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PHOTODEGRADATION OF HUMIC ACID IN AQUEOUS SOLUTION USING A TIO_2 ∏CARBONACEOUS HYPER∏CROSS∏LINKED POLYSTYRENE POLYMER NANOCOMPOSITE

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The development of alternative methods to degrade natural organic matter or its components to harmless products is an area that has been attracting significant research interest lately. This paper reports the photodegradation of humic acid using a composite photocatalyst made up of TiO_2 nanoparticles and a carbonaceous hyper-cross-linked polystyrene-type precursor derived from post-consumer waste polystyrene. The physicochemical properties of the TiO_2-carbonaceous hyper-cross-linked polystyrene nanocomposites were determined using Fourier transform infrared spectroscopy, UV-visible spectroscopy, scanning electron microscopy and X-ray diffraction spectroscopy. Batch experiments were used to evaluate the capacity of the materials to photodegrade humic acid in synthetic wastewater samples using a solar simulator. Despite showing marginal band-gap narrowing, the introduction of carbonaceous hyper-cross-linked polystyrene into TiO_2 was accompanied by a 100% increase in the degradation rate of humic acid at a contact time of 90 min. Overall, the photodegradation capacity of the composites increased with an increase in the carbonaceous hyper-cross-linked polystyrene content. The use of post-consumer waste polystyrene in preparing high-value materials is novel and a cost-effective way of water treatment that simultaneously makes a contribution towards alleviating the environmental burden of waste polystyrene.

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