Photocatalytic degradation of methylene blue by the Andersontype polyoxomolybdates/TiO2 thin films

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Abstract

In the herein work, two Anderson-type polyoxomolybdates (containing Cu and Zn, respectively) were synthesized and deposited on TiO2 thin films. The properties of the films were studied through measurements of inductively coupled plasma optical emission spectrometry (ICP), Fourier transform infrared spectroscopy (FT-IR) and absorption diffuse reflectance. The photodegradation of methylene blue (MB) was studied under UV-irradiated on TiO2 and polyoxomolybdates/TiO2 thin films in aqueous solution. Langmuir–Hinshelwood model was used to obtain kinetic information of the photocatalytic process. Results showed that the polyoxomolybdates/TiO2 photocatalytic activity is improved with respect to the TiO2 pure. The highlighted result was reached when copper polyoxomolybdates/TiO2 film was employed and the efficiency in the MB photodegradation improved from 18.8% to 40%. Furthermore, DFT and TD-DFT quantum mechanics calculations were used to characterize the geometry and electronic structure of the compounds and to give a rational explanation to the measured photocatalytic activity.

Keywords

Heterogeneous photocatalysis||Polyoxometalate||TiO2||Thin films||DFT