Chapter 77
Biosorption of Heavy Metals: Biological Approach to Control the Industrial Waste

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ABSTRACT

Large-scale production of commodities for mankind by industries did huge damage to the environment. Industrial waste contains lots of toxic materials including heavy metals were drained to water bodies like river, lakes, ponds, etc. These effluents drastically ruin water quality as well as the soil fertility. Type of industry and its raw material decides quantity and quality of the emerged wastes including both biodegradable as well as non-biodegradable. Among non-biodegradable wastes, copper, chromium, nickel, cadmium, etc. are widespread contaminants of soil, water, and these are most common heavy metals. Several heavy metals such as cadmium, mercury, and lead are highly poisonous and fatal to human as well as animals. Several plants as well as microbes respond to heavy metals by diverse biological processes like biosorption to their cell wall and entrapment in their capsule, oxidation and reduction, precipitation, complexation, etc. These responses may help significantly in the remediation of heavy metals from the contaminated sites.

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INTRODUCTION

All over the world ceaseless growth of mankind has resulted into the more demand of commodities or goods which are meant to be life supportive for them. As a result industrialization occurs on large scale to fulfill their requirements by introducing new alternatives (Ahemad & Khan, 2012; Ahemad & Malik, 2011). Large scale production of such commodities by industries did huge damage to the environment. Industrial effluent contains several toxic materials including heavy metals were drained into several water bodies like river, lakes, ponds etc. during their various operations. These effluents drastically ruin not only water quality but also damage the soil fertility as well (Singh *et al.*, 2010; Ahemad & Malik, 2011). The type of industries and their raw materials decides quantity and quality of the emerged wastes including both biodegradable as well as non-biodegradable. Among non-biodegradable wastes copper, chromium, nickel, cadmium etc. are widespread contaminants of soil, water and these are most common heavy metals (Ahemad & Malik, 2011). Several heavy metals such as cadmium, mercury and lead are highly poisonous and fatal to human as well as animals. Ordinarily, some heavy metals are either essential nutrients (typically iron, cobalt and zinc) or relativity harmless such as ruthenium, silver and indium. They serve as micronutrients for prokaryotes as well as eukaryotes in their life cycle, but high concentration of these metals could be toxic (Ahemad, 2012). Several plants as well as microbes respond to heavy metals by diverse biological processes like biosorption to their cell wall and entrapment in their capsule, oxidation and reduction, precipitation, complexation etc. (Lawrence *et al.,* 2010). These responses may help significantly in the remediation of heavy metals from the contaminated sites.

BIOSORPTION

Before the starting we should have to know about the term biosorption. What does it means? What does this term defines? One cannot easily define biosorption because of its complex mechanism. Bio and

Table 1. Some of the heavy metal effluents from industries

S.No.	Metals	Industries
1	Copper	Metal refining, electroplating industry, plastic industry etc.
2	Chromium	Electroplating industry, leather, chrome plating, petroleum refining, tanning, textile.
3	Lead	Automobile batteries, Petrol based materials, pesticides, Paints
4	Nickel	Metal refining, galvanization, paint and powder, batteries processing units, super phosphate fertilizers.
5	Zinc	Rubber industries, paints, dyes, wood preservatives and ointments.
6	Mercury	Thermometers, adhesives, paints, light bulb industry, wood preservatives, leather tanning, ointments producing industry
7	Iron	Metal refining, galvanization engine parts.
8	Arsenic	Semiconductors, petroleum refining, wood preservatives, animal feed additives, coal power plants Automobile exhaust, industrial dust and dyes.

(Lone *et al.,* 2008)