuwald et al. (2023). Sci. Total Environ. 886, 163921.

Supervision:

Stephan Brosillon (Pr. U. Montpellier; supervisor), Elena Gomez (Pr. U. Montpellier; supervisor), and Geoffroy Duporte (Assoc. Pr. U Montpellier; co-supervisor) and Catherine Faur (Pr. U. Montpellier, co-supervisor)

Candidate profile

The candidate (M/F) should hold a Master's or Engineering degree in Chemistry, Process Engineering, or a related field. The candidate should have strong foundational skills and an inclination for experimental work in the laboratory. Excellent writing and communication skills, particularly in English, are required, along with the ability to work independently. Previous experience in chemical engineering or in mass spectrometry analysis would be advantageous.

Application procedure

The application must include the following

- A CV
- A letter of motivation
- A copy of the degree required for registration and master's degree marks (M1 and M2)
- Any additional specific information requested by the doctoral school GAIA (<https://gaia.umontpellier.fr>)

If you would like to apply for this position, please **send an e-mail by specifying « candidature NEXUS HSM/IEM » in the subject of the E-mail.**

to :

- **stephan.brosillon@umontpellier.fr** and **elena.gomez@umontpellier.fr** (co-directeurs de thèse)

by copying :

- **catherine.faur@umontpellier.fr** (porteur du Nexus)
- **exposum-aap@umontpellier.fr**

Application before 16th may 2025.



UNIVERSITÉ DE
MONTPELLIER



Institut
eXposUM
UNIVERSITÉ DE MONTPELLIER



l'Europe
s'engage
en France



The University of Montpellier

KEY FIGURES



RESEARCH CENTERS

From space exploration and robotics to ecological engineering and chronic diseases, UM researchers are inventing tomorrow's solutions for mankind and the environment. Dynamic research, conducted in close collaboration with research organizations and benefiting from high-level technological platforms to meet the needs of 21st century society. The UM is committed to promoting its cutting-edge research by forging close links with local industry, particularly in the biomedical and new technologies sectors.

More Information: <https://www.umontpellier.fr/en/recherche/unites-de-recherche>

SCIENTIFIC APPEAL

Open to the world, the University of Montpellier contributes to the structuring of the European higher education area, and strengthens its international positioning and attractiveness, in close collaboration with its partners in the I-SITE Program of Excellence, through programs adapted to the major scientific challenges it faces.

More Information: <https://www.umontpellier.fr/en/international/attractivite-scientifique>



UNIVERSITÉ DE
MONTPELLIER



Institut
eXposUM
UNIVERSITÉ DE MONTPELLIER