Abstract

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Project Title : Mineralization of organic compounds over 1D nanostructure Ti-O photocatalyst

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Abstract:

The aim of the present work is to enhance the photocatalytic antibacterial performance of plastics according to JIS Z 2801:2010 standard and their mechanical properties by studying: (i) the influence of calcination for TiO_2; (ii) modified with different TiO_2 concentrations; (iii) effect of silane as a coupling agent. Acrylonitrile-Butadiene-Styrene plastics (ABS) and *Escherichia coli* (*E. coli*) were chosen as a model of plastic and bacteria, respectively. The 500°C calcined TiO_2 had successfully provided the best photoantibacterial activity with an approximately 62% decrease of *E. coli* colonies upon 30 minutes of exposure. Heat treatment could improve the crystallinity of anatase TiO_2, resulting in low electron-hole recombination while effectively adsorbing reactants on a surface. However, the aggregation of TiO_2 particles could occur at a high temperature (800°C) leading to the recombination and subsequently, decreasing the efficiency. ABS with 500°C calcined TiO_2 at the concentration of 1%wt had given rise to the highest performance due to their proper distribution. At this point, blending silane as a coupling agent with TiO_2 could improve efficacy of photoantibacterial activity of material up to 75% (remaining bacteria survivor 25%) due to greater interactions with polymer matrix. Moreover, mixing TiO_2 in ABS was found to influence yield strength enhancement of workpiece simultaneously due to its benefits in creating temporary crosslinks between the polymer chains during the deformation process. Treating with silane could promote a 1.5 times increase of yield strength via more adherent bonding between TiO_2 and ABS matrix. Excellent photocatalytic and material stability can be achieved as constant photocatalytic efficiency up to 5^{th} reuse cycle without loss in the yield strength.

Keywords: Titania photocatalyst, Photocatalytic degradation, Disinfection, APTES treatment, Photocatalytic inactivation**,** Photokilling