Yeast in bioremediation

Heavy metal pollution has become one of the most serious environmental problems

throughout the world. Among the innovative solutions for treatment of contaminated

water and soil, bioremediation that use biological materials like living or dead microorganisms is a promising, safe and economical technology.

One of the most ubiquitous biomass types available for bioremediation of heavy metals is yeast. Yeast cells represent an inexpensive, readily available source of biomass that retains its removal ability for a broad range of heavy metals to varying degrees. Furthermore, yeasts exhibit the ability to adapt to extreme conditions such as temperature, pH and high levels of organic and inorganic contaminants.

Bioremediation is based on biodegradative processes related to microbial population

dynamics in soil or water and its ability to consume xenobiotics as corbon source.

Environmental pollution can be caused by: (i) spills during the industrial production

process; (ii) disposal of toxic compounds; (iii) excessive treatment of agricultural surfaces.

Industrial wastes comprise organic compounds such as alifatic and aromatic hydrocarbons

derived from petroleum, charcoal and wood, as well as natural products, halogenated

solvents, pesticides, herbicides and explosives.

*S. cerevisiae*, *Schizosaccharomyces pombe* and *Candida* sp.are used in bioremediation.

*Candida Clavispora, Debaryomyces, Leucosporidium, Lodderomyces, Metschnikowia, Pichia,*

*Rhodosporidium, Rhodotorula, Sporidiobolus, Sporobolomyces, Stephanoascus,*

*Trichosporon* and *Yarrowia These species used hydrocarbon as carbon source.*

yeasts evolved several different detoxifying mechanisms by which they can

mobilize, immobilize or transform metals. The immobilization mechanisms include (i) biosorption,

interaction of metals with the cell membrane via different processes such as ion

exchange, complexation, crystallization, adsorption and precipitation; (ii) biotransformation,

toxic metals are reduced to less toxic forms; and (iii) bioaccumulation, intracellular uptake of

metal ions by living microorganisms.

**Biosorption**

It consists of the ability of biological materials

to bind and concentrate heavy metals through metabolically mediated or physico-chemical

pathways

*Yeast cell wall properties*

the biosorption efficiency of

heavy metals by microbial biomass is mainly connected with the structure of the microorganism

cell wall and consequently with cell surface properties in which structure determines the

interaction nature between micro-organism and metal cation. Yeast cell walls are negatively charged, and the ability of yeast cells to bind heavy-metal cations

is likely due to electrostatic interactions. Several yeast species such as *S. cerevisiae*, *Pichia anomala, Candida tropicalis, C. albicans*, and

*Cunninghamella elegans* emerged as a promising sorbents against heavy metals

*bioaugmentation* – mostly used for soil remediation by addition of microorganisms

or specific enzymes with degrading effects on the polluted substrate.

*bioventing* – air is ventilated through soil in order to augment the growth of

indigenous or exogenous microorganisms.

*composting* – the polluted soil is mixed with non-toxic organic compounds required

for the development of a rich microbial population.

Bioremediation has many advantages compared to the conventional decontamination

techniques, such as: maintaining the ecological equilibrium; the contaminants are eliminated

through microbial metabolic processes; biological systems transport costs are relatively low

and use less energy; bioremediation may be used in combination with other treatment

technologies.