

# **NANOTECHNOLOGY FOR SUSTAINABLE WATER RESOURCES**

Edited By  
**Ajay Kumar Mishra and  
Chaudhery Mustansar Hussain**

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**WILEY**

**The book emphasizes techniques developed to better understand and extend the real-time applications of nanotechnology for sustainable water resources.**

Nearly every field of science and technology has been inspired by the tools and ideas of nanotechnology and this innovation continues to be made in a range of fields and applications. This book introduces the reader to the use of nanotechnology to preserve water resources, improve water quality, as well as the social inferences therein that may affect approval or extensive usage.

The contributors to the book have been selected from all over the world and the essential functions of the nanotechnologies have been presented rather than their anticipated applications. Moreover, up-to-date knowledge on the economy, toxicity and regulatory issues related to nanotechnology are presented in detail. The role of nanotechnology for a green and sustainable future is also debated.

This important and unique book:

- **Is the first book that covers real-time applications of nanotechnology for sustainable water resources;**
- **Provides a better understanding of the properties, structure, and fabrication methods of nanomaterials that is really required to utilize them for sustainable water resources;**
- **Presents computer modeling methods which are crucial to the development of design strategies for these next generation materials.**

**AUDIENCE**

This book will be of significant interest to environmental engineers, nanotechnologists and materials scientists working on the issues surrounding real time applications of nanotechnology for sustainable water resources, as well as those working in industry on commercial scale exploration. Advanced undergraduate and graduate students will find the book a source of knowledge for their studies.

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**MISHRA  
HUSSAIN**

**MANOTECHNOLOGY FOR  
SUSTAINABLE WATER RESOURCES**

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# Nanotechnology for Sustainable Water Resources

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## Preface

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The main purpose of nanotechnology is to improve and develop materials, devices, and systems with fundamentally different properties by exploiting unique properties of molecular and supramolecular systems at the nano level. Nearly all the tools have inspired every field of science and technology, and the ideas of nanotechnology and innovation it brings continues to be made in medical technology, lab-on-a-chip, sensor technology, energy resources, and environmental protection and preservation. The continuous use of nanotechnology and nanomaterials in most of the disciplines is beginning to mature. This current book introduces the reader to the use of nanotechnology to preserve water resources, improve water quality and the social inferences therein that may affect approval or extensive usage.

Nanomaterials are nano-sized structures and have extraordinary physical and chemical properties, such as the unique optical, electrical, thermal, magnetic and adsorption characteristics, etc, due to their ultra-small size. Large specific surface areas of nanomaterials can improve the detection sensitivity and miniaturize the devices. In addition, these nanomaterials of various compositions and morphologies provide powerful tools for improving water quality. Therefore, the nanomaterials-based techniques can play vital roles in many water resources. Moreover, freedom to functionalize the nanomaterials with various chemical groups can also increase their affinity toward target contaminants, which is very much desirable for selective cleaning and detection of target contaminants in urban and industrial waters. In this book, we will summarize recent progresses due to novel nanomaterials for sustainable water resources.

The present book has been divided into four sections. Part 1: "Nanotechnology for Natural Resources" contains the details of preservation of natural resources especially water and long-term sustainable development. Recently, nanomaterials and polymer nanocomposites are researched as one of the prime materials for sustainable development. This section is an overview of the latest development and potential that nanotechnology has generated for water resources. Part 2: "Nano Sensor as Tools for Water Resources" has been described where sensors can be deployed as a standalone unit. One of its creators says that the technology

may one day be adapted for use in deployable water chemistry labs and could help scientists working in pollution cleanup operations. This section presents nanosensors to detect contaminations in water at concentration levels of significance to human health and regulatory compliance. part 3: "Nanoseparation Techniques for Water Resources" describes the separation technologies and capabilities including a range of techniques, test environments, and related expertise to separate different waste fractions in a form in which they can be used effectively for other applications or disposed of. The techniques range from membrane technologies electrochemically assisted nutrient recovery to sludge treatment and hydrothermal carbonization. Finally, Part 4: "Sustainable Future with Nanotechnology" where water has been presented as core sustainable development and is very critical for environment, healthy ecosystems, and for human survival itself. It is vital to reduce the global burden of disease and improving the health, welfare, and productivity of populations. It is central to the production and preservation of a host of benefits and services for people. Water is also at the heart of adaptation to climate change, serving as the crucial link between the climate system, human society, and the environment. Overall, this book provides a summary of the state-of-the-art knowledge to scientists, engineers, and policy maker, about recent developments in nanotechnology and the sustainable water resources arena. Moreover, up-to-date knowledge on the economy, toxicity, and regulation related to nanotechnology have been presented in detail. In the end, the role of nanotechnology for green and sustainable future has also been briefly discussed.

**Ajay Kumar Mishra and Chaudhery Mustansar Hussain**  
**Editors**  
**October 2017**

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