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EFFECT OF CADMIUM AND LEAD ON NITRATE AND PHOSPHATE REMOVAL BY THE DUCKWEED *LEMNA GIBBA*

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Abstract – In the present study, the effect of the heavy metals, such as cadmium and lead on the removal of nitrate (NO_3^-) and orthophosphate (PO_4^{3-}) was assessed using *Lemna gibba*. Duckweed plant was cultured in N and P-rich medium, supplemented with heavy metals. A total of two initials (0.1 and 1 mg/L) concentrations of Cd and Pb were used. Samples were taken every two days to assess plants efficiency in removing both nutrients and heavy metals over Six days. Results showed that in control and in all treatments (Cd and Pb), nitrate and orthophosphate concentrations decreased markedly within the two days of initiating experiments as compared to the initial concentrations (1.76 ±0.01 mg P/L and 850±0.01 mg N/L).The highest phosphate removal efficiencies (percentage removal) were obtained on the fourth day at 1 mg Cd/L and 1 mg Pb/L. Whereas, nitrate removal showed maxima on the sixth day at 1 mg Cd/L and at 0.1 mg Pb/L. As compared to the control, the presence of Cd and Pb at 0.1 mg/L in the culture medium had no effect on phosphate removal, while a Pb concentration of 1 mg/L revealed a better phosphate removal. Cd and Pb at 0.1 mg/L enhanced nitrate removal as compared to control. *Lemna gibba* was able to simultaneously remove Cd, Pb, nitrate and phosphate, major causes of contamination and eutrophication in water bodies.

Keywords: heavy metals, nutrients, phytoremediation, aquatic plant, eutrophication.

Introduction

Heavy metal contamination and eutrophication of aquatic ecosystem are global environmental problems. The problem of water pollution by heavy metals is becoming more and more serious with the increasing industrialization.
Unlike organic substances, heavy metals are essentially non-biodegradable and therefore accumulate in the environment (Ali et al., 2013). Because of their toxicity, cadmium and lead are of prime environmental concern (Scheifler et al., 2002). Over the past five decades, the worldwide release of Cd has reached 22.000 tones (Singh et al., 2003) and a total of 4 million tons of Pb are mined in one year (Dirilgen, 2011). Their bioaccumulation through the food chain can pose risks to human health (Gisbert et al., 2003). The threat of these toxic metals to human and animal health is aggravated by their long-term persistence in the environment (Forstner, 1995). Often present in industrial effluents, cadmium and lead are hazardous to living organisms in the aquatic system (Nanda Kumar et al., 1995).Cadmium occurs in natural and wastewaters, and it originates from many industrial sources such as processing, smelting and mining ores, reclamation of scrap metals, incineration for disposal of waste products, run-off carrying fertilizers and fungicides etc. (Liu et al., 2007). For lead, the most important sources into wastewater include batteries, pigments; paints, petrol, cables, steels, alloys, and plastic industries (Salem et al., 2000).
Also, eutrophication of water bodies is an important global

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