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Contents

Preface

A composite is defined as a combination of two or more materials with different physical and chemical properties and distinguishable interface. There are many advantages of composites over many metal compounds, such as high toughness, high specific stiffness, high specific strength, gas barrier characteristics, flame retardancy, corrosion resistance, low density, and thermal insulation. Composite materials are composed of two phases: the continuous phase known as matrix and the dispersed phase known as reinforced materials. Nanomaterials, in particular nanocomposites, have diversified applications in different areas such as biological sciences, drug delivery systems, and wastewater treatment. In nanocomposites, the nanoparticles were incorporated within different functionalized materials such as multiwalled carbon nanotubes, activated carbon, reduced grapheme oxide, and different polymeric matrices.

Water pollution is mainly caused by the pollutants that result in severe environmental problems. In recent years, various methods for heavy metal detection from water have been extensively studied. A different variety of core–shell nanocomposites such as SiO_2@Au and SiO_2@Ag were also used as a tool for water purification. These nanocomposites provide high surface area and a specific affinity for heavy metal adsorption from aqueous systems. The adsorption of different pollutants such as heavy metal ions and dyes from the contaminated water using nanocomposites has attracted significant attraction due to their characteristic properties such as extremely small size, very large surface area, absence of internal diffusion resistance, and high surface-area-to-volume ratio. Metal oxide nanoparticles, including aluminum oxides, titanium oxides, magnesium oxides, cerium oxides, and ferric oxides, have been proved to be very efficient for the removal of various pollutants from the aqueous water.

Nanocomposites have better adsorption capacity, selectivity, and stability than nanoparticles. Magnetic nanocomposites are also a very efficient class of nanocomposites in which magnetic nanoparticles have been used as the reinforcing material. They

have the advantages of both magnetic separation techniques and nano-sized materials, which can be easily recovered or manipulated with an external magnetic field. They are also very effective for the removal of both organic and inorganic pollutants from the pollutant water.

This book describes the applications of nanocomposites in various areas, including environmental science, such as remediation and speciation, water research, medicine, and sensors. The application of nanocomposites in wastewater research, which includes organic, inorganic, and microbial pollutants, has also gained more attention in research. The book contains a comprehensive discussion about wastewater research.

Researchers working in the similar domain of research will benefit from the fundamental concepts and advanced approaches described in the book. Researchers involved in the environmental and water research on nanocomposites and their applications will be major beneficiaries of the content of the book. The book will also be beneficial to the researchers who are working for their graduate and postgraduate degrees in the area of nanotechnology. It provides a platform for all researchers as it covers a vast background for the recent literature, abbreviations, and summaries. It will be a worthy read for the researchers in the fields of nanotechnology and engineered materials who are interested in nanocomposites.

The book covers a broader research area of chemistry, physics, materials science, polymer science and engineering, and nanotechnology to present an interdisciplinary approach. It presents the fundamental knowledge with the recent advancements in the research and development of nanocomposites. It discusses the recent approach and prospects about the current research and development in nanocomposites.

Ajay Kumar Mishra