Chapter 10
Application of Plant Tissue Culture in Management of Hg Contaminated Water

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ABSTRACT

In the chapter, the authors describe how a plant can be selected as a natural indicator of heavy metal (mercury) contamination, how one can select a plant species to monitor a particular type of heavy metal and use those plants to remove the contaminants from the area under consideration. The chapter also contains a brief idea of environmental contamination by heavy metals and how the situation can be managed by the techniques of modern plant biotechnology. The authors add some reports and data of their in-vitro studies of mercury toxicity on Ananas sp., generally known as pineapple, for better understanding of the text.

INTRODUCTION

Since the genesis of the Earth and its atmosphere, the nature has its own mechanisms to deal with the naturally occurring pollutants or contaminants. Early human beings used natural resources like air, water, shelter and food mainly to satisfy their basic needs. The residues generated by the use of these resources were generally compatible

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with the environment, or were readily assimilated by it. Primitive humans usually ate raw plant and animals without disturbing the atmosphere with the smoke from fire. When the use of fire became common, the small amount of smoke generated by these activities were rapidly dispersed and easily assimilated by the atmosphere. Early civilizations drank from the same rivers and water bodies in which they bathed and deposited their wastes. However, the impact of such use of natural water resources was relatively low since natural cleansing mechanisms or self-purification processes easily restored the water's natural quality. The early humans used natural shelters like caves or built their homes from wood, mud or animal skins. They left behind items that were readily decomposed by microorganisms and absorbed by the nature. With the rise of Industrial Revolution, humans were better able than ever before to satisfy their natural needs for air, water, food or shelter. By the early twentieth century automobiles, appliances, processed food and beverage became popular as necessities. Meeting these acquired needs became a major thirst of modern industrial society. Unlike natural needs the acquired needs are usually met by the products that must be processed or manufactured or refined. The production, distribution and the use of such products usually result in more complex residues, many of which are not compatible with the environment, or readily assimilated by it. These residues are less compatible with the environment and less likely to be readily assimilated into the biosphere. As modern societies ascend the socioeconomic ladder, the list of acquired needs or luxuries increases and so do the complexities of the production chain and the amounts and varieties of pollutants generated. As a result, the impact of modern human population upon the environment is of major concern to the environmental engineers and scientists.

If one considers the present state of the environment, the exponential rise in industrialization and urbanization over past years has resulted in contamination of the air one breathes, the water one drinks, and even the foods and the soil and water in which the food grows. These are the consequences of use of synthetic organic chemicals such as solvents, pesticides, refrigerants and chemical intermediates etc. The contamination of environment has also resulted due to various industrial operations like fugitive emissions, accidental spills and leaks, dumping of hazardous substances etc. The excessive use of these synthetic chemicals over the years which are not degradable by natural means turns out to be hazardous or toxic. These issues can be managed to an extent with the proper use of Genetic Engineering Technologies and their application in Plant Tissue Culture and Plant Biotechnology with respect to Environmental Engineering. In other words application of plants in bioremediation processes. The process of performing bioremediation with the help of plants are known as phytoremediation. Phytoremediation is the term, coined in 1991, given to a group of technologies that employs plants for cleaning up of the contaminated sites.