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Studies on heavy metal bioaccumulation by *Eichhornia crassipes* in the municipal waste water of Supaul district

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Abstract:- Aquatic macrophytes are well known accumulator of heavy metals from wetland. The objective of this study is to evaluate the capacity of *Eichhornia crassipes* for accumulating lead from municipal waste water. Young plant of *Eichhornia crassipes* of equal size were grown in municipal waste water for 20 days. The plant in the experiment removed 50% lead. Removal of metal from waste water was fast in the first 10 days. Bio-concentration factor (BCF) was more than 1000. *Eichhornia* was found to be suitable macrophyte for removal of heavy metal form waste water.

Key words: *Eichhornia crassipes*, Lead, heavy metal, bioaccumulation, municipal waste water

INTRODUCTION

Rapid industrialization, urbanization, and population in the last few decades have added huge loads of pollutants in the water resources.[1] In India, where most of the developmental activities are still dependent upon water bodies, heavy metal pollution is posing serious environmental and health problems.[2,3]

Heavy metals are metallic chemical elements with a high atomic weight and density much greater than water. They are highly toxic and cause ill effects even at very low concentrations e.g. mercury (Hg), cadmium (Cd), arsenic (As), chromium (Cr), thallium (Tl), and lead (Pb). They are added to the aquatic system, either naturally by slow leaching from soil/rock to water or through anthropogenic sources. These heavy metals are not biodegradable; hence there is a need to develop such remediation technique, which should be efficient, economical and rapidly deployable in a wide range of physical settings.[4]

Wetland treatment technology offers a comparative advantage over conventional, mechanized treatment systems as the level of self-sufficiency, ecological balance, and economic viability is greater.[5] Phytoremediation technology consists of mitigating pollutant concentrations in contaminated water bodies with naturally occurring or genetically engineered plants that have ability to accumulate, degrade or eliminate metals, pesticides, solvents, explosives, crude oil, and its derivatives *etc*.[6,7]

MATERIAL & METHODS

Tests were conducted in three cylindrical tanks of 1000 L capacity with 80cm radius and 50cm depth. In each tank 20cm deep 400 L municipal waste water sampled from

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Kishanpur, Saraigarh, Triveniganj, Raghopur and Supaul was added. Each tank was seeded with 4kg fresh and young Eichhornia plants which were taken from an unpolluted pond. 1 tank was taken as control. Plants were thoroughly washed with clean water before seeding. In waste water lead was analysed in initial 5th, 10th, 15th and 20th day. Metal concentration of each plant was analysed on initial and final stage of experiment.

Chemical analysis

50ml of water sample at each level (in initial, 5^{th} , 10^{th}, 15^{th} and 20^{th} day) were digested in 2M HNO_3 at 95^0C for 2 hours and made upto 100ml in a volumetric flask with distilled water. Digested samples analysed for metal using atomic absorption spectrophotometer.

The plant samples were separated into root and leaves to determine the accumulation trend from waterto the roots and to the leaves. They were each dried in an oven at 60°C till well dried. The dried samples were ground before digestion. 500 mg of dried weight of each fraction were digested with10 mL of $HClO_4$ and HNO_3 mixture (1:3) at about 80°C for 4 hours. The resulting cleared coloured solutionswere made up to the mark in a 25 ml volumetric flask with the distilled water. All the reagents that were usedwere of analytical grade and all the reaction vessels were treated well to avoid external contributions of themetals. Sample blanks were analysed to correct the possible external contributions while replicate samples werealso evaluated and all the analyses were done in triplicate to ensure reproducibility of the results. The digestedsamples were analysed for lead by atomic absorption spectrophotometer.

In the present investigation, the bioconcentration factor (BCF) of heavy metal (Lead) within *Eichhornia crassipes* was calculated by following formula:

$$\text{BCF} = \frac{Trace\ element\ conc.\ in\ harvested\ plant\ \left(\frac{mg}{kg}\right)}{Initial\ conc.\ of\ element\ in\ water\ \left(\frac{mg}{l}\right)}$$

RESULT

The final concentration of lead in waste water treated with *Eichhornia cressipes* was lower than concentration of lead in control tank. The bio-concentration factor (BCF) in the present study is given in Table No.-1.

Table 1. Showing Bio-concentration factor (BCF) in different parts of *Eichhornia crassipes* weed with respect to lead grown in municipal water samples of Supaul

Metal	BCF in Root	BCF in Leaves	BCF in Plant
Pb	7625.54	2116.67	4866.15

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