AOPs: Recent Advances to Overcome Barriers in the Treatment of Water, Wastewater and Air

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Advanced oxidation processes (AOPs) and electrochemical advanced oxidation processes (EAOPs) have been actively tested for water, wastewater, soil and air remediation purposes. These processes generate highly reactive species that are able to effectively promote oxidation and reduction reactions, which are able to remove refractory organic and inorganic species from different type of matrices. Despite their great potential as green technologies for environmental remediation, AOPs/EAOPs have not yet reached a mature level for large-scale applications. Research efforts have been performed regarding the development of advanced photocatalytic materials absorbing in the visible region, their preparation in the form of structured catalysts, and stabilization on inert surfaces, avoiding a post-treatment for catalysts particles removal. The iron catalysed reactions, principally the so-called photo-Fenton or photoelectro-Fenton systems, have attracted wide attention due to their high catalytic activity. Several strategies have been adopted to supress the barriers regarding the sludge production, acidic pH adjustments and catalyst consumption through the use of: i) heterogeneous iron reactions using zero-valent iron, iron minerals and iron(hydr)oxides, multimetallic iron-based materials, supported iron-based materials; ii) photoactive iron complexes with high solubility and reactivity at neutral pH using chemical additives such as carboxylates, chelating agents and humic-like macromolecules; and iii) continuous dosing of iron or the use of low iron concentrations for applications where the load contaminants is low. Another advance is related to the combination of AOPs/EAOPs with other technologies, such as biological oxidation, adsorption, membranes, ozonation, which makes possible to achieve the treatment of contaminants at considerably lower costs.

This special issue of *Environmental Science and Pollution Research* contains a selection of 45 papers presented at the 8th Meeting on Environmental Application of Advanced Oxidation Processes (VIII EPOA), chaired by Profª. Camila Amorim, and the 2nd Iberoamerican Congress of Advanced Oxidation Technologies (II CIPOA), chaired by Dr. Vítor Vilar, which were held in Belo Horizonte city, Brazil, from 03 to 06 November 2015.
The history of EPOA is since 2001, created by the Research Group of Prof. Dr. Wilson F. Jardim of Environmental Chemistry Laboratory, Institute of Chemistry, Universidade de Campinas, Brazil. From its first edition, the EPOA has attracted a growing number of professionals linked to the multidisciplinary fields of chemistry, engineering, environmental technology and key issues related to pollution removal. The meetings have been held biannually, taking place in Campinas-SP, São Paulo-SP, Santos-SP, Cubatão-SP, Rio de Janeiro - RJ and Recife-PE. The 7th edition, in Recife-PE in 2013 was held in conjunction with the I CIPOA. The idea to combine EPOA and CIPOA was to assemble senior researchers from Iberoamerican countries, allowing more research to be covered, fostering the conference to an international level, as one important forum on study and application of AOPs.

In VIII EPOA/II CIPOA meeting, 248 abstracts were selected as plenary, oral, short-oral or poster presentations and the number of participants was 231. From those 248 abstracts, 133 abstracts were submitted from Brazil and the remaining from Argentina, Spain, Portugal, Chile, Colombia, Ecuador, Venezuela, Peru, USA, France, Germany, UK, India and Pakistan. These indicators are quite good and a bright future can be expected for the meeting.

The review panel of VIII EPOA/II CIPOA, composed by the scientific committee selected the 59 oral presentations and 98 short-oral communications primarily from early-career researchers. The poster session (189 posters) represented an interesting scientific forum, suitable for less formal discussions while enjoying a Brazilian coffee. Also, twelve plenary speakers shared their innovative research work in different topics of advanced oxidation processes.

From the 248 abstracts received, 100 works were selected and submitted as full research papers to the special issue of Environmental Science and Pollution Research Journal, and after rigorous peer-review 45 of which were accepted for publication. The topics covered included (i) new photocatalytic materials; (ii) environmental remediation of water, wastewater, air and soil, using different AOPs and EAOPs; and (iii)
integration of AOPs/EAOPs with other technologies, such as biological oxidation, adsorption, coagulation/flocculation and membranes. Several papers selected from the scientific presentations of VIII EPOA/II CIPOA outline TiO$_2$ (TiO$_2$/BiPO$_4$, TiO$_2$/Ce, TiO$_2$/Pd) and ZnO based materials in slurry or immobilized on different inert supports for the degradation of different organic pollutants in water and air. The classical heterogeneous and homogeneous Fenton, electro-Fenton, photo-Fenton, photoelectro-Fenton, solar driven photo-Fenton processes, catalysed by ferrous iron, ferric iron, magnetic iron species, ferrioxalate complexes, iron oxides and Fe/C composites, were also evaluated for water and soil remediation. Other types of oxidation processes such as ultrasonic, persulfate, UVC/H$_2$O$_2$ and ozonation were also tested for the remediation of water. Other papers dealt with reaction pathways, kinetic modelling, ecotoxicity and inactivation of microorganisms. This special issue also provides an overview of photocatalytic applications and environmental challenges in Iberoamerican countries.

The guest editors would like to thank all the authors for the innovative scientific contributions to this special issue, the reviewers whose comments and suggestions were extremely important to achieve high-quality papers, as well as the institutions and companies that sponsored VIII EPOA/II CIPOA.

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