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# Banyan latex: a facile fuel for the multifunctional properties of MgO nanoparticles prepared via auto ignited combustion route

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## Abstract

MgO nanoparticles (MNPs) were prepared by a solution combustion route using banyan tree (BT) latex and glycine as fuels. The powder x-ray diffraction results indicate the formation of a single cubic phase and the crystallite size obtained from transmission electron microscopy was found to be ~10–15 nm. Scanning electron microscopy result reveals spherical-shaped particles obtained with BT latex. However, in a chemical route, porous and agglomerated particles were obtained. The energy band gap of MNPs obtained using BT latex and a chemical route were found to be in the range 4.85–5.0 eV. Photoluminescence peaks observed at 473, 514, and 588 nm when excited at 433 nm, which were attributed to surface defects. The enhanced photocatalytic activities of spherical MgO were due to smaller crystallite size, higher surface defects, dye sensitization, and capability to reduce the electron–hole pair recombination. Further, green-synthesized MNPs exhibit superior antifungal activity against various plant pathogens. The present studies demonstrated a green engineering route for the synthesis of multifunctional MNPs using BT latex.

## 1. Introduction

Metal oxide nanostructures have attracted special attention in recent years due to their unique properties and potential applications in solar cells, catalysis, electro-optical devices, sensors, antimicrobial agents, and luminescent materials [1–3]. Magnesium oxide (MgO) has a rock salt structure (fcc) (space group-fm-3m-225) with magnesium ions occupying octahedral sites within the anion closed packed structure. Its ionic constituents comprise a relatively small number of electrons and its nanostructures were expected to have novel properties superior to their bulk counterparts. The Mg atoms were present at the corner of the cube and coordinated by eight equivalent nearest-neighbor oxygen atoms. In this lattice, the point group symmetry of Mg sites in the cubic MgO structure was ideally $D_{2d}$ and the Mg site possessed inversion symmetry. Further, MgO, a typical wide band gap insulator, attracts researchers due to its excellent physical and chemical properties, such as high specific surface area, large pore volume, narrow pore-size distribution, wide band gap semiconductor, and thermal and chemical stability [4, 5]. MgO finds a wide range of applications in catalysis, toxic waste remediation, and additives in refractory, paint, antibacterial, antifungal, and dye decolorization [6, 7]. Recently, much interest has been focused on non-rare-earth hosts in an attempt to reduce the high cost of rare-earth [8]