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Response of the antioxidant systems of the nitrogen fixing cyanobacterium *Cylindrospermum* sp. to lead stress

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ABSTRACT - Cyanobacteria *Cylindrospermum* sp. as biofertilizer for rice cultivation has a beneficial effect on crop productivity and maintenance of soil fertility. A study was undertaken under controlled laboratory conditions, to study the influence of different concentrations of lead (0, 25, 50, 75, 100 and 125 µM) on the growth, lipid peroxidation (MDA), peroxidase (POD), catalase (CAT), superoxide dismutase (SOD) and proline of cyanobacterium *Cylindrospermum* sp. Lead stress caused negative impact on growth (Dry weight) of *Cylindrospermum* sp. and the damaging effect was further increased by enhanced lipid peroxidation probably because of generation of reactive oxygen species. To explore the survival stretegies of cyanobacterium under Pb stress enzymatic antioxidants SOD, POD, CAT and non enzymatic antioxidant proline was studied. A general induction of SOD, POD and proline was observed. In contrast to this CAT activity was reduced after 50 µM Pb. This study may be helpful in biological indication of lead toxicity in cyanobacteria.

Key words - *Cylindrospermum* sp., Pb, MDA, POD, SOD

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Cyanobacteria are capable of both carbon assimilation and nitrogen fixation, thereby enhancing productivity in varieties of environments. Apart from fixing atmospheric nitrogen they secrete a number of biologically active substances (Muthukumar *et al*., 2007). Tropical conditions such as those in India provide favorable environment for the luxuriant growth of these organisms in the natural ecosystems such as different type of soil, freshwater bodies, oceans, saline backwaters, estuaries and also hyper saline saltpans (Srivastava and Odhwani, 1992; Thajuddin and Subramanian, 1992; Rajkumar, 2004).Since cyanobacteria are unique and cosmopolitan in distribution, they are therefore known to have survived a wide spectrum of environmental stresses like salinity, pesticide, temperature, cold, UV-B and heavy metals (Tandeau-De- Marsac and Houmard, 1993).Heavy metals play an important but dual role in plant metabolism. On one hand, some of them are essential micronutrients acting, for example, as cofactors of key metabolic enzymes. On the other hand, when exceeding their critical concentrations, the same metals become the most toxic pollutants in the soil (Stobrawa and Lorenc-Plucinska, 2007). Lead, a heavy metal is a potent environmental pollutant (Verma and Dubey, 2003). Pb contamination has resulted from mining, smelting activities, Pb containing paints, gasoline, explosives, as well as from the disposal of municipal sewage sludge enriched in lead (Nidelkoska and Doran, 2000). Although it is not essential for plants; it is absorbed and accumulated in different plant tissues (Van Assache and Clijsters, 1990). Elevated concentrations of heavy metals specially lead in the soil can lead to toxicity symptoms and growth inhibition in plants (Pourrut *et al.*, 2011). Toxicity may results from the binding of metals to sulphydryl groups in proteins, leading to inhibition of activity or disruption of structure or from displacement of an essential element, resulting in deficiency effects (Van Assache and Clijsters, 1990). In addition, a heavy metal excess may stimulate the formation of free radicals and