Solar photocatalysis of MeO wastewater with metal@TiO_2 film

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One of advanced oxidation processes (AOPs) - solar photocatalysis with novel Ag@TiO_2 film as catalyst for the treatment of an azo dye (methyl orange (MeO)) wastewater was investigated in this study. Ag@TiO_2 films were prepared successfully by a Dip-coating method and following by a photoreduction method on glass plate. The results of SEM/EDS analysis illustrated that Ag nanoparticles were partially and indeed deposited on the surface of TiO_2 film. The UV-VIS/DRS spectra showed that Ag@TiO_2 film could extend the absorption of TiO_2 film in visible light band, which reduced the defect that TiO_2 film could only absorb ultraviolet light band (λ <387 nm) and made it more efficient to use solar energy. The diagram of XRD analysis showed that Ag@TiO_2 film would not change the basic crystal structure of TiO_2 and the characteristic peak of Ag (2θ : 44.27^0) was observed. Under solar light irradiation (UV_{a+b}: 54.2 W/m^2), the abs@λ_{max} reduction efficiency and MeO molecular degradation efficiency of MeO wastewater (10 mg/L) were more than 90%. Moreover, the results showed that the optimal addition ratio of Ag was 0.5%(w/w) on TiO_2 film and an increase of 1.39 times of the abs@λ 464 nm reduction rate and 1.36 times of MeO degradation rate were achieved for using Ag(0.5%)@TiO_2 film as compared to use TiO_2 film, respectively. Increasing the light irradiation was found to be beneficial to enhance the formation rate of hydroxyl radicals and then promoted the oxidation reaction rate. Increasing the temperature of wastewater from 15 ^{0}C to 25^{0}C could improve the degradation efficiency of MeO which was probably resulted from increasing the frequency of collision between hydroxyl radicals and MeO molecules. However, the enrich effect of wastewater temperature was limited as compared to that of light intensity. In addition, a little lower MeO degradation rate was observed with the reuse of Ag@TiO_2 film. Accordingly, the feasibility of solar photocatalsis using Ag@TiO_2 film for the treatment of dye wastewater was obvious.

Keywords: Solar Photocatalysis, MeO, Ag@TiO2 film

