DEVELOPMENT OF VISIBLE LIGHT-ACTIVATED TIO2 PHOTOCATALYSTS FOR THE TREATMENT OF CONTAMINANTS OF EMERGING CONCERN IN WATER

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Abstract

In this presentation, Professor Dionysiou will give an overview of the synthesis of non-metal doped TiO_2 and related high performance nanocomposite photocatalytic materials for the destruction of contaminants of emerging concern in water. Details will be provided on the development of tailor-designed mesoporous NF-codoped TiO_2, S-TiO_2, multi-phase heterojunction N-C-S-anatase-rutile-brookite visible-light active photocatalysts, and combination of these with core-shell magnetic-photocatalytic materials. Development of other photocatalytic systems based on layer-by-layer films of monodisperse TiO_2 nanoparticles, composite ferrite-TiO_2 heterojunctions, and TiO_2-plasmonic composite nanoparticles will be discussed. Details will be presented on the degradation of cyanotoxins, pharmaceuticals, pesticides, herbicides, and industrial chemicals. While most emphasis will be placed on the oxidative pathways, examples on the reductive pathways will also be provided (i.e., reduction of metals such as Cr(VI)). Special phenomena based on destruction of selected antibiotics through visible light-driven photosensitization reactions will be discussed. Transformation kinetic rates and reaction intermediates formed by OH radical attack and other reactive oxygen species on specific sites of the target contaminants will be presented and the detailed reaction pathways will be elucidated. Analysis will be provided on the photocatalytic mechanism in the case of UV and visible light driven processes. The role of water quality parameters such as natural organic matter, alkalinity and pH will be discussed, considering also the chemistry of the target contaminants and the role of the catalyst nano-interface.

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