Exploration of the antibacterial capacity and ethanol sensing ability of Cu-TiO2 nanoparticles

ABSTRACT

Titanium oxide (TiO2) is one of the most scrutinized material because of its in-built fundamental properties and has been developed as an outstanding photo-catalytic material intended for many different industrial applications. In order to further explore the properties of TiO2, we prepared Copper-loaded TiO2 (Cu-TiO2) nanoparticles (NPs) for inhibiting the growth of bacterial cells and also to serve as a chemical sensor. The physico-chemical characteristics of the synthesized Cu-TiO2 NPs were characterized by many different techniques for the crystallinity, bonding and functionality, morphology, elemental composition, and absorption characteristics. From the results, we confirm for the formation of anatase phase of TiO2 having a tetragonal crystal system, while the morphology studies indicated that the Cu dope TiO2 has spherical morphology. The elemental analysis confirmed for the inclusion of Cu into TiO2 crystal lattice and the absorption spectroscopic analysis helped for the bandgap calculation and visible light absorption property of Cu-TiO2 NPs. The metal nanoclusters of Cu are observed to be deposited on different phases and sites of TiO2 resulting in the inter-band transitions. Further, the sensitivity of Cu-TiO2 as a chemical sensor is determined by fabricating the electrode at the FTO glass substrate where the ethanol sensitivity was found to be little increased/enhanced with Cu loading. Finally, the antibacterial activity of Cu-TiO2 NPs was confirmed by its activity against various bacterial cultures and are found to be efficient.

Keyword: Cu-doped TiO2; Antibacterial activity; Ethanol detection; Chemical sensors; Phase transition; Escherichia coli; Staphylococcus aureus