

## ARTICLE

# Photocatalytic efficiency of sol-gel synthesized Mn-doped TiO<sub>2</sub> nanoparticles for degradation of brilliant green dye and mixture of dyes

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## Abstract

The Mn-doped TiO<sub>2</sub> nanoparticle photocatalysts have been prepared by a simple sol-gel method. 1, 3, and 5 mol% Mn-doped TiO<sub>2</sub> nanoparticles have been prepared by using a stoichiometric amount of manganese acetate and titanium isopropoxide as precursors of Mn and Ti respectively. The physico-chemical characterization of the prepared samples has been studied by x-ray diffraction (XRD), Brunauer-Emmett-Teller surface area analysis, field emission scanning electron microscope, energy dispersive x-ray analysis, high-resolution transmission electron microscopy, x-ray photoelectron spectroscopy, Ultraviolet-visible spectroscopy, photoluminescence spectroscopy, Fourier transform infrared spectroscopy (FTIR) and thermogravimetric analysis (TGA). XRD study reveals the formation of pure anatase phase of TiO<sub>2</sub> and decrease in crystalline size of TiO<sub>2</sub> on increasing the Mn doping content. TGA reveals minimum weight loss in the high-temperature region of 500–1,000°C, showing the thermal stability of the catalyst. FTIR study shows highly bonding in metal atoms. These samples have been tested for photocatalytic degradation of brilliant green dye. 5 mol% Mn-doped TiO<sub>2</sub> is having nearly four times more photocatalytic activity than pure TiO<sub>2</sub>. In addition, Mn-doped TiO<sub>2</sub> has shown excellent photodegradation of a mixture of three dyes namely, rhodamine B, brilliant green, and methylene blue.

## KEYWORDS

kinetic study, Mn-doped TiO<sub>2</sub>, nanoparticles, photocatalytic activity, sol-gel method

## 1 | INTRODUCTION

Various industries such as the manufacture of textile, paint, leather, pesticides, fertilizers, pharmaceuticals, and so on are primarily responsible for water pollution. By means of these industries, various organic pollutants have been dumped into the water bodies. The aquatic life and human life may be largely affected by these organic

pollutants, which are exceptionally difficult to be degraded or eliminated by nature.<sup>[1–3]</sup> Numerous predictable methods such as biological methods, chemical precipitation, and membrane filtration are suggested for wastewater treatment, but these methods may not be greatly possible. However, chemical precipitation causes several disadvantages, large chemical feeding such as lime, oxidants, or H<sub>2</sub>S and physicochemical monitors