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ABSTRACTS

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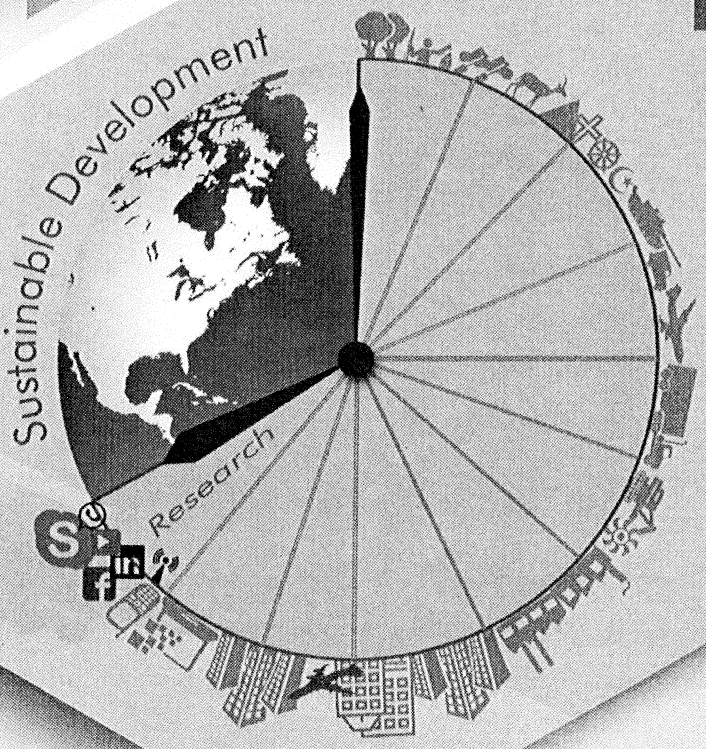

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Green Synthesis of TiO_2 Nanoparticles: A Cost Effective Approach

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Titanium dioxide (TiO_2) nanoparticles (NPs) are very useful for many purposes due to their unique physical and chemical properties. Biological synthesis of TiO_2 NPs is poorly understood compared to chemical and physical synthesis methods. The present investigation was undertaken to synthesize TiO_2 NPs using Baker's Yeast by a low-cost and sustainable process. For yeast mediated TiO_2 NP synthesis, yeast was cultured in sterile filtered 5% (w/v) glucose solution and incubated for 24 h. After that, $TiCl_3$ was added slowly until a clear purple solution observed. Then the solution was allowed to stand at room temperature under dark conditions for three days. The solution was centrifuged and the precipitate was washed several times with sterile distilled water, dried at room temperature and oven-dried at heating periods of 250, 350, 450, 550, 650 and 750 °C for 2 h. Characterization of synthesized TiO_2 NPs was performed using X-ray diffraction (XRD), Transmission Electron Microscopy (TEM) and Scanning Electron Microscopy (SEM). Spherical TiO_2 NPs were observed with a large amount of thin TiO_2 lamellas. Lamellas were consisted of a large number of small TiO_2 NPs. XRD pattern of the NPs obtained by using yeast template was assigned to be pure anatase TiO_2 according to characteristic peak positions at 25.303 (1,0,1), 37.78 (1,0,3), 48.03 (2,0,0), 54.45 (1,0,5), 62.80 (2,1,3), 70.34 (2,2,0), 74.91(1,0,7) and 82.81 (3,0,3) degrees. The most predominant orientation was the (1,0,1) plane as the highest intensity was observed at 25.303. The particle size distribution was 3.6 – 12.0 nm with a mean particle size of 6.7 ± 2.2 nm as shown in TEM imaging. In this study, TiO_2 NPs were synthesized with $TiCl_3$ as the precursor salt, in an eco-friendly manner. The increased temperature induced crystallinity. Anatase phase TiO_2 NPs get converted into rutile phase within 600-700 °C range. The biosynthesized anatase TiO_2 NPs were thermally stable. Yeast cells were used as a biotemplate that can facilitate Ti^{3+} adsorption followed by nucleation. The NPs were smaller with a narrow size distribution. The results suggest that Yeast mediated TiO_2 NP synthesis is a renewable and eco-friendly alternative to chemical synthesis.

Keywords: TiO_2, anatase, TEM, SEM, lamella

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