



## 2023 Master internship at University of Cadiz



### TITLE

Searching for sustainability and environmental friendliness in an Laboratory of Electroanalysis.

### LAB & PEOPLE

- Name of the hosting lab: FQM-249 Laboratory (Research group: Instrumentation and Environmental Sciences)
- General activities of the lab:
  - Development of new types of electrochemical/optical (bio)sensors based on (nano)materials synthesized via green approaches.
  - Characterization of the new material synthesized by electrochemical (Voltametry, amperometry, EIS) and textural methods (SEM, TEM, STEM, EDS, DLS, DRX, FTIR, AFM, ATG, etc.)
  - Application of the developed devices in agrifood, environmental and clinical/farmaceutical samples.
- Website: <https://fqm249.uca.es/>
- Number of staff / PhD: 6
- Supervisor name and contact: Laura Cubillana Aguilera/José María Palacios Santander

### TOPIC OF THE INTERNSHIP

- Scientific context of the internship (max 20 lines)

Keywords : Sonogel-Carbon modified Materials, nanomaterials, electrochemistry, green synthesis, environmental applications.

The development of electrochemical sensor devices is currently devoted to simpler, cheaper, and more eco-friendly routes of synthesis of novel materials with enhanced analytical performance. Sonogel-Carbon electrodes (SNG-C), characterized by the application of high-energy ultrasound for sonocatalyzing the sol-gel process, stand out among handmade carbon ceramic sensors. Not only does this method of synthesis provide a highly competitive sensor through an eco-friendly and fast procedure, but a material susceptible to be modified with organic-inorganic receptors and biological recognition species to enhance its electroanalytical performance as well [1]. Whereas this modification of the naked SNG-C material can be carried out after the preparation of the sensor, by depositing the modifier in the electrode surface, it is possible to merge the modifiers with the silicon oxide network during its synthesis to obtain a completely novel bulk material. Hence, the compounds susceptible to be used as modifiers range from metal nanoparticles [2] or conducting polymers [3] to massive modifiers, providing new sensor devices with analytical applications in the sensing of diverse analytes and great results in pharmaceutical [4] or environmental [3] samples.

## Bibliography :

1. Bellido-Milla D, Cubillana-Aguilera LM, El Kaoutit M, Hernández-Artiga MP, Hidalgo-Hidalgo de Cisneros JL, Naranjo-Rodríguez I, Palacios-Santander JM (2013) *Anal Bioanal Chem* 405:3525–3539. [https:// doi. org/ 10. 1007/s00216- 013- 6816-2](https://doi.org/10.1007/s00216-013-6816-2)
  2. Ajaero C, Abdelrahim MYM, Palacios-Santander JM, Gil, MLA, Naranjo-Rodríguez I, Hidalgo-Hidalgo de Cisneros JL, Cubillana-Aguilera LM (2012) *Sensors Actuators, B Chem* 171–172:1244–1256. [https:// doi. org/ 10. 1016/j. snb. 2012. 06. 087](https://doi.org/10.1016/j.snb.2012.06.087)
  3. López-Iglesias D, Fanelli F, Marchi L, Alcántara R, Cocchi M, Cubillana-Aguilera LM, Palacios-Santander, JM, García-Guzmán JJ (2022) *J Electroanal Chem* 905:115971. [https:// doi. org/ 10. 1016/j. jelec hem. 2021. 115971](https://doi.org/10.1016/j.jelechem.2021.115971)
  4. López-Iglesias D, García-Guzmán JJ, Zanardi C, Palacios-Santander JM, Cubillana-Aguilera LM, Pigani L (2020) *J Electroanal Chem* 878:114591. [https:// doi. org/ 10. 1016/j. jelec hem.2020. 114591](https://doi.org/10.1016/j.jelechem.2020.114591)
- Tasks and duties entrusted to the student:
    - During the stage, the student will carry out the development of modified Sonogel-carbon materials with several bulk modifiers (nanomaterials, conducting polymers among others) in order to obtain an electrochemical device for the determination of several environmental pollutants. These processes are optimized in the hosting research group by using a high power ultrasound probe.
    - The student will be trained in the management of different synthesis processes using environmentally friendly methods, reducing the impact on the environment, waste generation as well as cost and energy.
    - During this period, the student will also be in deep contact with the electrochemical and structural characterization techniques available in the group and those offered in the specialized research services centre located in the Faculty where the laboratory is located.
    - Once the different devices are finally developed and characterized, they will be applied to synthetic and real samples corresponding to environmental contaminants, such as pesticides, phenolic compounds or others of interest.
  - Skills to be acquired or developed:
    - Training work with several electrochemical techniques.
    - Fabrication and employment of different sensor devices based on Sonogel-Carbon materials.
    - Use of high power ultrasound to synthesize the electrode materials.
    - Analysis and interpretation of the data obtained from the analysis developed.
    - Literature revision and research planning.

## **PROFILE OF THE DESIRED STUDENT**

- Minimum level of study required: Degree level
- Field(s) of study: Chemistry
- Scientific skills : Laboratory skills.
- Language skills required : B1 English/B1 Spanish/B1 Italian

## **THE INTERNSHIP ASSIGNMENT:**

Desired duration of the internship (in months): 6 months

Desired Starting date of the mission: *(please indicate the level of flexibility) : february 1st (it is possible start in January 15th)*

Indicative weekly schedule: *25h / week*

Remuneration : No

*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, [laura.cubillana@uca.es](mailto:laura.cubillana@uca.es), [josem.palacios@uca.es](mailto:josem.palacios@uca.es) before the 15/11/2023.*