

Chapter 15

Nanobiotechnology for Bioremediation: Recent Trends

Swati Jagdale

Maharashtra Institute of Pharmacy, India

Asawaree Hable

Maharashtra Institute of Pharmacy, India

Aniruddha Chabukswar

Maharashtra Institute of Pharmacy, India

ABSTRACT

Nanobiotechnology is the combination of nanotechnology and biotechnology. Bioremediation is defined as a waste management technique that involves use of organisms to remove or neutralize pollutants from a contaminated site. This involves no use of chemicals and it allows waste to get recycled; this process has evolved as one of the most important methods. Remediation of contaminants using existing conventional technology is neither effective nor efficient in environmental cleanup. Techniques developed from nanobiotechnology can detect, control, and remediate pollutants by acting as sensors. Use of nanomaterials has less toxic effects and this will not only reduce consumption time but also reduce cost. Nanoparticles developed by using microbial systems provide green nanotechnology and help in keeping the environment clean. Green nanotechnology needs to develop to make cleaner environment with great ecological balance on earth. This chapter deals with traditional methods of bioremediation, methods in nanobiotechnology, and future aspects.

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INTRODUCTION

Currently all over globe there is rapid development going on in terms of industrialization, urbanization and modern agricultural practices. Due to these reasons pollution is on rise. Pollution in soil, ground water and air is increasing tremendously. Elimination or minimization of pollutants is a very big challenge now. Exploitation of natural resources is being done for fulfillment of human needs. This results in degradation of soil, water resources and reduced air quality which leads to imbalance of ecological system. Pollution can be defined as the presence of pollutants in the environment which causes instability, disorder, harm and discomfort to the ecosystem. Present treatment technologies are although efficient causes several problems which make remediation processes more complex. Among these technologies, bioremediation has been prominently practiced as an efficient cost-effective technology for controlling hazardous pollutants like heavy metals in the soil and water. This chapter reviews the treatment technologies currently available for removing heavy metals and applications of nanotechnology in water treatment. A novel method of nano-bioremediation is effective and more significant for heavy metal removal in all the aspects. The drawback of bioremediation can be possibly avoided by the application of nanotechnology (Mehndiratta et al., 2013, Qu et al., 2013, Bihari, 2013).

BIO-REMEDIATION

As a consequence of human activities, huge quantities of organic and inorganic compounds are discharged into the environment every year. In some cases the discharge is deliberate and regulated (e.g. industrial waste) while in some they are accidental (e.g. spill of chemicals or oil). Majority cases these compounds are toxic and persistent in the environment. The accumulation of toxic compounds in excess levels results in contamination of soil, air and groundwater. The quality of life on earth is dependent on the overall quality of environment on earth. In early years, there was a great abundance of land and other natural resources. In today's world, because of our negligent and careless behavior in use of natural resources it is getting contaminated. Now, problems associated with contaminated sites are increasing in many countries. Contamination of land/ soil/air/water is a result of domestic and industrial activities like production and disposal of hazardous pollutants. Now contamination of natural resources is recognized as a potential threat to human health. The research on minimization on contamination provides not only remedies to reduce the risk of adverse health or environmental effects caused by contamination but also redevelopment of resources. Many conventional methods are available for

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