Heavy Metal Removal from Domestic Wastewater Employing Live Eichhornia Crassipes

Lal Ji Verma[*1] , Pramod Kumar Singh[2] and Saurav Ambastha[3]

1. * Environment Science BBD University Lucknow, (U.P.), India. e-mail : lalji40@gmail.com
2. Environment Science BBD University Lucknow, (U.P.), India. e-mail : singh_p_kumar@rediffmail.com
3. Environment Science BBD University Lucknow, (U.P.), India. e-mail : saurav.ambastha@gmail.com

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***Corresponding author :**

Lal Ji Verma

e-mail : lalji40@gmail.com

Abstract

This study uses naturally growing water hyacinth for wastewater purification system, this is an alternative technique of heavy metal remediation. These plants enhance the removal of pollutants by consuming part of them in the form of the plant nutrients. The vascular plants cultured in such treatment system perform several functions, including assimilation and storing contaminates, transporting O_2 to root zone, and providing a substrate for microbial activity, canal containing floating macrophytes. This applies to municipal wastewater, in particular, where treatment units of different size can be applied at the pollution source and consumes less energy for the running. The effectiveness of wastewater purification by different plants was tested on laboratory and pilot scales. The aquatic plants system offers an environmentally friendly and cost effective technology, which have been used for removing Cadmium, Iron and Copper from wastewater. Batch experiments verified that the plants are capable of decreasing all tested indicators for water quality to levels that permit the use of purified water for irrigation, which poses serious problems in various locations throughout the country. It is shown that mixture of wastewater from in front of Gautam Budha University canal/ Greater Noida's canal wastewater and Galgotias University sewage treatment plants. The removal efficiency of the Cadmium, Iron and Copper is 74.52%, 75.31% and 67.75% in greater Noida's canal and 73.72%, 74.99 % and 68.37% in Galgotias University's wastewater respectively.

Keyword: *Water Hyacinth, Cadmium, Iron, Copper, AAS.*

1. INTRODUCTION

During this century, the trend has been for more mechanized wastewater treatment system with almost every aspect of the various processes under the direct control of the operations. Shortly after the enactment of water pollution act 1974, alternate methods of wastewater treatment once again become recognized as valid means of achieving the required level of effluent quality. Initially, attention was centered on existing natural system such as wetlands and coastal marshes, but more recently, constructed system using *Eichhornia crassipes* have been investigated. Natural treatment system come back into consideration mostly as an attempt to find a more cost effective means of achieving the mandated treatment level then was available with the existing mechanical or chemical processes. Removal of contaminants takes place by plant uptake, microbial degradation, filtration, chemical precipitation, and sedimentation. Texas state performance, design regulations and performance reports from existing and past treatment systems, and research papers on the various aspects of proposed and existing aquatic plant systems. Treatment systems which use vegetation are attractive to designers in part because the plants act as a natural nutrient sink. *Eichhornia crassipes* has essentially the same nutritional requirements as terrestrial plants, but they have adapted their metabolisms to the aquatic environment. The development of the root system depends upon the plant's growth rate, temperature, nutrient content of the water, and operation by modifying the recycle ratio as well as the harvest amount and frequency. *Eichhornia crassipes* is a perennial, vascular plant with larger, rounded, shiny green leaves and a central stalk of violet flowers. Reproduction is generally vegetative. But seeds are also produced by the flowers to help ensure survival.

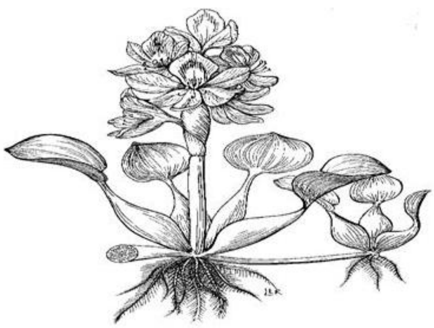

Fig.1: Eichhornia Crassipes

2. LITERATURE REVIEW

Originally from India, *Eichhornia crassipes* (Mart.) Solms, is one of the world's most prevalent invasive *Eichhornia crassipes*. *Eichhornia crassipes* a floating vascular plant, is known to cause major ecological and socio-economic changes (Centre, 1994). It commonly forms dense, interlocking mats due to its rapid reproductive rate and complex root structure (Mitchell, 1985). Water hyacinth reproduces both sexually and asexually. Ten to 100% of existing seeds are found to germinate within six months, with dry conditions promoting germination (Ueki and Oki, 1979). It is prevalent in tropical and subtropical water bodies where nutrient levels are often high due to agricultural runoff, deforestation, and insufficient wastewater treatment. Its success as an invader misattributed to its ability to outcompete native vegetation and phytoplankton for light and its release from consumers found within its native range(Wilson *et al. 2007).*

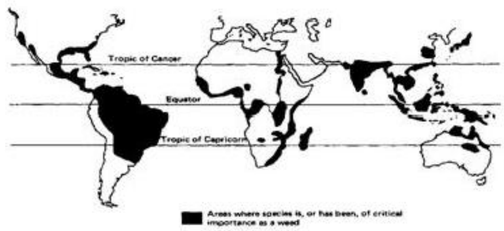

Fig.2 : Growth Area of Water Hyacinth

The depression that depends primarily upon field runoff for its surface water supply and whose only water release mechanism is percolation, evaporation and transpiration. Between these two extremes lie many possible gradations of flooding and drainage that ultimately determine the manageability of individual marshes". The high cost of some conventional treatment processes has produced economic pressures and has caused engineers to search for creative, cost-effective and environmentally sound ways to control water pollution. Rapidly escalating costs of construction and operation associated with conventional treatment facilities.Recognition of the natural treatment functions of *Eichhornia crassipes* systems and wetlands, particularly as nutrient sinks and buffering zones. The first type uses floating plants and is distinguished by the ability of these plants to derive their carbon-dioxide and oxygen needs from the atmosphere directly.

Cadmium exerts toxic effects on the kidney, the skeletal system and the respiratory system and is classified as a human carcinogen. IPCS (2005–2007). It is generally present in the environment at low levels; however, human activity has greatly increased those levels. IPCS (1992). Cadmium can travel long distances from the source of emission by atmospheric transport. WHO(2007). Incineration of municipal waste (especially cadmium-containing batteries and plastics), the kidney is the critical target organ. Cadmium accumulates primarily in the kidneys, and its biological half-life in humans is 10–35 years.

3. EXPERIMENTAL SETUP

Four buckets of plastic material were used for the experiment. Each bucket filled with the waste water, two with GALGOTIAS UNIVERSITY'S WASTEWATER and two by GREATER NOIDAS CANAL WASTEWATER. Each bucket used for *Eichhornia crassipes*, the control of each bucket is used to observe difference in growth rates of among each plant due to uptake contaminants. We are providing sun shine 2hr every day for the respiration and growth of plants.

Each types of wastewater having difference in growth rates among each plant due to uptake contaminants [9].

First of all wastewater sample are collected in the plastic bottles after washing with distilled water. Afterwards, all samples have been centrifuge for 4 min. and it is preserved with the 2 drop of hydrochloric acid in the laboratory, so the metal does not attach to the wall of sampling bottles.

Fig.3: Experimental Setup

Table-1 : Dimension of the Basket

Depth	34 cm
Upper Diameter	29.8 cm
Lower Diameter	27.0 cm
Capacity	25 Lit
Area	907.46 cm^2

4. RESULT AND DISCUSSION

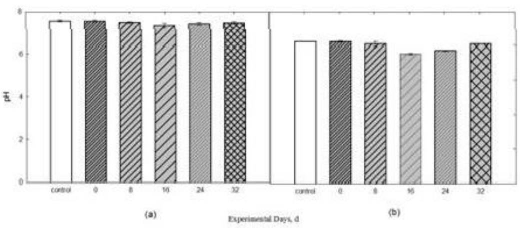

Fig.4: Graph Between pH and Experimental Days
(a) Greater Noida's Drain Wastewater
(b) Galgotias's University Wastewater

Effect on TDS

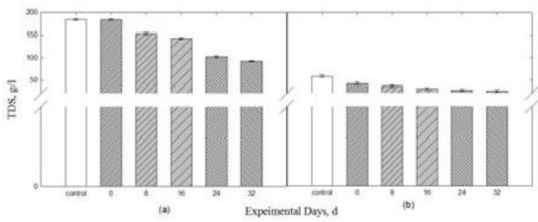

Fig.5: Graph between TDS and Experimental Days
(a) Greater noida's Drain Wastewater
(b) Galgotias's University Wastewater

Effect on Turbidity

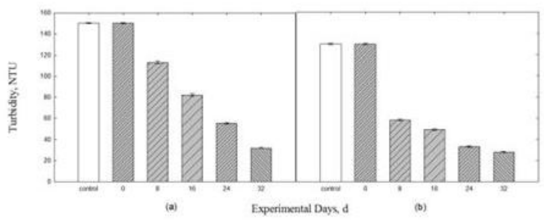

Fig.6: Graph between Turbidity and Experimental Days
(a) Greater Noida's Drain Wastewater
(b) Galgotias's University Wastewater

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Effect on Salinity

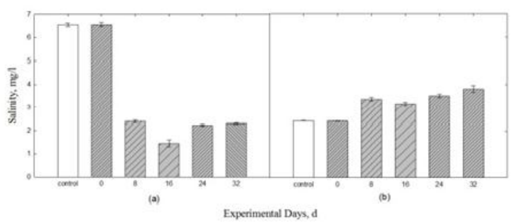

Fig.7: Graph Between Salinity and Experimental Days
(a) Greater Noida's Drain Wastewater
(b) Galgotias's University Wastewater

Effect on Cadmium

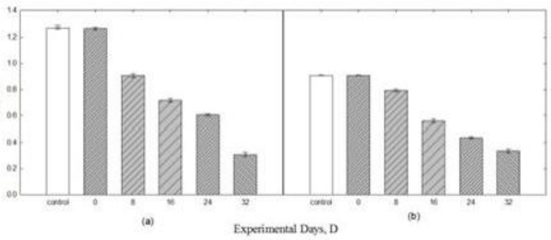

Fig.8: Graph between Cadmium and Experimental Days
(a) Greater Noida's Drain Wastewater
(b) Galgotias's University Wastewater

Effect on Iron

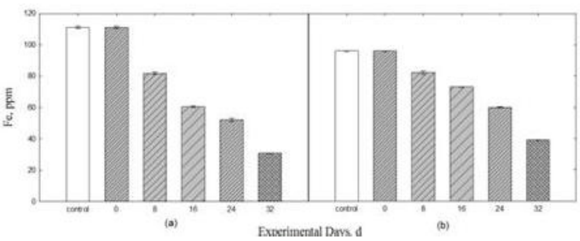

Fig.9: Graph Between Iron and Experimental Days
(a) Greater Noida's Drain Wastewater
(b) Galgotia's University Wastewater

Effect on Copper

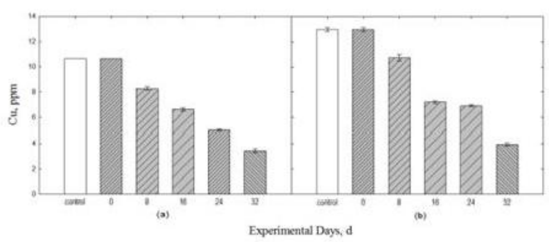

Fig.10: Graph between Copper and Experimental Days
(a) Galgotias's University Wastewater
(b) Wastewater Greater Noida's Drain

5. CONCLUSION

It is shown that mixture of wastewater from In front of Gautam Budha University canal/ Greater Noida's canal Wastewater and Galgotias University sewage treatment plants. The removal efficiency of the Cadmium, Iron and Copper is 74.52%, 75.31% and 67.75% in greater Noida's canal and 73.72%, 74.99 % and 68.37% in Galgotias University's wastewater respectively

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