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Structural, Optical, Antibacterial and Antifungal Properties of Zirconia Nanoparticles by Biobased Protocol

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Biological entities and inorganic materials have been in constant touch with each other ever since inception of life on earth. This method has lots of merits such as not requiring complex procedures, template supporting etc. In this work, *Aloe vera* plant mediated synthesis of tetragonal zirconia nanoparticles has been performed and thermogravimetric and differential thermal analysis (TG/DTA), X-ray diffraction (XRD), scanning electron microscopy (SEM) with energy dispersive X-ray spectroscopy (EDX), atomic force microscopy (AFM), ultraviolet–visible (UV-VIS) technique and Fourier transform infrared spectroscopy (FTIR) have been provided for characterizing the nanoparticles. Formation of homogeneously distributed spherical zirconia nanoparticles of 50–100 nm in size is predicted. The antimicrobial and antifungal properties are also investigated for synthesis of zirconia nanoparticles and the treated cotton by agar diffusion method against *S. aureus* and *E. coli* bacterial pathogens and fungal strains *C. albicans and A. niger*, respectively.

KEY WORDS: Zirconia nanoparticles; Biosynthesis; *Aloe vera*; Cotton; Antibacterial property

1. Introduction

Fabrication of nanomaterials of various shape, size and controlled dispersity have been the subject of supreme interest due to their prospective properties such as high surface area and high fraction of surface atoms[1–3]. With the development of new chemical or physical methods, the concerns for environmental contamination are also heightened and resulted in generation of large amount of hazardous byproducts. Thus there is a need for the development of green, cost effective and environmentally benign methods and materials for the synthesis of nanoparticles that do not use toxic chemicals in their synthesis protocols[4]. Though numerous chemical methods are available for the nanoparticle synthesis such as sol-process, sol-gel, chemical precipitation, pyrolysis, chemical vapor deposition[5–7] but copious reactants and starting materials, external agents and chemical reduction of metal salt involved in these process are toxic and potentially hazardous[8]. To defeat these problems, a viable alternative and advanced approach have been raised over chemical methods, of which the biological synthesis has more environmental concerns such as eco-friendliness and compatibility for various applications in biomedical and pharmaceutical field. Many biotechnological syntheses using microorganisms,