Photocatalytic inactivation of pathogenic bacteria using polyoxometalates

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Polyoxometalates (POMs) as a homogeneous photocatalyst and semiconductor oxide TiO_2 as a heterogeneous photocatalyst share many aspects of similarity in their operating mechanisms. In this study, we compared photocatalytic inactivation of pathogenic *E. coli* using POM and TiO_2 in aqueous solution. Almost all the initial *E. coli* (5×10^7 cell/ml) were inactivted with 40 min in the presence of both POM and TiO_2, but the POM-mediated inactivation was faster than that with TiO_2 under the experimental conditions employed in this study. Photocatalytic inactivation of *E. coli* was more efficient by free $H_4O_{40}SiW_{12}$ or $Mo_{12}O_{40}P$ than by TiO_2. Kinetic studies using tert-butyl alcohol or methanol as an OH radical scavenger suggested that OH radicals are dominant photooxidant in photocatalyst inactivation. In particular, the biocidal action of the photocatalyst has been accepted that reactive oxygen species (ROS) and OH radicals play the role.