Topic: Ag and MCM-41 Doped TiO_2 Thin Film and Its Applications to Indoor Air Treatment

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ABSTRACT

Silver doped TiO_2 was incorporated into as-synthesized MCM-41 via a microwave assisted sol-gel technique and coated on a glass substrate. The characterization results displayed high adsorbability and photocatalytic reactivity of the Ag/TiO_2/MCM-41 nanocomposite film. Results from UV-visible spectroscopy revealed a significant increase in both UV and visible light absorption when Ag and MCM-41 were incorporated in TiO_2 film. The water contact angle measurements showed that the surface of the nanocomposite film exhibited a superhydrophilicity which is a desirable property for self-cleaning application. The performance of the photocatalyst films was tested by photocatalytic decolorization of MB dye, under UV and visible light irradiation. The kinetic rate constants were arranged in the order of Ag/Ti/Si (0.1/1/2) > Ag/Ti/Si (0.1/1/1) > Ag/Ti/Si (0.1/1/0.5) > Ag/Ti/Si (0.1/1/0) > TiO_2. The application of the Ag/TiO_2/MCM-41 nanocomposite film for gaseous benzene treatment was carried out in the simulated indoor air system. The kinetic reaction of all photocatalyst films fit well with pseudo first-order model. The photodegradation efficiencies of gaseous benzene under visible light irradiation were arranged in the order of Ag/Ti/Si (0.1/1/2) (55%) > Ag/Ti/Si (0.1/1/0) (28%) > TiO_2 (15%). Under UV and visible light irradiation, the kinetic rate constants on photodegradation of gaseous benzene by Ag/Ti/Si (0.1/1/2) films were 0.263 h^{-1} and 0.135 h^{-1}, respectively. The antimicrobial activity of the Ag/Ti/Si (0.1/1/2) film against gram-negative *E. coli* was evaluated under visible light irradiation. The percentage reduction of viable *E. coli* (%R) on Ag/Ti/Si (0.1/1/2) film was approximately up to 98% within 2 h.

Keywords: Ag/TiO_2/MCM-41; microwave, nanocomposite film; benzene; antimicrobial, indoor air