

Facile synthesis of nanocomposites and their environmental applications

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Abstract

Multiple approaches have been carried out to synthesize the nanocomposites containing binary, ternary and quaternary rare earth-transition metal oxides for the purpose to achieve enhanced activities for the degradations of textiles pollutants, pesticides, organic pollutants, explosive materials etc.

We have successfully synthesized more than 50 nanocomposites with variety of metals. Various factors e.g. change in precursors, pH, temperature, feed rate, surfactants, solvents, methods of preparation, concentration of precursors, were studied which change the efficiency of the nanocomposites. Our focus is to synthesize nanocomposites having band gap in the visible region so that they may be used for enhanced catalytic activity under sun light.

The structural investigation, thermal degradation, crystallite size, morphology, surface and photocatalytic properties of synthesized samples were studied by using different characterization techniques i.e. Thermogravimetric analysis (TGA), Fourier transform infrared spectroscopy (FTIR), Particle Size Analyzer (PSA), Powder X-ray diffraction (XRD), Scanning electron microscopy (SEM), Transmission electron microscopy (TEM), and Ultraviolet-Visible spectrophotometer (UV-VIS). The performance of nanocomposites as photocatalytic agents was also investigated under the illumination of sun light and degraded products were evaluated by GC-MS.

Applications of nano-materials in formulation of nanofiltration [1] nano-medicines [2,3], solar cells, hydrogenation reactions, forensics [4], slow release fertilizers [5], photodegradation, and nanocatalysts for synthesis of organic reactions were also studied.

Keywords: nanocomposites, environmental applications, , pesticides, organic pollutants,

References

- [1]. Muhammad Akhyar Farrukh, Development of nanofiltration system with La/SnO₂-TiO₂ nanoparticles, US patent filing application No. 15/131,814, Patent. No. US 10,258,977 B2, Pub. Date of patent issued: 16 April 2019.
- [2]. Muhammad Akhyar Farrukh, Muhammad Rehan Gul, and Muhammad Khaleeq-ur-Rahman, Ciprofloxacin loaded diethylaminoethyl cellulose nanoparticles, US patent filing application No. 14/516,824, Patent. No. US 9,555,009 B2, Date of patent issued: 31 January 2017.
- [3]. Muhammad Akhyar Farrukh, Adarsh Shams, and Muhammad Khaleeq-ur-Rahman, Drug entrapment efficiency and sustained drug release of Chloramphenicol loaded polymeric-iron nanoparticles, US patent filing application No. 14/514,055, Patent. No. US 9,393,313 B2, Date of patent issued: 19 July 2016.
- [4]. Muhammad Akhyar Farrukh, ZnO-SiO₂ nanopowder for the development of latent fingerprints, US patent filing application No. 13/968,025, Pub. No.: US 2015/0050495 A1, Publication Date: 16 February 2015.
- [5]. Muhammad Akhyar Farrukh and Fizza Naseem, Nano-Leucite for Slow Release Nitrogen Fertilizer and Green Environment, US patent filing application No. 13/738,727, Patent No. US 8,911,526 B2, Date of patent issued: 16 December 2014