Nonhydrolytic Sol-Gel Synthesis and Antibacterial Properties of Nanosized TiO_2

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The titanium dioxide (TiO_2) is one of the most studied metal oxides during the last 20 years due to its technological and environmental importance. Although a wide variety of approaches for its synthesis have been reported it still remains a particularly active research field. The nonhydrolytic sol-gel methods have been developed for the synthesis of TiO_2 with controlled particles size [1]. Among the various applications of this oxide, its antibacterial properties are one of the most investigated topics [2]. It is known that the photocatalytic activity of TiO_2 strongly depends on the particles size and the type of the precursors. For this reason, many researchers have extensively investigated the relation between the synthesis conditions and the properties of nanosized TiO_2 powder [3]. This motivates our study to synthesize TiO_2 by a nonhydrolytic sol-gel route and to examine its antibacterial properties. In the present work the reaction between $TiCl_4$ and benzyl alcohol was performed at 80^{o}C under continuous stirring for 8 hours, followed by calcinations at 500^{o}C. The structure and morphology of the resulting particles were characterized by XRD, IR and SEM. The average particles size of synthesized TiO_2 (anatase) was 10-20 nm.

The antimicrobial action of the as-prepared TiO_2 was investigated using *Escherichia coli* as test microorganism. The bacteria growth was examined by the effect of UV light alone, in the presence of TiO_2 at dark conditions and in the presence of both – TiO_2 and UV radiation. The experiments were done in suspension containing initial cell concentration of 185000 colony forming units (CFU)ml^{-1} and TiO_2 concentration of 1 gL^{-1}. It was found that the photocatalytic activities of TiO_2 and UV light alone were roughly the same – approximately 50% of bacteria were killed for 3 hours, while the combination of TiO_2 and UV radiation led to the complete killing of bacteria in 30 min. It was concluded that the as-obtained nanosized TiO_2 (anatase) could be successfully used for disinfection of water.

References

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