ISSN 2664-4169 (Print) & ISSN 2664-7923 (Online)
South Asian Research Journal of Biology and Applied Biosciences
Abbreviated Key Title: South Asian Res J Bio Appl Biosci

| Volume-7 | Issue-2 | Mar-Apr -2025 | **DOI: https://doi.org/10.36346/sarjbab.2025.v07i02.015**

Original Research Article

Phytoremediation Zinc Chloride and Manganese Chloride by *Elodea Canadensis* and *Myriophyllum verticillatum*

Qassim Ammar Ahmood AL-Janabi[1*], Rafeef Hasan Marjan[1], Zahraa Falah Hasan[1]
Environmental Pollution Department, Collage of Environment Science, Al-Qasim Green University, Babylon51013, Iraq

***Corresponding Author:** Qassim Ammar Ahmood AL-Janabi
Environmental Pollution Department, Collage of Environment Science, Al-Qasim Green University, Babylon51013, Iraq

Article History
Received: 16.03.2025
Accepted: 23.04.2025
Published: 26.04.2025

Abstract: This study's goal was to remove various concentrations of heavy metal salts, such as manganese and zinc chloride, from some aquatic plants, such as Elodea Canadensis and Myriophyllum verticillatum, over the course of a month. The findings indicated that the concentrations of the components in the aquatic plants used in the test increased at the end of the study in a different manner than those in the control sample.

Keywords: Zinc chloride and Manganese chloride, *Elodea Canadensis* and *Myriophyllum verticillatum*.

INTRODUCTION

Using plants' capacity to concentrate environmental elements and compounds and detoxify a variety of chemicals, phytoremediation is a cost-effective plant-based remediation method [3]. Static water environments and contaminated soil can both benefit from phytoremediation. In order to lessen the impact of contaminants in soils, water, or air, phytoremediation has been successfully applied in the restoration of abandoned metal mine workings, sites where polychlorinated biphenyls were disposed of during manufacturing, and ongoing coal mine discharges [5]. Certain plants known as hyper-accumulators have the capacity to bio-accumulate chemicals, which zincs to the concentrating effect. The remediation effect is quite different. Toxic heavy metals cannot be degraded, but organic pollutants can be and are generally the major targets for Phytoremediation. The viability of employing plants for environmental remediation was validated by a number of field tests [4]. Globally, phytoremediation programs have reduced the levels of contaminants such metals, herbicides, solvents, explosives, and crude oil and its derivatives. Numerous plants have demonstrated the ability to hyper-accumulate pollutants at toxic waste sites, including pigweed, hemp, alpine pennycress, and mustard plants. Because of variations in plant physiology, not all plants can absorb organic contaminants or heavy metals [6]. This technology has been used at locations with soils contaminated with zinc, uranium, and arsenic, and it has been studied more and more. Even cultivars of the same species have different capacities to accumulate pollutants. One significant drawback of phytoremediation is that it necessitates a long-term commitment since it depends on a plant's capacity to grow and survive in an environment that is not optimal for typical plant growth, even if it has the benefit of allowing environmental concerns to be addressed in situ [7].

MATERIALS AND METHODS

In order to test the ability of two plants—Myriophyllum verticillatum and Elodea Canadensis—to eliminate varying concentrations of the salts zinc chloride and manganese chloride, 50 g of each plant's fresh weight was taken, and the plants were grown in ten plastic containers with a combined capacity of fifteen liters. (10) liters of water with three distinct quantities of salts (10, 20, 30 mg/liter) (nickel chloride, manganese chloride, cobalt chloride, and zinc chloride) are contained in each container. To ascertain the elimination percentage, samples of the experiment's plants were taken a month later and subjected to varying element salt concentrations [8]. Flame atomic spectrometry was used to quantify the heavy elements in plant and water samples [9].

RESULTS & DISCUSSION

Figure 1 illustrates the accumulation of zinc in the aquatic plant Myriophyllum verticillatum (1.438, 1.841, 2.129) in comparison to the control, while the concentration of zinc in the plant Elodea Canadensis (1.438, 1.841, 2.186) in comparison to the control. The study's findings indicated an increase in the concentration of heavy elements in the aquatic plants at the end of the experiment. Figure (2) illustrates the accumulation of Manganese in the aquatic plant Myriophyllum verticillatum (1.316, 1.684, 2.007) and the concentration of zinc in the plant Elodea Canadensis (1.465, 1.873, 2.228) in comparison to the control. The study's findings also demonstrated an increase in the concentration of heavy elements in the aquatic plants under investigation at the conclusion of the experiment.

Figure (3) illustrates the percentage of zinc removal in the aquatic plant Myriophyllum verticillatum (25.357, 21.922, 18.9425) in comparison to the control, and the percentage of zinc removal in the plant Elodea Canadensis (21.983, 18.091, 16.811) in comparison to the control. These findings demonstrate the percentage of removal of heavy elements in the aqueous solution at the conclusion of the experiment. The percentage of Manganese elimination in the aquatic plant Myriophyllum verticillatum (27.781, 24.353, 21.928) and the plant Elodea Canadensis (24.715, 22.891, 20.091) in comparison to the control was also displayed in Figure (4).

It demonstrates how the aquatic plants being studied can either absorb large quantities of the element and change into inactive vacuoles, accumulate this element in their tissues, or have a special ability to endure high concentrations of the element [10]. The natural equilibrium of heavy metals in plants. The enzyme phytochelatin synthase does this by activating the presence of heavy element ions using glutathione as a basic material. [12] It should be mentioned that a variety of external factors, including salinity, pH, the effectiveness of complex organic and inorganic molecules, and their effects on the physical and chemical processes that control the rate of metabolic processes, including temperature, oxygen content, and light intensity, all affect the concentration of heavy metals in living things' tissues. The element's ambient concentration, environmental characteristics, organism type, and exposure time all have an impact on bioaccumulation. The results of the study showed that at the end of the trial, the total amount of chlorophyll in the aquatic plants under examination had dropped. This is due to the presence of these highly poisonous compounds in the experimental plants, which can accumulate in plant tissue [13]. It does this by inhibiting the enzymes that make it, such as aminolevulinic acid dehydratase and porphobilinogen deaminise, which creates porphyrin. exposed to the enzymatic impacts of these elements [15]. Studies have demonstrated that the production of chlorophyll, the process of photosynthesis, and the synthesis of other colours such as carotene and efficacy all affect certain heavy metals [14]. Because the enzymes that help with the synthesis of carotene and chlorophyll are inhibited, the amount of chlorophyll in plant tissues decreases as the concentration of heavy metals increases. By installing certain enzymes, Nasser facilitates the synthesis of chlorophyll [16].

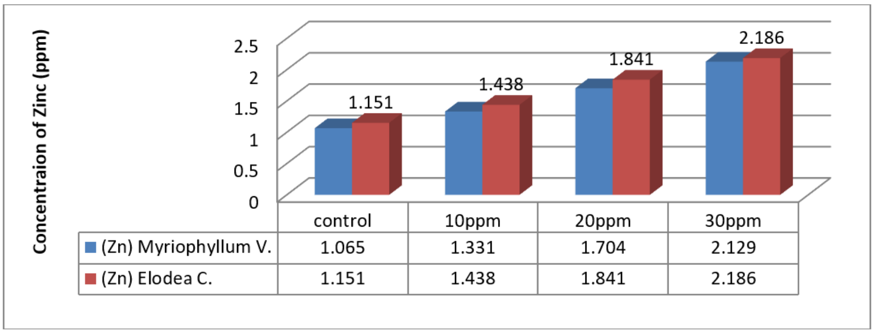

Figure 1: Showed the accumulation of Zinc in Myriophyllum verticillatum and Elodea Canadensis tissues

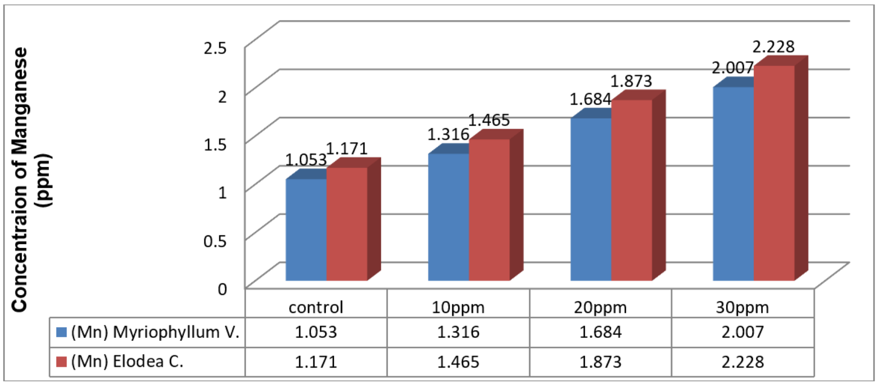

Figure 2: Showed the accumulation of Manganese in Myriophyllum verticillatum and Elodea Canadensis tissues

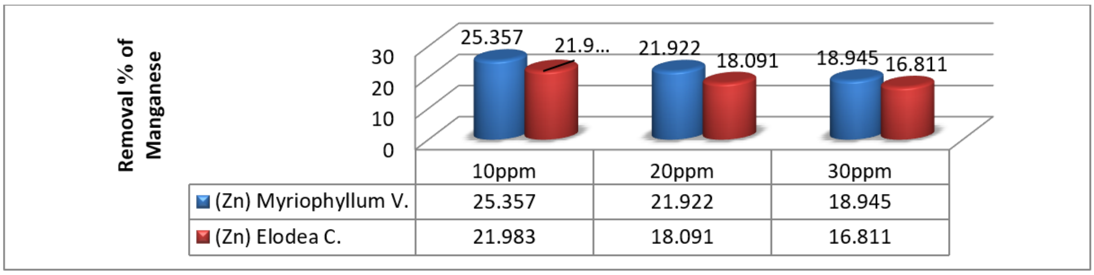

Figure 3: Showed the percentage removal of Zinc by Myriophyllum verticillatum and Elodea Canadensis

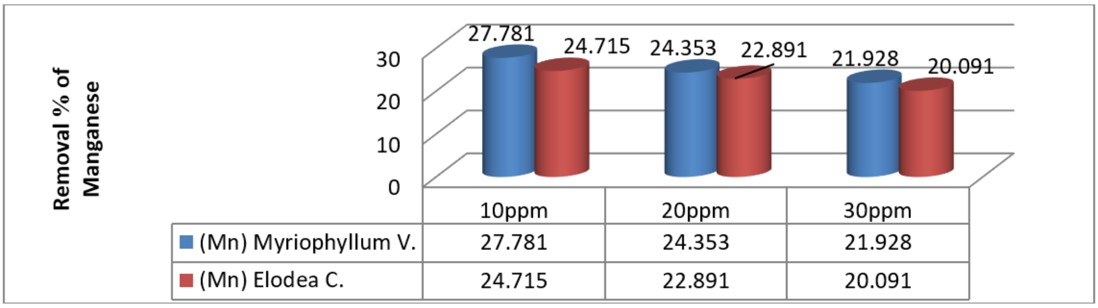

Figure 4: Showed the percentage removal of Manganese by Myriophyllum verticillatum and Elodea Canadensis tissues

CONCLUSIONS AND RECOMMENDATIONS

Growth processes are adversely affected by heavy metals, and the consequences worsen as the pollutant's concentration rises concurrently. The choice of plant species is based on the kind of pollutant and its concentration in the environment. Plants are an efficient biological agent for eliminating pollutants from highly polluted settings.

REFERENCES

1. Qassim A. Ahmood and Mohammed H. Al-Jawasim (2019). EFFECTS OF HEAVY METALS ON PHYSIOLOGICAL STATUS OF PLANTS. *Plant Archives* Vol. 19 No. 2, 2019 pp. 2865-2871 e-ISSN:2581-6063 (online), ISSN:0972-5210.
2. El-Khatib A, Hegazy A, Abo-El-Kassem AM (2014). Bioaccumulation Potential and Physiological Responses of Aquatic Macrophytes to Pb Pollution. International Journal of Phytoremediation,16(1):29-45.
3. Bhardwaj R, Gupta A, Garg JK.(2017). Evaluation of heavy metal contamination using environmetrics and indexing approach for River Yamuna, Delhi stretch, India. Water Science. 2017;31(1):52-66.
4. Saha P, Shinde O, Sarkar S.(2017). Phytoremediation of industrial mines wastewater using water hyacinth. International Journal of Phytoremediation. 2017;19(1):87-96.
5. Ghosh A, Dastidar MG, Sreekrishnan TR. Bioremediation of chromium complex dyes and treatment of sludg generated during the process. International Biodeterioration & Biodegradation. 2017;119:448-60.
6. Ahmad ZU(2015). Phytoremediation of heavy metal contaminated soil using Indian mustard and marigold plant. Department of Civil Engineering, Bangladesh University of Engineering and Technology. 2015; 70.
7. Bhardwaj R, Gupta A, Garg JK.(2017). Evaluation of heavy metal contamination using environmetrics and indexing approach for River Yamuna, Delhi stretch, India. Water Science. 2017;31(1):52-66.
8. Ghosh A, Dastidar MG, Sreekrishnan TR. Bioremediation of chromium complex dyes and treatment of sludg generated during the process. International Biodeterioration & Biodegradation. 2017; 119:448-60.
9. Qassim A. A. AL-Janabi, Saad Kadhim A. Al- Kalidy& Zaid B. Hameed (2021). Effects of heavy metals on physiological status for Schoenoplectus litoralis & Salvinia natans *L* 1st INTERNATIONAL VIRTUAL CONFERENCE OF ENVIRONMENTAL SCIENCES IOP Conf. Series: Earth and Environmental Science **722** (2021) 012012 IOP Publishing doi:10.1088/1755-1315/722/1/012012.
10. Kumar B, Smita K, Flores LC. Plant mediated detoxification of mercury and zinc. Arabian Journal of Chemistry. 2017; 10:S2335-42. Mahar A, Wang P, Ali A, Awasthi MK, Lahori AH, Wang Q, Li R, Zhang Z. Challenges and opportunities in the phytoremediation of heavy metals contaminated soils: A review. Ecotoxicology and Environmental Safety. 2016;126: 111-21.
11. Mahar A, Wang P, Ali A, Awasthi MK, Lahori AH, Wang Q, Li R, Zhang Z. Challenges and opportunities in the phytoremediation of heavy metals contaminated soils: A review. Ecotoxicology and Environmental Safety. 2016;126: 111-21

12. Mohammed E. Al Defferi1, Qassim A. AL-Janabi, Sama A. Mustafa and Ali K. AL-Muttarri (2019). PHYTOREMEDIATION OF ZINC AND NICKEL BY *BASSIA SCOPARIA*. *Plant Archives* Vol. 19 No. 2, 2019 pp. 3830-3834 e-ISSN:2581-6063 (online), ISSN:0972-5210.
13. Vijayaraghavan K, Arockiaraj J, Kamala- Kannan S. *Portulaca grandiflora* as green roof vegetation: Plant growth and phytoremediation experiments. International Journal of Phytoremediation. 2017;19(6):537-44.
14. Qassim A. Ahmood and Mohammed H. Al-Jawasim (2019). EFFECTS OF HEAVY METALS ON PHYSIOLOGICAL STATUS OF PLANTS. *Plant Archives* Vol. 19 No. 2, 2019 pp. 2865-2871 e-ISSN:2581-6063 (online), ISSN:0972-5210.