# 2023 Master internship at University of UCA

## TITLE : Polymer inclusion membrane-based optical sensor for the metal ions analysis in real samples

## LAB & PEOPLE

- Name of the hosting lab: Environmental analytical chemistry (4.4.4.016_Faculty of Sciences)
- General activities of the lab: sample preparation, pretreatments for preconcentration and separation of analytes, development of metal analysis methods, use of several instrumental techniques, heavy metal analysis, processing of analytical data using chemometric tools
- Website:
  https://rnm236.uca.es/
  https://produccioncientifica.uca.es/grupos/7849/detalle/

- Number of staff / PhD: 6/4
- Supervisor name and contact:
  María Dolores Granado Castro
  Department of Analytical Chemistry, Faculty of Sciences, University of Cadiz, Puerto Real, Spain, 11510. E-mail : dolores.granado@uca.es

## TOPIC OF THE INTERNSHIP

- Scientific context of the internship (max 20 lines)

Optical chemical sensors belong to a group of chemical sensors in which electromagnetic radiation generates an analytical signal in a transduction element [1]. The working principle is based on the binding of an immobilised reagent on a solid substrate with the analyte, which leads to a change in the optical properties of the solid phase (absorption, reflectance, transmission, fluorescence, refractive index, etc.). This change can be correlated to the concentration of the target analyte, allowing its detection and quantification [2].

PIMs (polymer inclusion membranes) are thin, flexible and stable films which are formed by casting a solution containing a base polymer - such as poly(vinyl chloride) (PVC) or cellulose triacetate (CTA). They can also contain different types of additives which can act as extractant agents to facilitate the transport of the species from the solution to the optode[3, 4]. The Schiff bases can be very useful in the design of PIMs since they can act as chelating reagents, being effectively applied for the removal, recovery and the analysis of metal ions. Among the Schiff bases, the hydrazones contain =C=N–N= groups which offer good optical properties after the complexation of metal ions [5, 6].

Therefore, in this contex, the work is focused on the design of a polymer inclusion membrane as an optical sensor to determine metal ions. For that, different chromogenic reagents (Schiff bases) will be proposed to be immobilised in the PIM membrane as complexing agent of metal ions.

Keywords: Optical sensor; Polymer inclusion membrane; metal determination

Bibliography :

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2-Urek, S.K.; FranIiI, N.; Turel, M.; Lobnik, A. Sensing heavy metals using mesoporous based optical chemical sensors, J. Nanomater. 2013 (2013) 1–13
3- Sánchez-Ponce, L.; Galindo-Riaño, M.D. ; Casanueva-Marenco, M.J. ;Granado-Castro, M.D. ; Díaz-de-Alba, M. Sensing Cd(II) Using a Disposable Optical Sensor Based on a Schiff Base Immobilisation on a Polymer-Inclusion Membrane. Applications in Water and Art Paint Samples. Polymers 13(2021), 4414, 1–14
4-Casanueva-Marenco, M.J. ; Diaz-de-Alba, M. ; Herrera-Armario, A. ; Galindo-Riano, M.D. ; Granado-Castro, M.D. Design and optimization of a single-use optical sensor based on a polymer inclusion membrane for zinc determination in drinks, food supplement and foot health care products. Materials Science & Engineering C Materials for Biological Applications 110 (2020) 110680, 1–9.
5-Marczenko, Z.; Balcerzak, M. Spectrophotometric reagents. In Separation, Preconcentration and Spectrophotometry in Inorganic Analysis, 1st ed.; Elsevier: Amsterdam, The Netherland, 2000; pp. 53–57.
6-Berhanu, A.L.; Gaurav; Mohiuddin, I.; Malik, A.K.; Aulakh, j.S.; Kumar, V; Kim, K.H. A review of the applications of Schiff bases as optical chemical sensors, TrAC Trends in Analytical Chemistry, 116 (2019), 74–91

Tasks and duties entrusted to the student:
The student will collaborate in:
1-Research on methods for the separation and preconcentration of metals from real samples (environmental, pharmaceutical or agri-food samples).
2-Synthesis of heavy metal complexing organic reagents for their immobilisation in sensing polymeric inclusion membranes (PIMs).
3-Design and preparation of polimeric inclusion membranes for heavy metals in real samples (environmental, pharmaceutical or agri-food samples).
4-Detection of metals using different instrumental techniques.
5-Tasks related to the application of statistical and chemometric techniques in chemical analysis.

Skills to be acquired or developed:
1-Handling of common preparation, separation and preconcentration methods of samples for heavy metal analysis in real samples.
2-Knowledge of synthesis of complexometric ligands to spectroscopic analysis of heavy metals.
3-Management of diverse instrumentation, mainly molecular and atomic spectroscopy (ICP-OES, ICP-MS, AAS) for the analysis of metals.
4-Knowledge of polymeric optodes and their use in heavy metal analysis.
Study and discussion of analytical chemistry data

## PROFILE OF THE DESIRED STUDENT

- Minimum level of study required: university graduate
- Field(s) of study: analytical chemistry, environmental chemistry, heavy metal analysis
- Scientific skills: handling of material, basic laboratory operations and equipment ; laboratory skills
- Language skills required : spoken and written English (medium or high level), optional Spanish

## THE INTERNSHIP ASSIGNMENT:

Desired duration of the internship (in months): 3
Desired Starting date of the mission: *(please indicate the level of flexibility)* : from november 2023 to the end of July 2024.

Indicative weekly schedule: *25h / week*
Remuneration : *Erasmus grant*

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, dolores.granado@uca.es before the 21/09/ 2023.*