

Antibacterial Effects of Photocatalytic Nanoparticulate TiO₂ Thin Films

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Over the past few decades nanotechnology has developed rapidly. Compared with bulk materials, novel nanomaterials size-dependant physico-chemical properties (e.g., higher specific surface area, quantum effects). Currently, titanium dioxide nanoparticles (nano-TiO₂) have found use in wide range of applications from pigments to self-cleaning surfaces, solar cells and sunscreens. Many of these applications exploit the ability of nano-TiO₂ to absorb short-wavelength light resulting in generation of reactive hydroxyl radicals that can oxidize organic compounds. The aim of the current work was to observe the antibacterial effects of nano-TiO₂ thin films under UV light. The photocatalytic activity of nano-TiO₂ films against recombinant constitutively bioluminescent bacterium *Escherichia coli* MC1061 (pSLlux) was studied by adding a small drop of bacterial suspension onto the film and exposing the samples to UV light for 20 minutes. Silicon wafers under UV light and respective treatments in dark were used as controls. After incubation on the surfaces the colony forming ability of the bacteria was estimated by plate count method. The results of this study showed that UV light alone had only mild antibacterial effect in 20 minutes but in combination with nano-TiO₂ thin films the bacteria completely lost their ability to form colonies. For control, incubation of bacteria in the dark had only slight effect on bacterial colony forming potential. The antibacterial effect of nano-TiO₂ thin films was likely caused by decomposition of membrane components. Hence, it can be concluded that photocatalytic activation of nano-TiO₂ thin films results in a significant antibacterial effect; thus, the tested nano-TiO₂ thin films have a strong potential as coatings for self-cleaning surfaces.