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Amelioration of lead toxicity by cyanobacteria *Scytonema* and *Hapalosiphon*

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SUMMARY

In the present investigation a comparative study has been made with free and immobilized *Scytonema* sp. and *Hapalosiphon* sp. cells subjected to lead treatment. These Immobilized cells gave enhanced growth and nitrate reductase activity as compared to free cells without added lead (Control). In sublethal doses of lead, immobilized cell were able to over come the Pb toxicity to considerable levels. In fact, the growth and nitrate reductase activities were stimulated with added lead under immobilized conditions has compared to Pb treated free cells and also to investigate whether immobilization can help retain nitrate reductase activity if nitrate concentration as increased in the medium and also mitigate lead toxicity. Between both the cyanobacteria *Scytonema* sp. was more efficient to remove Pb toxicity. The observations of the present study clearly demonstrate the protective effect of immobilization in *Scytonema* sp. *and Hapalosiphon* sp. against Lead toxicity. With this aim the nitrate reductase activity was compared in free and immobilized cells of two heterocystous filamentous free-living cyanobacteria *i.e. Scytonema* sp. and *Hapalosiphon* sp., isolated from paddy fields and amelioration of lead metal toxicity.

Key words : Cyanobacteria, Lead, Immobilization, Nitrate reductase, Amelioration.

Industrialization and domestic activities have resulted in increased mobilization and deposition of heavy metals pollutants including Pb in natural habitats. Lead is a naturally occurring bluish-gray metal found in small amounts in the earth's crust. Heavy metals such as lead ranked second, on the 2003 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) priority list for hazardous substance because it is a toxic widespread pollutant, which enters the environment by both natural and anthropogenic causes. It is one of the major heavy metals of the antiquity and has gained considerable importantance as a potent environmental pollutant. Lead itself does not break down, but lead compounds are changed by sunlight, air, and water. When released to the air from industry or burning of fossil fuels or waste, it stays in air about 10 days. Apart from the natural weathering processes, Pb contamination of the environment has resulted from mining and smelting activities, Pb containing paints, gasoline and explosives as well as from the disposal of municipal sewage sludge enriched in Pb. Lead sticks to soil particles. It stays a long time in both soil and water. High levels of lead are toxic to plants, animals and other microorganisms (ATSDR, 1993).

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In response to heavy metals, microorganisms have evolved various measures via processes such as transport across the cell membrane, biosorption to cell walls and entrapment in extracellular capsules, precipitation, and complexation and oxidation-reduction reactions. It has been proved that they are capable of adsorbing heavy metals (Chen, Hong and Pan, Shan-shan, 2005). Cyanobacteria are a group of photosynthetic, oxygen evolving prokaryotes, which have a capacity to fix atmospheric nitrogen, and their ubiquity on the planet and dominance in every conceivable ecosystem is a major example of their ecophysiological resilience and adaptability. The submerged conditions of rice field provide congenial habitat for cyanobacteria where they functionally act as the most efficient system providing biological fixed nitrogen to the crops. Numerous studies have shown that microorganisms especially the cyanobacteria can interact with heavy metals. They also possess several detoxification mechanisms to counteract metals stress which include biosorption, bioaccumulation, exclusion of heavy metals, change in metal binding proteins, trapping of metals in bodies containing sulphoquinovocyl diglyceride, and compartmentalization into polyphosphate bodies.

Cyanobacterial cultures can be turned into relatively homogenous preparations by immobilization and altering the condition of immobilization can control particle size. Although various method are available for the immobilization cell entrapment is probably most extensive used method. Immobilization techniques have been widely used in modern biotechnology. Natural immobilization of