



2023 Master internship at University of Gdansk



TITLE : Metal organic frameworks (MOFs) and their composites for sorption and photodegradation of organic pollutants

LAB & PEOPLE

- Name of the hosting lab: Photocatalysis Group (Department of Environmental Technology, Faculty of Chemistry, University of Gdańsk)
- General activities of the lab: nanomaterials synthesis, photocatalysis, materials characterisation
- Website: <https://chemia.ug.edu.pl/wydzial/katedry/katedra-technologie-srodowiska>
- Number of staff / PhD: 10 staff members, 9 PhD students
- Supervisor name and contact: Adriana Zaleska-Medynska (Prof.), Aleksandra Pieczyńska (PhD) (aleksandra.pieczynska@ug.edu.pl)

TOPIC OF THE INTERNSHIP

- Scientific context of the internship (max 20 lines)

Metal–Organic Frameworks (MOFs) are crystalline porous materials formed by self-assembly of central metal ions or clusters with bidentate or multidentate organic ligands via coordination bonds (Chen et al., 2020). MOFs are characterized by large surface area, tunable pore structure, abundant active sites, functional group diversity, and high mechanical and thermal stability. These properties have made MOFs a prime material for environmental applications (Nosakhare et al., 2023). Among these applications, the use of MOFs for the adsorptive removal of pollutants from wastewater is very promising (Mohan et al., 2023). In addition, MOFs exhibit photocatalytic capabilities as a result of their photo-responsive nature which derives from their ability to absorb light via the metal centers or the organic linkers (Naghdi et al., 2023). This makes MOFs ideal materials for the removal of pollutants from water through the mechanisms of adsorption and photocatalysis.

The main aim of the research will be develop a simultaneous adsorption and photocatalytic degradation process for the removal of organic pollutants from water such as disinfection by-products (DBPs) using MOFs and MOFs-based composites. The selected MOFs stable in water and possessing high sorption capacity will be synthesized and tested for DBPs and or their organic matter precursors sorption from aqueous solutions. Previously synthesized MOFs and MOFs-composites with semiconductors, possessing high visible light driven activity in model pollutants photooxidation will be tested in DBPs and or their organic matter precursors photocatalytic

degradation. The effect of DBPs initial concentration and photocatalyst load on the DBPs' removal efficiency will be investigated.

Keywords : sorption, photocatalysis, Metal Organic Framework (MOF), nanocomposites, disinfection by-products

Bibliography :

Chen, L., Zhang, X., Cheng, X., Xie, Z., 2020. Nanoscale Advances The function of metal – organic frameworks in the application of MOF-based composites 2628–2647.
<https://doi.org/10.1039/d0na00184h>

Mohan, B., Kamboj, A., Singh, K., Singh, G., Pombeiro, A.J.L., Ren, P., 2023. Metal-organic frameworks (MOFs) materials for pesticides , heavy metals , and drugs removal : Environmental safety. Sep. Purif. Technol. 310, 123175.
<https://doi.org/10.1016/j.seppur.2023.123175>

Naghdi, S., Moheb, M., Zendeabad, M., 2023. Recent advances in application of metal-organic frameworks (MOFs) as adsorbent and catalyst in removal of persistent organic pollutants (POPs) 442.

Nosakhare, A., Lewis, C., Uyi, O., Agbovhimen, E., Oshiokhai, S., Kayode, P., Septya, H., 2023. A comprehensive review of recent advances in the synthesis and application of metal-organic frameworks (MOFs) for the adsorptive sequestration of pollutants from wastewater. Sep. Purif. Technol. 311, 123246. <https://doi.org/10.1016/j.seppur.2023.123246>

Tasks and duties entrusted to the student:

- Synthesis and characterization of MOF
- Study of the sorption and photocatalytic activity of the obtained materials

Skills to be acquired or developed:

- Student will learn methods of MOFs, semiconductors and composites synthesis
- Student will learn methods for characterization of photocatalysts (SEM, UV-Vis, Raman Spectroscopy, FTIR techniques, BET sorption analyzer)
- Student will learn systems for conducting photocatalytic and sorption tests
- Student will learn use of chromatographic devices (GC-MS, HPLC)

PROFILE OF THE DESIRED STUDENT

- Minimum level of study required: **End of Bachelor**
- Field(s) of study: **Chemistry, Environmental Technology, Materials engineering and related fields**
- Scientific skills : **basics of inorganic, organic and analytical chemistry**
- Language skills required : **English (spoken, written)**

THE INTERNSHIP ASSIGNMENT:

Desired duration of the internship (in months): **3-6 month**

Desired Starting date of the mission: **November 2023 – June 2024**

Indicative weekly schedule: *35h / week*

Remuneration ?

Erasmus grant : additional Erasmus grant could be asked to your own university

Internship agreement: *an internship agreement will be signed.*

To SEA-EU students:

*If you're interested please send your CV and letter of motivation to the scientist in charge,
email : aleksandra.pieczynska@ug.edu.pl, before the date 01/10/2023.*