

Bio-TiO₂ Nanoparticle-Impregnated Bacterial Cellulose for Water Treatment

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This study examined a new kind of water treatment material derived from bio-TiO₂ nanoparticle-impregnated bacterial cellulose (TiO₂-BC) synthesized by an environmentally friendly method. The TiO₂-BC can be used to effectively eliminate organic compounds from wastewater through photocatalytic reaction. Firstly, green synthesis of the bio-TiO₂ nanoparticles using *Jatropha curcas* leaf extract yielded 20-50 nm TiO₂ in anatase phase. Secondly, to improve the specific surface area and provide reusability of the TiO₂ nanoparticles, the TiO₂ NPs were impregnated into bacterial cellulose. Bacterial cellulose production using *Gluconacetobacter xylinus* is cost-effective and can be produced using culturing medium containing waste coconut water, which is an agricultural waste generally found in Thailand. Impregnation of TiO₂ in bacterial cellulose was performed by sonication of a suspension containing TiO₂ and bacterial cellulose followed by freeze-drying. Photocatalytic properties of TiO₂-BC for treatment of organic compounds in water were observed from the decomposition rate of methylene blue (MB) with UV-visible spectrophotometry. The results showed that the rate of MB decomposition corresponded well to the concentration of TiO₂ suspensions up to 0.01 M. The repeatability test showed that MB decomposition rate by the TiO₂-BC did not decrease when the material was reused twice. For application with real contaminated water, high COD removal was obtained by using TiO₂-BC under sunlight. These results suggest the development of the environmentally friendly material that can be used for water treatment with higher efficiency in the future.

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