Visible Light TiO2 Photocatalyst Composite Based on Carbon Microfiber Derived from Human Hair

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ABSTRACT

The present work reports titanium dioxide (TiO2) photocatalyst composite based on human hair that can operate efficiently under visible light. The human hair melanin structure contains active sites, which can be described as a carbon compound derived from a Quinone where one of two oxygen atoms is bonded to a hydrogen radical and that can be reversibly photogenerated under visible or ultraviolet irradiation. The human hair-derived microfibers (HHDMs) were created by the pyrolyzing hair at 850°C, resulting in a rod-like hollow structure. TiO2 was immobilized on the pyrolyzed hair by a simple self-template method. The resulting composite was calcined at five different temperatures (150 to 350°C). The HHDM and HHDM-TiO2 morphologies and the chemical compositions were characterized using scanning electron microscopy (SEM), Energy-dispersive X-ray spectroscopy (EDX), X-ray photoelectron spectroscopy (XPS), Fourier-transform infrared spectroscopy (FTIR), and X-ray powder diffraction (XRD). The HHDM-TiO2 photocatalytic efficiency in degrading methylene blue was investigated and compared to that of a conventional TiO2 catalyst (P25). HHDM-TiO2 was more effective for methylene blue degradation under visible light than the conventional P25 catalyst suspension due to the unique photosensitivity and porous structure of the composite. The catalyst calcined at 300°C showed the best performance, which was 71% higher than that of the P25 catalyst.

KEYWORDS: Immobilization; Photocatalysis; Titanium Dioxide; Semiconductors; Waste prevention

ACKNOWLEDGEMENTS

The research team wishes to address and appreciate the financial support from University Malaysia Pahang by the research grant with the number 1603152.