Chapter 13
Nanoparticles for Bioremediation of Heavy Metal Polluted Water

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ABSTRACT

The process of bioremediation can be intrinsic or natural attenuation, where the process of remediation happens on its own, or it can be extrinsic or bio-stimulated when it is incited with help of some growth productive conditions like addition of fertilizers or nanoparticles, the smallest active particles on the earth. Nanoparticles are charged entities with low activation energy and exhibiting quantum effects making the chemical reaction between the nanoparticle and surrounding feasible in lesser time, and they also exhibit surface plasmon resonance that helps in identification of toxic material in surrounding. Apart from these properties, their different shapes and sizes help in designing the environmental cleanup process as per the suitable conditions and requirements. Polluted water treatment is being done with the help of nanoparticles due to their property of being highly profitable as adsorbents and for filtration purposes.

INTRODUCTION

The way the heavy metals are being used in various applications and factory processes like mining and processing of minerals, food products, dyes etc., it produces large amount of toxic waste that is being accumulated leading to the generation of large quantities of effluent containing high levels of toxicity. These effluents are discharged in open water resources like rivers etc. where it harms the marine ecology. Sometimes these toxic elements leach into the groundwater system thereby causing groundwater contamination. It is this water that is used for irrigation and drinking and the presence of different organic and heavy metal contaminants in groundwater that creates a large environmental, public health and economic impact. There is an abundant need of safe drinking water worldwide. In places like Somalia, the kids of tender age travel about ten kilometres every day for drinking water that is not even clean and safe. So a major cause of death in many parts of the world, particularly in young children, the elderly, or those with compromised immune systems is still the water borne diseases. Over the years with changing environment, the epidemiology of the disease is continuously changing with development of new or more resistant microbes. Therefore it becomes very important that these microbes are screened and identified so that the proper remedial process can be designed. Hence in present scenario, the remediation has to be at two levels: a) Remediation of Environment and b) Remedial measures for effective treatment of water borne diseases. For remediation of environment the existing applications include solvent extraction, activated carbon adsorption, biological degradation and common chemical oxidation, but these processes are not cost effective and are time consuming. Similarly for effective remedial measures for treatment of disease the effective microbial testing is done by time consuming culture methods that are not completely accurate. At times the most resistant strains are difficult to screen. However, newer enzymatic, immunological and genetic methods are being developed to replace and/or support classical approaches to microbial detection but it is also an expensive process.

The word Bioremediation is made up of two words; Bio means various biological agents such as bacteria, fungi, protists or their enzymes or living component active principle and Remediate means to solve the problem thus Bioremediation means the process by which various biological agents, such as bacteria, fungi, protists, or their enzyme are used to degrade the environmental contaminants into less toxic forms or in other terms it is the process of cleaning the environment with help of biological agents (Dillewijn et. al, 2007). There is an increase in the application of this process over conventional ways of cleaning because of following benefits

- It is economical,
- No requirements of supplementary nutrient,

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