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Efficient visible light-induced photocatalytic degradation of Rhodamine B over chlorophyll and Mg co-modified P25 nanoparticles

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The new composite materials of TiO2 nanoparticles and biomolecules are promising to provide the potential alternative for improving the photocatalytic activity by merging the ability and features of both material types. In this research, the unique visible light-responsive chlorophyll and magnesium (Mg) co-modified P25 catalyst (Chl-Mg/P25) was successfully synthesized by using a simple incipient wetness impregnation method. Chlorophyll and Mg were loaded on P25 nanoparticles with an attempt to enhance photocatalytic efficiency and inhibit the recombination of photo-induced electron-hole pair. The existences of chlorophyll and Mg on P25 were verified by Fourier transform infrared spectroscopy (FT-IR) and X-ray photoelectron spectroscopy (XPS). The synthesized catalysts were tested for photocatalytic degradation under visible light by using Rhodamine B (RhB) as a probe molecule and the effect of chlorophyll and magnesium on photocatalytic degradation were investigated. It was found that the activities of catalysts were in the order of: P25 < Mg/P25 < Chl/P25 < Chl-Mg/P25. The addition of chlorophyll, Mg, and chlorophyll-Mg in the catalyst could promote the photocatalytic efficiency for approximately 1.9, 1.1, and 2.3 times of P25, respectively. These outstanding photocatalytic activities could be attributed to the enhancement in visible light harvesting from chlorophyll, the higher charge separation efficiency from Mg, and the synergistic effect between chlorophyll-Mg and P25 nanoparticles. Moreover, Chl-Mg/P25 catalyst also showed a good recyclability and high stability after seven repeated experiments.

Author: Ms PHONGAMWONG, Thanaree (KU-Green Catalysts Group, Department of Chemical Engineering, Faculty of Engineering, Kasetsart University)

Presenter: Ms PHONGAMWONG, Thanaree (KU-Green Catalysts Group, Department of Chemical Engineering, Faculty of Engineering, Kasetsart University)

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