Advanced oxidation processes: recent achievements and perspectives

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Advanced oxidation processes (AOPs) and Electrochemical Advanced Oxidation Processes (EAOPs) are extensively applied for the decontamination of water, wastewater, air, and soil matrices. Photo-assisted advanced oxidation processes are considered as the preferred technology for large scale applications. The integration of AOPs/EAOPs with more mature technologies, such as ozonation, membrane filtration, and adsorption, towards process intensification, can drive the AOPs/EAOPs technologies market globally. These technologies also offer the possibility of using renewable energy sources such as solar light for pollutant remediation, thereby making it sustainable and green.

This special issue of *Environmental Science and Pollution Research* contains a selection of 7 papers presented at the 6th European Conference on Environmental Applications of Advanced Oxidation Processes (EAAOP-6), which was chaired by Dr. Albin Pintar and held in Portorož-Portorose, Slovenia, from 26th to 30th June 2019.

The history of EAAOP is very recent, starting in the year of 2006, organized by Prof. Dionissios Mantzavinos and Prof. Ioannis Poulios in the city of Chania (Greece). The second edition was organized in 2009 and chaired by Prof. Despo Fatta Kassinos in the city of Nicosia (Cyprus). The third meeting

was held in Almeria, Spain, in the year of 2013, chaired by Dr. Sixto Malato. Since then, the meetings have been held every two years. The fourth EAAOP was held in Athens, Greece (chaired by Profs. Mantzavinos and Poulios) and the fifth in Prague, Czech Republic (chaired by Prof. Josef Krysa).

The EAAOP-6 meeting brought together more than 300 academics, professionals, and policy makers from 51 countries such as Slovenia, Italy, France, Germany, Poland, Brazil, Greece, Spain, Portugal, Argentina, Mexico, USA, Canada, Japan and Korea. The conference program was rather comprehensive, offering a considerable variety of topics covered, with 4 plenary lectures, 4 keynote talks, 131 oral presentations, and 223 posters. The student paper contest was identified as an integral part of the event. The topics covered included (i) novel catalytic materials for environmental applications, (ii) in situ and *operando* measurements, (iii) advanced oxidation processes (water and air treatment, soil remediation, production of energy, and value added chemicals), (iv) photocatalysis, (v) disinfection, (vi) Fenton-based processes, (vii) ozonation, (viii) electrochemical processes, (ix) wet air and supercritical oxidation, (x) catalytic redox processes, (xi) plasma technologies, (xii) pilot-scale studies and field applications, and (xiii) process coupling/intensification.

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The present collection includes articles dealing with the integration of photochemical, photo-catalytic, ozonation, electrochemical, membrane, and adsorption processes for pollutants removal from soil and water matrices. Although not exhaustive, the selection reflects the excellent perspectives for application of the processes described. Seven papers are included in this special edition entitled as (1) 1,4-dioxane removal from water and membrane fouling elimination using CuO-coated ceramic membrane coupled with ozone, (2) synergy optimization for the removal of dye and pesticides from drinking water using granular activated carbon particles in a 3D electrochemical reactor, (3) UV-C-activated persulfate oxidation of a commercially important fungicide: case study with iprodione in pure water and simulated tertiary treated urban wastewater, (4) improving ozonation to remove carbamazepine through ozone-assisted catalysis using different NiO concentrations, (5) assessment comparative of commercial TiO₂ and TiO₂ sol-gel on degradation of the caffeine using artificial radiation, (6) humic acids extracted from compost as amendments for Fenton treatment of diesel-contaminated soil, and (7) comparison between UVA- and zero-valent-iron-activated persulfate processes for degrading propylparaben.

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Prof. Suresh C. Pillai obtained his PhD in the area of Nanotechnology from Trinity College Dublin and then performed postdoctoral research at California Institute of Technology (Caltech), USA. Upon the completion of this appointment he returned to Trinity College Dublin as a Research Fellow before joining CREST-DIT as a Senior Research Manager in April 2004. Suresh joined IT Sligo as a Senior Lecturer in Nanotechnology in

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Ioannis Poullos is Professor in the Laboratory of Physical Chemistry at the Department of Chemistry at the Aristotle University of Thessaloniki. He received his Diploma in Chemical Engineering from the Technical University of Graz, Austria in 1979 and his Dr. Tech. degree from the same University in 1982. (Ph.D. thesis title: “ZnO Photoeffects under galvanostatic and potentiostatic conditions”). His research interests include photoelectrochemistry of semi-

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Prof. Dionissios Mantzavinos serves as a Professor of wastewater engineering in the Department of Chemical Engineering, University of Patras, Greece. He holds a Diploma (1991) in chemical engineering from Aristotle University of Thessaloniki, Greece, and M.S. (1993) and Ph.D. (1996) degrees in chemical engineering from Imperial College of Science, Technology, and Medicine, UK. After a short spell as a Research Fellow and Lecturer at Edinburgh and Leeds Universities, respectively,

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Associate, and Full Professor in the Department of Environmental Engineering at the Technical University of Crete before his move to University of Patras. His research interests focus on water/wastewater treatment by physical, chemical, and biological processes, as well as on environmental catalysis. Particular emphasis is given to advanced oxidation technologies including heterogeneous and homogeneous photocatalysis, electrochemical oxidation, ultrasound radiation, wet air oxidation, ozonation, and various combinations of the above.

Dr. Albin Pintar, Research Professor, is head of the Laboratory for Environmental Sciences and Engineering at the National Institute of Chemistry, Ljubljana, Slovenia. He obtained his M.Sc. and Ph.D. degrees from the University of Ljubljana in 1992 and 1996, respectively. He was a visiting scientist at the Tokyo Institute of Technology (Japan) and Research Institute of Catalysis and Environment (Villeurbanne, France). His research interests are in the fields of heterogeneous catal-

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