

## Photocatalytic degradation of organic dyes using nickel oxide incorporated titania nanocatalyst

Lalitha Gnanasekaran<sup>a</sup>, R. Hemamalini<sup>a,\*</sup>, Saravanan Rajendran<sup>b,\*</sup>, Mu. Naushad<sup>c</sup>, Jiaqian Qin<sup>d</sup>, F. Gracia<sup>e</sup>, Lorena Cornejo<sup>b</sup>

<sup>a</sup>Department of Physics, Queen's College, Chennai-600 004, India, emails: hemaphy.qmc@gmail.com (R. Hemamalini), lalitha1887@gmail.com (L. Gnanasekaran)

<sup>b</sup>Faculty of Engineering, Department of Mechanical Engineering, University of Tarapacá, Avda. General Velasquez, 1775, Arica, Chile, emails: saravanan3.raj@gmail.com (S. Rajendran), lcornejoponce3@gmail.com (L. Cornejo)

<sup>c</sup>Department of Chemistry, College of Science, Building#5, King Saud University, Riyadh, Saudi Arabia, email: mnaushad@ksu.edu.sa

<sup>d</sup>Metallurgy and Materials Science Research Institute, Chulalongkorn University, Bangkok 10330, Thailand, email: jiaqianqin@gmail.com

<sup>e</sup>Department of Chemical Engineering, Biotechnology and Materials, University of Chile, Beauchef 851, 6th floor, Santiago, Chile, email: fgracia@ing.uchile.cl

Received 31 December 2018; Accepted 11 November 2019

---

### ABSTRACT

In this present work, two-step methods were executed to prepare TiO<sub>2</sub>/NiO nanocomposite material. The selected area electron diffraction and X-ray diffraction pattern were interpreted and their fallouts demonstrate the occurrence of the tetragonal structure of TiO<sub>2</sub> beside the cubic structure of NiO. The NiO nanoparticles were randomly distributed on the surface of TiO<sub>2</sub>, which was seen by transmission electron microscopy (TEM) and elemental mapping analyses. The high-resolution scanning electron microscope (HR-SEM) images of the prepared materials represent the spherical-shaped nanoparticles. The prepared TiO<sub>2</sub>/NiO material shows high purity because it contains Ni, Ti and O elements without impurities which were represented by energy-dispersive X-ray spectroscopy. The estimated band gap of the prepared TiO<sub>2</sub>@NiO nanocomposite is in the UV region. Under UV light condition, the nanocomposite effectively exploits the colorful dyes like methylene blue and methyl orange. In addition, their photocatalytic mechanism has been explained in detail.

*Keywords:* Photocatalyst; Degradation; UV light; Methyl orange; Nanocomposites

---

\* Corresponding authors.