J Food Microbiol Saf Hyg 2018, Volume 3
DOI: 10.4172/2476-2059-C4-018

Electrochemical removal of emerging organic contaminants from effluent: Electro-catalytic materials and design influence

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Emerging organic contaminants (EOC) are products or chemicals without regulatory status and whose effects on the environment and human health are still unknown. Pharmaceuticals and personal care products (PPCPs) are recognized as 'emerging' contaminants due to their bioactivity, wide usage, and potential health and ecological risks. The wide range of chemical properties of PPCPs constraints the development of a universal technology for effluent cleaning in wastewater treatment plants (WWTPs). The present work is part of an INTERREG SUDOE project, 4KET4REUSE, which one of the main objectives is to promote innovative capabilities for water reuse promoting a sustainable growth. The electrokinetic (EK) technology is being studied by the team aiming to optimize and to make it suitable as an effluent polishing step in WWTPs. The work here presented focused on the definition of the best electrode materials and design aiming to improve PPCPs removal from the effluent. For that, metal mixed oxide coated titanium (MMO) as a cathode was investigated with (i) different anode materials: graphite, platinized titanium (Pt/Ti) and MMO, and (ii) three different shapes (bar, mesh and circular mesh). The EK experiments were carried out applying 0.3mA cm-2 of current for 2 hours. In order to optimize the treatment, higher current intensities were also tested. In addition, the microbiologic community was analyzed in the initial sample and after treatment. Differences in energetic costs between electrode materials and shape were also evaluated. The results showed that the Pt/Ti bar and MMO mesh with circular shape had the best EOC removals (<LD-69%). Furthermore, the compounds characteristics did influence the EK removals, being caffeine, carbamazepine, and ibuprofen more difficult to remove.

I am an environmental engineer, currently doing a PhD in Environmental and Sustainability Programme at FCT-NOVA with a strong focus on water sustainability. I have been studying sustainable technologies as phytoremediation and electro-based technologies to remove emerging contaminants from liquid and solid matrices. My main research target has been the design, development, and optimization of an electrokinetic technology for pharmaceuticals and personal care products removal in wastewater treatment plants in order to guarantee it safe re-use in agriculture and improve the quality of the aquatic bodies.

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