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Synthesis and Characterization of Nano-TiO_2 using Aqueous Extract of *Erythrina variegata* Leaves

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In present work, the *Erythrina variegata* leaves extract acts as a reducing agent for the green synthesis of titanium dioxide (TiO_2) nanoparticles. The characterization of the extracted TiO_2 nanoparticles were confirmed by ultraviolet spectral studies (UV-Vis), Fourier transform infrared (FT-IR) spectroscopy, X-ray diffraction (XRD), energy dispersive X-ray spectroscopy (EDAX) and scanning electron microscopy (SEM). The UV-Vis absorption spectrum exhibited maximum absorbance peak at 317.6 nm, which supports the formation of TiO_2 nanoparticles. The optical band gap energy value has been determined as 2.35 eV. Further characterization by XRD supports the crystallinity and the incidence of peak at 25.28 ºC corresponds to 101 anatase form. The anatase phase TiO_2 sample having tetragonal structure with mean crystalline size was found to be 7.91 nm. Scanning electron microscope image supports the shape of the nanoparticles. These nanoparticles are having effective dye degradation ability with various time intervals. The green synthesized TiO_2 nanoparticles exhibits interesting photocatalytic efficacy on methylene blue dye under UV irradiation (using multi-lamp photo reactor) and antibacterial activity against pathogenic organisms like Streptococci, *Staphylococci*, *E. coli* and *Pseudomonas aeruginosa*.

Keywords: *Erythrina variegata*, Titanium dioxide nanoparticles, Photocatalytic efficacy, Antibacterial activity.

INTRODUCTION

The research in nanotechnology pledges quantum leaps not only in materials manufacturing and nanoelectronics but also possesses a number of application in health care, medicine, energy, biotechnology and safety. It provides a broad range of novel uses and improved technologies for numerous applications [1]. It is an emerging field of applied science focused on design, size, synthesis, characterization and application of material and device on nanoscale. Now a days nanotechnology is increasing the interest of researchers towards the synthesis of nanoparticles and its rising application towards the medicinal field [2,3]. The green synthesis is one of the bottom to top up techniques. The green mediated plant, algae, fungi and bacteria provides ecofriendly, green safe, reliable and economical route to synthesize nanoparticles [4-6].

Under green nanotechnology, sustainable and novel methodologies are developed for the fabrication of metal oxide nanoparticles. In the bottom-up approach of green nanoparticle synthesis, the main reaction is reduction/oxidation. To prepare metal oxide and metal nanoparticles, plant phytochemicals having reducing properties are used [7]. Green synthesis is considered crucial to minimize destructive effects observed in traditional nanoparticle synthesis methods commonly employed industries and laboratories. Biological components and essential phytochemicals (alkaloids, flavonoids, terpeniods, aldehydes, and amides) act as solvent systems and reducing agents. Such components can reduce metal salts into metal nanoparticles. The applications of the metal oxide nanoparticles in environmental remediation for catalytic activity, antimicrobial activity, heavy metal ion sensing and pollutant dye removal are also confirmed. Biological precursor-based green synthetic methodologies rely on different reaction parameters including solvent, temperature, pH condition and pressure [8]. It has also several advantages such as easy and simple sampling and cost effective, which facilitates the large scale synthesis of nanoparticles [9].

Green synthesis of TiO_2 nanoparticles by various plants such as *Acalypha indica*, *Citrus reticulata* peel extract, *Phyllanthus*