

PhD Candidate Profile

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Research Group (if relevant): Biosuv

Research Centre (if relevant):



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Area (field) of study: Advanced Oxidation Processes

Thesis Title: New perspectives in the application of the Advanced Oxidation Processes

Abstract: The Advanced Oxidation Processes (AOPs) have been widely studied as they can degrade many types of organic contaminants, due to the action of the hydroxyl radicals which are generated in this kind of processes. Previous studies performed in the BIOSUV group demonstrate the AOPs are an efficient alternative for the remediation of different effluents.

In the current context, this thesis is going to be focused in the use of the AOPs in the treatment of effluents with high organic load (such as the winery solutions), or with emerging contaminants (such as pesticides, drugs or ionic liquids). Contaminated soils would be also treated.

It is proposed the study of different AOPs: i) The Fenton process, in which the hydroxyl radicals are obtained due to the reaction between iron and hydrogen peroxide, ii) the electro-Fenton process where an electric field is applied in order to generate the hydrogen peroxide and to favor the degradation mechanism, iii) the photo-Fenton process, carried out with an external ultraviolet radiation, iv) the photo-electro-Fenton process which combines the aforementioned processes. The effect of the working parameters in the AOPs would be studied, in order to increase the production of hydroxyl radicals and, undeniably, the degradation of the contaminants. Therefore, different reactor's configurations would be used to maximize the processes' efficiency (choosing between different reactor's size, kind of electrodes, radiation...). These studies would allow the optimization

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of the working conditions (such as the concentration of catalyst, voltage...), improving all the processes.

Furthermore, another line of investigation would be based on the development of new heterogeneous iron catalyst, which would be useful for working in batch and continuous mode, avoiding the detected problems of working with homogeneous catalyst.

On the other hand, the viability of the ElectroKinetic-Fenton treatments for the remediation of soils will be evaluated. In this kind of experiments it is important to know how the different species move in the soil as well as how the contaminant is degraded during its treatment in the soil.

For quantifying the degradation of the different contaminants, the implementation of the analytic techniques would be done (such as spectrophotometry, liquid and gas chromatography, TOC, COD and hydroxyl radicals measurements...) as well as the usage of toxicity measurements (Microtox assays, phytotoxicity ...). Moreover, the viability of the processes would be studied.

Collaborations:

- A.M. Díez, O. Iglesias, E. Rosales, M.A. Sanromán, M. Pazos. Optimization of two-chamber photo electro Fenton reactor for the treatment of winery wastewater, *Process Safety and Environmental Protection*, 101 pp. 72 – 79, 2016. DOI 10.1016/j.psep.2015.09.010.
- A. M. Díez, E. Rosales, M. A. Sanromán, M. Pazos. Sequential two-column electro-Fenton-photolytic reactor for the treatment of winery wastewater, *Environmental science and pollution research international*, pp. 1-15, 2016. doi:10.1007/s11356-016-7937-x
- A. M. Díez, E. Rosales, M. A. Sanromán, M. Pazos. Assessment of LED-assisted electro-Fenton reactor for the treatment of winery wastewater, *Chemical Engineering Journal*, 310 pp. 399-406, 2017. DOI: 10.1016/j.cej.2016.08.006

Presentations:

- “Advanced Oxidation Processes for the Treatment of Winery Industry Wastewater”, 2nd International Conference on Recycling and Reuse, Istanbul, Turkey 2014. (Extended and oral communication).
- “Red Wine Wastewater Treatment by Electro-Fenton and Photo-Electro-Fenton Processes”, 12th International Chemical and Biological Engineering Conference (CHEMPOR 2014), Porto, Portugal 2014 (Extended communication).
- “Optimization of hydrogen peroxide generation in the Electro-Fenton process: application on winery wastewater treatment”, 12th International Chemical and Biological Engineering Conference (CHEMPOR 2014), Porto, Portugal 2014 (Extended communication).
- “Photo/Electro/Fenton process to the treatment of winery wastewater”, Energy and Environment Knowledge Week (E2KW), Toledo, Spain 2014 (Extended communication).
- “New treatments for the management of winery wastewater” Wastes: solutions, treatments, opportunities, Viana do Castelo, Portugal, September 2015 (Extended communication).
- “Analytical Strategies for Monitoring Ionic Liquids Breakdown by Electro-Fenton Process” Pittcon Conference and Expo 2016 Atlanta, Georgia, USA, March 2016 (Extended communication).

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- “Advances on the treatment of winery wastewater”1XXI, Encontro Galego Portugués de Química (Galician-Portuguese Chemistry Meeting), Pontevedra, Spain, November 2015 (Oral communication)
- “Design of two-column photo-electro-fenton reactor for the treatment of winery wastewater” European Conference on Environmental Applications of Advanced Oxidation Processes, Athens, Greece, October 2015 (Extended and oral communication).
- “Remediation of Ionic Liquid Polluted Soils by Enhanced Electrokinetic Treatment” 2nd E3 Mediterranean Symposium: Electrochemistry for Environment and Energy, Gargano, Italy, September 2016 (Oral communication).
- “Advantages of Electro-Fenton process over Current Trend Treatments in the Degradation of Emerging Pollutants” 2nd E3 Mediterranean Symposium: Electrochemistry for Environment and Energy, Gargano, Italy, September 2016 (Poster communication).
- “Removal of Prednisolone Using Box–Behnken Designed Photofenton” Energy and Environment Knowledge Week 2016, Paris, France, October 2016 (Poster communication).
- “New Approaches for the Ionic Liquid Treatment Under Advanced Oxidation Processes” Energy and Environment Knowledge Week 2016, Paris, France, October 2016 (Oral communication).