

PhD Candidate Profile

Name:

Jérémie Decker

Research Group:

LISA (Laboratorio de Ingeniería Sanitaria y Ambiental)

Research Centre:

N/A

Department/School(s) (if relevant):

School of Civil Engineering

College:

Polytechnic University of Madrid, Spain

Supervisor(s):

Prof. Stefanos Giannakis

Funding body:

JPIAMR - Joint Programming Initiative on Antimicrobial Resistance: "ARPHILAKE" Project, funded by the Spanish National Research Agency, PCI2022-132918

Area (field) of study:

Environmental Science, Chemical Engineering, Photochemistry and Photobiology

Thesis Title:

Controlling the spread of antibiotic resistance with light-assisted Advanced Oxidation Processes

Abstract:

While antibiotics remain the treatment of choice for bacterial infections, their effectiveness is currently threatened as bacteria developed novel strategies to withstand their bactericidal properties. Such resistance mechanisms are typically conferred by the expression of novel genes, called antibiotic resistance genes (ARG), and are acquired over extensive exposure of bacteria to antibiotics. Moreover, it is now accepted that, the disposal of wastewater containing high concentrations of antibiotics, antibiotic resistant bacteria (ARB) and ARG into natural waters have played a major role in the development of resistance mechanisms. Within this context, this thesis is an attempt to assess the effectiveness of light-assisted Advanced Oxidation Processes (AOPs) to effectively combat the dissemination of antibiotic resistance elements by effective disinfection and degradation of ARB and the related ARG. Specifically, the research part of the thesis will probe the disinfection of selected pathogens with clinical and veterinarian interest, encountered in urban wastewater facilities. The mechanisms through which their elimination is achieved and the application of a suitable treatment for



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the context of LMICs will be sought. Successful assessment will aid to mitigate the dispersion of antibiotic resistance elements in surface waters.

Collaborations:

- Unidad de Tratamientos Solares de Aguas, Plataforma Solar de Almería, Spain
- Centro de Investigaciones de la Energía Solar, CIESOL, University of Almeria, Spain
- Khan Laboratory, University of Stellenbosch, South Africa
- Gruppo CEA, Prof. Davide Vione, University of Torino, Italy
- Instituto de Salud “Carlos III”, Centro Nacional de Microbiología, Madrid, Spain

Publications:

- Rodríguez-Chueca, J., Giannakis, S., Senyuz, T., **Decker, J.**, Oulego, P., Bensimon, M., Guillaume, T., Pulgarín, C. Sunshine and a pinch of tropical soils: A natural, low-cost photo-Fenton variation for safer water, assisted by H₂O₂ or percarbonate (2023) *Separation and Purification Technology*, 321, art. no. 124221. DOI: 10.1016/j.seppur.2023.124221
- Akbari, S., Moussavi, G., **Decker, J.**, Marin, M.L., Bosca, F., Giannakis, S. Superior visible light-mediated catalytic activity of a novel N-doped, Fe₃O₄-incorporating MgO nanosheet in presence of PMS: Imidacloprid degradation and implications on simultaneous bacterial inactivation (2022) *Applied Catalysis B: Environmental*, 317, art. no. 121732. DOI: 10.1016/j.apcatb.2022.121732
- Pulgarin, A., **Decker, J.**, Chen, J., Giannakis, S., Ludwig, C., Refardt, D., Pick, H. Effective removal of the rotifer *Brachionus calyciflorus* from a *Chlorella vulgaris* microalgal culture by homogeneous solar photo-Fenton at neutral pH (2022) *Water Research*, 226, art. no. 119301. DOI: 10.1016/j.watres.2022.119301

Presentations:

- VI Seminario de Investigación of UPMWater. Madrid, Spain, 19 January 2023.