Abstract:

The Ph. D. project herein deals with the application of a novel photocatalyst and its potential in wastewater treatment. Specifically, for wastewater intended for reuse in crop irrigation and with direct emphasis on antibiotic resistance dissemination. The project is divided in three work packages (WP). *WP A - Selection of a suitable photocatalyst* deals with the assessment of a number of photocatalyst that was carried out in order to identify a suitable catalyst showing higher efficiencies while having a low-cost synthetic route. The research carried out within this scope resulted in an optimised cerium doped ZnO catalyst which was identified as fitting the pre established requirements. This catalyst was subsequently studied in the immobilised form in *WP B - Catalyst immobilisation* here a procedure for coating stainless steel surfaces was set and the catalyst used for the removal of two model antibiotics trimethoprim and sulfamethoxazole, as well as testing the reusability of photocatalytic coatings. Additionally, the immobilised catalyst was used for the inactivation of bacteria in isotonic saline water and for the inactivation of autochthonous bacteria, including antibiotic resistant fractions in real wastewater. In the latter, Ce-ZnO was more efficient than the industry standard TiO_2-P25. This novel catalyst was also applied for controlled irrigation experiments. Lettuce plants (Lactuca sativa) were set up in four groups receiving either Ce-ZnO treated wastewater, chlorinated treated wastewater, fresh water or secondary wastewater in *WP C – HPC and chlorination for AR abetment in irrigation*. Both water treatments showed marginal differences in concentrations of the four selected genes (16S rRNA, bla_{OXA-10}, *qnrS* and *intI1*) in water concentrations. As for concentrations in soil after the irrigation campaign, both treatments showed lower levels than those from secondary wastewater but higher levels than fresh water with no major differences between treatments.