TiO2-based photocatalysts for the degradation of microplastics in aquatic environments

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Abstract

Microplastic particles, which have become a persistent pollutant in the oceans, are a consequence of decades of continued and increased production of plastic waste, coupled with their uncontrolled and inappropriate disposal. After being released into a marine environment, plastics are degraded and broken down into small fragments as a result of their exposure to sunlight, oxygen, heat, and moisture. Even though the implications of microplastic pollution on human health are not clear, studies suggest that if microplastics are small enough to enter tissues or cells they could inflame the tissue leading to cancer, while larger microplastics can carry toxic substances that, when ingested, can interfere with endocrine systems. Hence, it is imperative to find innovative solutions that prevent microplastics of all sizes to enter waterbodies. Photocatalysis has emerged as an environmentally friendly and competent solution to degrade microplastics present in aqueous media. However, it is necessary to couple this process with smart technologies while developing new materials to increase its efficiency. In this work, TiO2-based photocatalysts were obtained following sol-gel and hydrothermal synthesis procedures, and their morphology and photocatalytic properties were characterized. Based on the characterization, the photocatalysts were optimized to be more efficient in the degradation of microplastics. Characterization tests indicate that the photocatalysts exhibited different morphologies, light absorption and photocatalytic activity, while infrared spectroscopy and SEM of the degraded microplastics suggest that the use of optimized photocatalysts has an influence on the microplastics degradation process.

Keywords: microplastics remediation, photocatalysis, TiO2

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