Chapter 47
Nanotechnology for Environmental Control and Remediation

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ABSTRACT

The chapter emphasizes nanotechnology, which is an emerging field that covers a wide range of technologies that are presently under development in nanoscale. Nanotechnology offers the potential of novel nanomaterials for treatment of surface water, ground water, and waste water contaminated by toxic metal ions, organic and inorganic solutes, and microorganisms. The advantages of the use of nanomaterials, which are related to their properties that are completely different from the bulk materials, make them extremely attractive and give them enormous potential. Among the areas that are influenced by nanotechnology, environmental remediation is highlighted in this chapter. This chapter emphasizes several nanomaterials (Zero valent iron, titanium dioxide, nanoclays, nanotubes, dendrimers, ferritin, metalloporphyrinogens, and SAAMS) and their application in water treatment, purification, and disinfection. The use of nanoparticles in environmental remediation, which inevitably leads to the release of nanoparticles into the environment and subsequent ecosystems, is also explained.

INTRODUCTION

Word "environment" is most commonly used to describe "natural" environment and means the sum of all living and non-living things that surround an organism, or group of organisms. Environment includes all elements, factors, and conditions that have some impact on the growth and development of certain organisms. Environment includes both biotic and abiotic factors that have influence on observed organism. Abiotic factors such as light, temperature, water, atmospheric gases combine with biotic factors (all surrounding living species). Environment often changes after some time and therefore many organisms

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have ability to adapt to these changes. However the tolerance range is not the same with all species and exposure to environmental conditions at the limit of a certain organism's tolerance range represents environmental stress. Environmentalism is very important political and social movement with the goal to protect nature, environment by emphasizing the importance of nature, its role in the protection of the environment in combination with various actions and policies oriented to nature preservation. Environmentalism is movement connected with environmental scientists and many of their goals. Some of these goals include:

1. To reduce world consumption of fossil fuels.
2. To reduce and clean up all sorts of pollution (air, sea, river) with the future goal of zero pollution.
3. Emphasis on clean, alternative energy sources that have low carbon emissions.
4. Sustainable use of water, land, and other scarce resources.
5. Preservation of existing endangered species.
6. Protection of biodiversity.

The environmental impact of nanotechnology is the possible effect that the use of nanotechnological materials and devices will have on the environment. Green nanotechnology is considered to play a key role in the shaping of current environmental engineering and science & refers to the use of nanotechnology to enhance the environmental sustainability, minimize potential environmental and human health risks associated with the pollution and contamination by using nanotechnology products, and to encourage replacement of existing products with new nano-products that are more environmentally friendly throughout their Lifecycle. Nanotechnology is an emerging field that covers a wide range of technologies which are presently under development in nanoscale. The unique properties of these nanosized materials have resulted in the use of nanoparticles in various fields like biomedicine, pharmaceuticals, cosmet-

Figure 1. Future of our planet lies in our hands

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