

Sol-gel method synthesized Ce-doped TiO₂ visible light photocatalyst for degradation of organic pollutants

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The Ce-doped TiO₂ nanoparticles were prepared by the sol-gel method. The prepared nanoparticles were characterized by sophisticated analytical techniques such as XRD, FESEM with EDX, HR-TEM, XPS, FTIR, TGA, and UV-visible spectroscopy, which gives structural features, morphology, elemental composition, and thermal stability of prepared nanoparticles. Based on the analysis, we conclude that increasing the dopant content of cerium in TiO₂ results in a decrease in particle size, increase in thermal stability, and decrease in band gap. Further, on increasing the dopant content of cerium, there is an increase in photocatalytic activity due to changes in structural features due to doping, and 5 mol% Ce-doped TiO₂ has shown nearly four times higher photocatalytic activity than pure TiO₂ for degradation of tetracycline. In this study, the photocatalytic activity and kinetics of photocatalytic degradation of antibacterial agent tetracycline have been studied by using these prepared catalysts. Further, effects of different parameters such as change in pH and change in concentration of tetracycline and amount of catalyst loading have been studied for the degradation of tetracycline. Also, Ce-doped TiO₂ has shown good photocatalytic efficiency for degradation of a mixture of textile dyes (methylene blue, rhodamine B, and brilliant green) and for degradation of a mixture of emerging contaminants (tetracycline, diclofenac, and triclosan).

KEYWORDS

Ce-doped TiO₂, nanoparticles, photocatalytic activity, sol-gel method, tetracycline

1 | INTRODUCTION

In last few decades, industrial evolution facilitated the humankind in different fields, but it also resulted in water as well as air pollution. Accretion of waste by-products from industries is mostly responsible for the water pollution, as mostly focus of the industries on the commercial product produced and harmful by-products are ignored. These by-products are mostly leaves to the

water sources.^[1,2] The main sources of water pollution includes industrially used dyes, pharmaceutical products, pesticides, fertilizers, and emerging contaminants, which are responsible for several health problems to humans and also disturbing the aquatic life. Several research groups all over the globe are working to treat the effluent from industries and on the degradation of organic pollutants in water. Several different techniques have been used for the treatment of different organic pollutants in