

Extended Abstract

Synthesis and Characterization of Supported TiO₂ Based Nano Catalysts and Application for the Removal of Water Contaminants [†]

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The occurrence of persistent organic contaminants such as pharmaceuticals, personal care products, pesticides, and organic dyes in water sources have been recognized as a major problem worldwide. Besides, the removal of these contaminants, particularly organic dyes, by conventional wastewater treatment processes such as physical, chemical, and biological methods have not produced satisfactory results. In order to comply with the environmental regulatory framework vis-a-vis improvement of water quality, cost effective, sustainable, and advanced treatment techniques need to be established. Among various advanced oxidation processes (AOPs), heterogeneous photocatalysts such as titanium dioxide (TiO₂) have been identified as a possible treatment method for water pollution remediation due to unique characteristics such as low cost, photochemical stability, and strong oxidizing power [1]. Nevertheless, post-filtration of the suspended TiO₂ particles after water treatment, high band gap energy, and high recombination of electron-hole pairs constitute serious disadvantages that limit their industrial applications [2]. In this study, various TiO₂ based-catalysts were synthesized by sol-gel method and calcined under N₂ at different temperatures, ramping rates, and holding times. The TiO₂ based were doped and co-doped with transition metal Ag (TiO₂, Ag-TiO₂) and non-metals C and N (C-TiO₂, C-N-TiO₂). The resulting catalysts were also immobilized by sol-gel dip coating on various supports including stainless steel (SS) and Ti meshes, Cr and Ti nitride and oxynitride anticorrosion coatings. The catalysts were characterized by numerous analytical techniques such as UV-vis/diffuse reflectance spectroscopy, XRD, HRSEM, HRTEM, EDS, SAED, FTIR, TGA-DSC, BET, and XPS. The photocatalytic activity of the prepared catalysts was evaluated upon the degradation of model dyes (methylene blue & orange II sodium salts) and micropollutants, such as bisphenol A (BPA) and 2-nitrophenol (2-NP), under UV and visible light at the applied conditions. The results showed that high pollutant removal efficiencies were achieved with supported C-N-TiO₂, C-TiO₂, Ag-TiO₂, and TiO₂, respectively. Likewise, excellent catalytic activities were achieved by combination of the prepared catalysts with other AOPs including dielectric barrier discharge (DBD) plasma system and hydro dynamic cavitation Jet loop. These studies clearly demonstrated that AOPs are environmentally safe and robust alternatives that can be

employed for water and wastewater treatment, while the synthesized nano materials could be used for various applications for environmental remediation, and perhaps for clean energy technologies.

References

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