Chapter 8 Microalgae: A Promising Tool for Remediation of Heavy Metals

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ABSTRACT

The primary functions of ecosystems, wherever located, or whatever their constituents on earth, are to sustain life. They provide vital needs, commonly described as "ecological services," for all the living things residing within that particular system, or for those on its fringes. Such services include shelter, food, maintaining soils and hydrology, and providing livelihoods for its dwellers. Water is considered an important resource for mankind and other living organisms. Therefore, maintaining the water to a high quality is crucial. Bioremediation of heavy metals and micro pollutants by microorganisms (algae, bacteria, fungi, and yeast) has been used for the last two decades. All micro-organisms and microalgae are gaining increasing attention because microalgae can easily grow and is cheap to process and able to accumulate high metal content.

INTRODUCTION

All around the world natural water bodies are contaminated with different type of heavy metals and directly or indirectly discharge of wastewater by industries. These micro pollutants reached to our drinking water supplies, aquatic ecosystems and other

DOI: 10.4018/978-1-5225-4162-2.ch008

organisms. Heavy metal toxicity has proven to be a major threat to living organisms. Bioremediation of waste water by microalgae is a technology that transfers harmful toxic chemicals to less harmful forms. Bioremediation is cost effective and efficient method for removal of heavy metals from waste water now-a- days.

The most abundant pollutants in the wastewater and in sewage are heavy metals (Hong *et al*., 1996).Industrialization has proved to be one of the major reasons for the spread of heavy metal pollutants. Heavy metals are toxic, persistent and non-degradable that has a negative impact on the biosphere. These heavy metals leach into the drinking water reservoirs and freshwater habitats, altering the macro, as well as, microbiological communities (Teitzel & Parsek, 2003). Finally, they are accumulated through the food chain, leading to serious ecological and health problems. Phytoremediation appears to be a promising method that uses algae to clean up polluted water and soil. Algae have the natural ability to take up, accumulate and degrade the constituents that are present in their growth environment. Photosynthesis can be effectively exploited to generate oxygen from waste water remediation by algae. Algae are preferred to be used in wastewater treatment systems because of their efficiency to grow in and to take up nutrients from wastewater. Fresh-water microalgae are one of the potential organisms which can be safely used without any hazard to the environment. Instead of that the algal flora will help to reduce the carbon component in the waste water, as well as to remove the nitrate and phosphate component, whereas the oxygen cotent will increase in the water. There are various reports about the heavy metal uptake capacity of microalgae by different means, by adsorption or by intercellular uptake which are ultimately detoxified by metallothioneins or phytochelatins or are sequestered into the vacuoles or polyphosphate bodies. There are various Marine Algal flora which can really remove various heavy metals from aquatic environment, but we are more concerned about the heavy pollutants in rivers and waste water bodies where the fresh water microalgae can be used successfully. High Rate Algal Ponds or Algal Turf Systems are being used successfully for removal of pollutants in some places. But more studies should be done for using other combined technologies like immobilized algal cultures along with other to improve the different pollutants removal capacity by freshwater microalgae. Transgenic algae production must be attempted to increase their potentiality in these aspects by manipulating the detoxifying mechanisms.

ORIGIN OF HEAVY METALS IN AQUATIC ECOSYSTEMS

Most of the aquatic ecosystems are mainly used to industrial waste discharge. Pesticides and heavy metals are the major contaminants of both surface and groundwater. Metals enter into the aquatic ecosystems due to weathering of soil