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New Photocatalytic Materials for Environment, Energy and Sustainability

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ABSTRACTS

Lead Organizer:
Dr. Hussain Al-Ekabi
Redox Technologies Inc., Western University Research Park,
London, Ontario, Canada

National Institute of Chemistry, Ljubljana, Slovenia
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Removal of trimethoprim and 5-fluorouracil by uv/persulfate and uv/vuv persulfate methods

Luca Farkas, Adrienn Szirmai, Anett Cović, Tünde Alapi
Department of Inorganic and Analytical Chemistry, University of Szeged, H-6720 Szeged, Dóm square 7, Hungary
fluca@chem.u-szeged.hu, alapi@chem.u-szeged.hu

Antibiotics remain the primary treatment for bacterial infections not only for humans but also for animals. However, the excess of antibiotics into the environment has led to the emergence of antibiotic-resistant bacterial strains and created a global health emergency causing at least 700,000 deaths a year. The conventional wastewater treatment renders limited results in terms of elimination pharmaceuticals; thus, additive water treatment processes are required to prevent their exceed into the environment and decrease the risk. Besides antibiotics, we must also pay attention to removing other drugs that are used in large quantities but are difficult to biodegrade.

This research studied the application of low-pressure mercury vapor lamps (LPM) emitting at 254 UV and 185 nm VUV light for elimination trimethoprim, a widely used and hardly biodegradable antibiotic, and 5-fluorouracil, a cytotoxic chemotherapeutic drug used to treat cancer that occurs primarily in large amounts in hospital wastewater and their mixture. UV (254 nm) and UV/VUV (254/185 nm) photolysis were combined with persulfate to enhance the formation of reactive species and the transformation rate of target substances. Methods (UV photolysis, UV/persulfate, UV/VUV photolysis, and UV/VUV/persulfate) were examined in terms of transformation and mineralization rate, the electrical energy demand, and matrix effect, for which we used biologically treated domestic wastewater as a matrix. Special attention was paid to the effect of HCO_3^- and Cl^-, the main inorganic components of the matrix. The relative contribution of the direct UV photolysis, hydroxyl radicals generated from the water via 185 nm VUV photolysis, and persulfate radicals generated by UV photolysis from persulfate were also investigated.

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