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BIO-REMEDIATION OF HEAVY METAL CONTAMINATED SOILS

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Soil contamination is the presence of man-made chemicals or other alteration of the natural soil environment. This type of contamination typically arises from the rupture of underground storage tanks, application of pesticides and percolation of contaminated surface water to subsurface strata, leaching of wastes from landfills or direct discharge of industrial wastes to the soil. The most common chemicals involved are petroleum hydrocarbons, solvents, pesticides, lead and other heavy metals. This occurrence of this phenomenon is correlated with the degree of industrialization and intensity of chemical usage. The concern over soil contamination stems primarily from health risks, both of direct contact and from secondary contamination of water supplies. The unscientific disposal of untreated or under-treated effluents has resulted in accumulation of heavy metals in land and water bodies. Heavy metal contamination due to the sewage and sludge application to soils imposes a major limitation on potential land use. Cultivated areas under peri-urban agriculture are worst affected by this problem. The heavy metals accumulating in soil may get entry into the human and animal food chain through the crops grown on it. (Alloway, 2013).

Heavy metals prevailing in soils and their regulatory limits (Vries *et al.*, 2013)

Elements	Conc. Range (mg kg^{-1})	Regulatory limit (mg kg^{-1})
Lead	1-6900	600
Cadmiun	0.1-345	100
Arsenic	0.1-102	20
Chromium	0.005-3950	100
Mercury	0.01-1800	270
Copper	0.03-1550	600
Zinc	0.15-5000	1500

Management of soil pollution

Bioremediation

Bioremediation can be defined as any process that uses microorganisms, fungi, green plants or their enzymes to return the environment altered by contaminants to its original condition. Bioremediation may be employed to attack specific soil contaminants, such as degradation of chlorinated hydrocarbons by bacteria. An example of a more general approach is the cleanup of oil spills by the addition of nitrate and / or sulfate fertilizers to facilitate the decomposition of crude oil by indigenous or exogenous bacteria.

Important and widely reported hyper-accumulators used for metal remediation

Elements	**Plant species**	**Max conc. (mg kg^{-1})**
Cadmium	*Thlaspicaerulescens*	500
Copper	*Ipomoea alpina*	12300
Cobalt	*Haumaniuastrumrobertii*	10200
Lead	*Thlaspirotundifolium, Brassica juncea, Zea mays*	8200
Nickel	*Alyssum lesbiacum, Sebertiaaccuminata*	47500
Zinc	*Thlaspicaerulescens, Brassica juncea, B. oleracea, B. campestris*	51600
Selenium	*Brassica juncea, B. napus*	900
Chromium	*Brassica juncea, Helianthus annus*	1400

(Crawfordand Crawford, 2009)

Microorganisms used for metal remediation

Elements	**Microorganisms**
Cadmium	*Citrobacter spp.*
Copper	*Bacillus spp.*
Cobalt	*Zooglea spp.*
Nickel	*Zooglea spp.*
Zinc	*Bacillus spp.*
Chromium	*Pseudomonas ambigua, Chlamydomonassp, Oscillatoria sp., Arthrobacter sp., Agrobacterium sp.*

(Crawford and Crawford, 2009)

It is therefore imperative that to solve the soil chemical constraints and make the lands highly productive on a sustainable basis, we need to develop the technologies suitable to specific locations which will be economically feasible and workable at farmer's field. So we have to give emphasis on increasing the current yield level and at the same time develop suitable technologies to reclaim the problem soils.

References

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