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Original Research Article

Effect of Manganese Chloride and Zinc Chloride on Physiological Characteristics of *Myriophyllum verticillatum and Schoenoplectus litoralis*

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Abstract: The purpose of the study was to evaluate the effects of varying concentrations of manganese and zinc chloride (10, 20, and 30 mg/L) on the physiological traits of Schoenoplectus litoralis and Myriophyllum verticillatum, as well as to measure the levels of total chlorophyll and protein content. The study was conducted for one month. The research results demonstrated that the water plants used for the investigation had higher component concentrations at the conclusion of the investigation when compared to the control sample. Additionally, the water plants exposed to the effects of heavy metals had lower levels of protein and chlorophyll.

Keywords: Manganese, Zinc, Myriophyllum V, Schoenoplectus L, Protein and Chlorophyll.

INTRODUCTION

Because aquatic plants have a fundamental role in influencing the aquatic ecosystem, they are especially important in addressing the major environmental concern posed by heavy metal pollution of the water [1]. Using plants in treatment is a novel way to remove pollutants since some plants have genetic, chemical, and physiological properties that do not harm the environment, unlike chemicals, which are detrimental to the environment when used to treat contaminated water [2]. Different plant families have been utilized as biological evidence to examine water pollution with heavy metals because of the diversity of aquatic plants, their widespread distribution in water bodies, and their good tolerance to changing environmental conditions. Because of their propensity to extract heavy elements from water and accumulate them in tissues, they have also found widespread application in the bio-filtration industry [3]. Phytoremediation is the technique of employing plants to remove contaminants from wastewater, surface water, groundwater, and soil because plants' biological processes aid in the process of "green treatment." Several of these plants provide strong evidence of heavy element contamination in water because they have a greater capacity to store heavy elements in their tissues than in the aquatic environment, In addition to their rapid growth and low environmental requirement for adaptation to a wide range of habitats [4]. Different amounts of heavy metals can accumulate in different plant bodies, depending on the species of the plant and the organ under investigation [5, 6]. In natural systems, elements are absorbed by plants more slowly and as dissolved complexes, which are contingent upon the chemical and physical parameters of their immediate surroundings [7]. This has a significant impact on procedures pertaining to element ion absorption [8]. Due to interference in the ion transport system between the two types of elements brought on by similarities in the chemical properties of minerals, some plants accumulate high concentrations of both essential and non-essential elements in their tissues, rendering the plant unable to discriminate between the two types of elements [9, 10]. Since these plants can extract elements from the substrate at far higher rates than normal plants, they are referred to as hyper-accumulators [11]. To become resistant to high element concentrations, these plants bind to peptides called Phytochelatin, which have the (-SH) group [12]. The purpose of this study was to look at how zinc and manganese chloride affected the growth and physiological characteristics of *Myriophyllum verticillatum and Schoenoplectus litoralis*.

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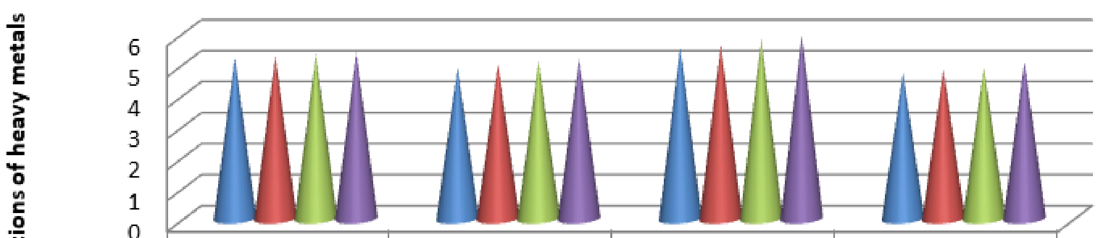
MATERIALS AND METHODS

The objective of the study was to ascertain whether aquatic plants like Schoenoplectus litoralis and Myriophyllum verticillatum might eliminate certain heavy metals. Each plant was given a weight of 500 grams, and they were raised separately in 15-liter plastic containers. Ten liters of water tainted with manganese and zinc chloride at three distinct concentrations (10, 20, and 30 mg/liter) were contained in each container [13, 14]. The study lasted a month in accordance with the required test, with samples being taken every 10 days. Plant samples were collected from the ponds in order to determine the amounts of heavy metals, protein, and chlorophyll. The total chlorophyll content and protein level in aquatic plant tissues were measured using methods [15, 16].

RESULTS AND DISCUSSION

The results of the study showed an increase in the concentration of heavy elements in the studied aquatic plants at the end of the experiment. Figure (1) shown accumulation of manganese chloride and zinc chloride (5.349 and 5.173) compared with the control (5.199 and 4.893) respectively in the aquatic plant *Myriophyllum Canadensis* tissues where concentrations of manganese chloride and zinc chloride in the aquatic plant *Schoenoplectus litoralis* tissues (5.934 and 5.078) compared with the control (5.552 and 5.726) respectively. In other words, the aquatic plant Schoenoplectus litoralis has a higher lead chloride accumulation than the aquatic plant Myriophyllum Canadensis, but the aquatic plant Myriophyllum Canadensis has a higher accumulation of cadmium chloride in its tissues, this indicates that the studied aquatic plants have the ability to retain this substance within the plant tissues, or that they have a unique way of carrying a large amount of elements, or that they take elements in high concentrations, which are converted into inactive forms of vacuoles. The differences in the concentration of elements collected within the plant bodies may be due to differences in plant species, the physiological state of the plant, and the reception of the element. Plants exposed to heavy metals develop phytoplankton, which hinders their ability to detoxify and maintain a healthy balance of heavy elements. Note that a variety of external conditions, such as salinity, pH level, and the efficiency of complex organic and inorganic compounds, affect the physical and chemical processes that regulate the rate of accumulation of heavy metals in the tissues of the organism, as well as metabolic processes such as oxygen content, light intensity, and temperature. In addition, the level of the element in the natural environment and the characteristics of the environment affect bioaccumulation [17-19].



	(Mn) Myriophyllum V.	(Zn) Myriophyllum V.	(Mn) Schoenoplectus L.	(Zn) Schoenoplectus L.
control	5.199	4.893	5.552	4.726
10ppm	5.261	4.973	5.617	4.838
20ppm	5.322	5.085	5.809	4.904
30ppm	5.349	5.173	5.934	5.078

Figure 1: Concentrations of manganese chloride and zinc chloride in *Myriophyllum verticillatum and Schoenoplectus litoralis* tissues

The results of the study showed a decrease in the total concentration of chlorophyll in the studied aquatic plants at the end of the experiment, figure (2) shown the concentration of chlorophyll in the aquatic plants *Schoenoplectus litoralis* in concentration 30 ppm of manganese chloride and zinc chloride (2.278 and 2.429) compared with the control (2.719 and 2.871) respectively where concentrations of manganese chloride and zinc chloride in the aquatic plant *Myriophyllum Canadensis* tissues (2.058 and 2.016) compared with the control (2.497 and 2.438) respectively, one of the reasons that lead to a decrease in the amount of chlorophyll in plant tissues is exposure to different concentrations of heavy metals, which lead to inhibition of enzymes involved in the synthesis of carotene and chlorophyll, which leads to a decrease in the amount of chlorophyll in plant tissues in addition to inhibiting a small number of enzymes that help in the synthesis of chlorophyll [20, 21].

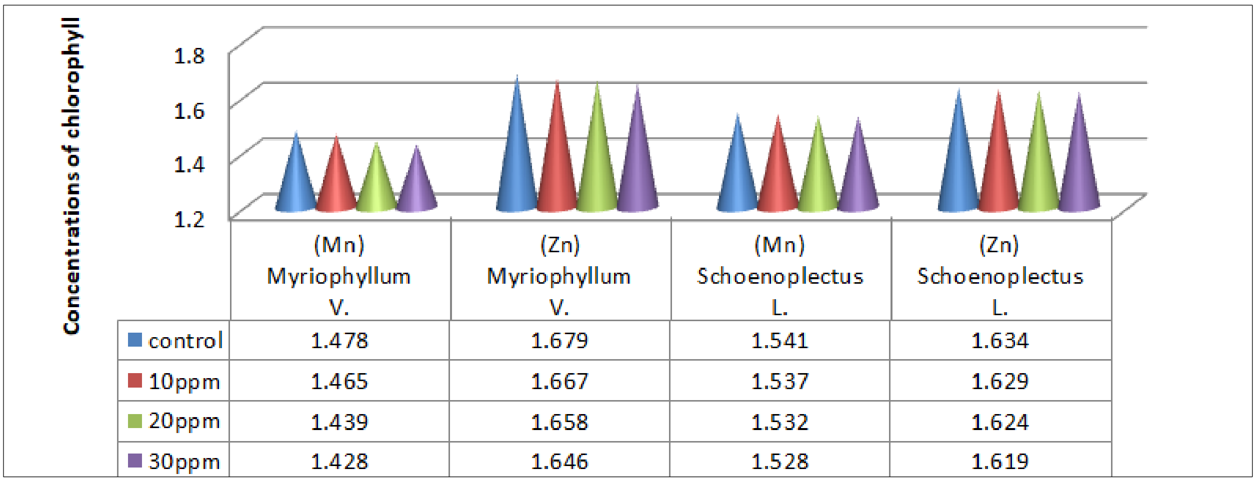


Figure 2: Concentration of chlorophyll in *Myriophyllum verticillatum and Schoenoplectus litoralis* tissues

Figure (3) shown The protein content in the aquatic plants *Schoenoplectus litoralis* in concentration 30 ppm of manganese chloride and zinc chloride (2.445 and 2.420) compared with the control (2.901 and 3.879) respectively in the aquatic plant *Schoenoplectus litoralis* tissues where concentrations of manganese chloride and zinc chloride in the aquatic plant *Myriophyllum Canadensis* tissues (2.824 and 2.747) compared with the control (3.286 and 3.212) respectively the reason for the decrease in protein content in the tissues of these plants is due to its consumption of some basic activities or metabolic processes that take place within them to withstand the concentration of elements, which leads to a decrease in the percentage of protein content in their tissues and is directly proportional to the time of exposure [22, 23].

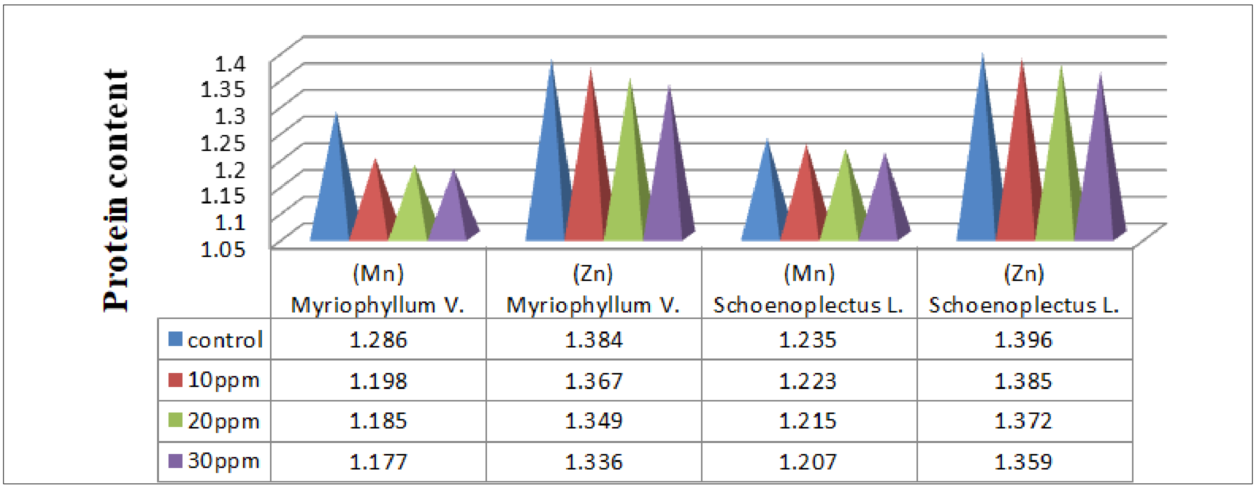


Figure 3: Protein content in Myriophyllum verticillatum and Schoenoplectus litoralis tissues

CONCLUSION

In comparison to Schoenoplectus litoralis, the aquatic plant Myriophyllum Canadensis exhibits a greater accumulation of zinc chloride in its tissues, Conversely, Schoenoplectus litoralis exhibits a higher accumulation of manganese chloride in its tissues than Myriophyllum Canadensis. Schoenoplectus litoralis and Myriophyllum verticillatum levels of protein and chlorophyll were most significantly lowered by the metals. When selecting plant species, the type of plants are an efficient biological instrument for eliminating pollutants from highly polluted areas.

REFERENCES

1. Abdallah, M. A. M. (2012). Phytoremediation of heavy metals from aqueous solutions by two aquatic macrophytes, Ceratophyllum demersum and Lemna gibba L. *Environmental technology*, *33*(14), 1609-1614.
2. Ahmood AL-Janabi, Q. A., AL-Karim Qasim, M. A., & Mohammed, R. T. (2024). Effect of Zinc and Manganese chlorides on *Schoenoplectus litoralis and Elodea Canadensis* physiological status, *South Asian Research Journal of Agriculture and Fisheries*, 6.
3. Falinski, K. A., Yost, R. S., Sampaga, E., & Peard, J. (2014). Arsenic accumulation by edible aquatic macrophytes. *Ecotoxicology and environmental safety*, *99*, 74-81.

4. Abioye, O. P., Agamuthu, P., & Abdul Aziz, A. R. (2012). Phytotreatment of soil contaminated with used lubricating oil using Hibiscus cannabinus. *Biodegradation*, *23*, 277-286.
5. Das, S., Goswami, S., Talukdar, A. D. (2013). A Study on Cadmium Phytoremediation Potential of Water Lettuce, Pistia stratiotes L. Bulletin of environmental contamination and toxicology, 1-6.
6. Bhardwaj, R., Gupta, A., & Garg, J. K. (2017). Evaluation of heavy metal contamination using environmetrics and indexing approach for River Yamuna, Delhi stretch, India. *Water science*, *31*(1), 52-66.
7. El-Khatib, A. A., Hegazy, A. K., & Abo-El-Kassem, A. M. (2014). Bioaccumulation potential and physiological responses of aquatic macrophytes to Pb pollution. *International Journal of Phytoremediation*, *16*(1), 29-45.
8. AL-Janabi, Q. A. A., Hameed, Z. B., Ala, S. K., & Al-Kalidy, A. (2019). Effect of Heavy Metals on the Protein and Chlorophyll Content of Phragmitus australis and Typha domingensis. *Indian Journal of Ecology*, *46*(8), 65-71.
9. Bianconi, D., Pietrini, F., Massacci, A., & Iannelli, M. A. (2013). Uptake of Cadmium by Lemna minor, a (hyper?-) accumulator plant involved in phytoremediation applications. In *E3S Web of conferences* (Vol. 1, p. 13002). EDP Sciences.
10. Mohammed, E. Al. D., Qassim, A., AL-Janabi, S. A. M., & Ali, K. AL-Muttarri. (2019). Phytoremediation of Lead and Nickel by *Bassia Scoparia. Plant Archives*, *19*(2), 3830-3834.
11. Borne, K. E., Fassman-Beck, E. A., & Tanner, C. C. (2014). Floating treatment wetland influences on the fate of metals in road runoff retention ponds. *Water research*, *48*, 430-442.
12. Hadiyanto, M. C., Soetrisnanto, D., & Christwardhana, M. (2013). Phytoremediations of palm oil mill effluent (POME) by using aquatic plants and microalgae for biomass production. *Journal of Environmental Science and Technology*, *6*(2), 79-90.
13. Qassim Ammar Ahmood AL-Janabi, Mohammed Raheem Tarrad & Mustafa Abdul AL-Karim Qasim (2024). Effects of cadmium and lead on physiological characteristics of Schoenoplectus litoralis and Elodea Canadensis, *South Asian Journal of Agricultural Sciences*.
14. Ghosh, A., Dastidar, M. G., & Sreekrishnan, T. R. (2016). Bioremediation of a chromium complex dye using Aspergillus flavus and Aspergillus tamarii. *Chemical Engineering & Technology*, *39*(9), 1636-1644.
15. Al-Janabi, Q. A., Al-Kalidy, S. K. A., & Hameed, Z. B. (2021, April). Effects of heavy metals on physiological status for Schoenoplectus litoralis & Salvinia natans L. In *IOP Conference Series: Earth and Environmental Science* (Vol. 722, No. 1, p. 012012). IOP Publishing.
16. Ghosh, A., Dastidar, M. G., & Sreekrishnan, T. R. (2017). Bioremediation of chromium complex dyes and treatment of sludge generated during the process. *International Biodeterioration & Biodegradation*, *119*, 448-460.
17. Kumar, B., Smita, K., & Flores, L. C. (2017). Plant mediated detoxification of mercury and lead. *Arabian Journal of Chemistry*, *10*, S2335-42. Mahar, A., Wang, P., Ali, A., Awasthi, M. K., Lahori, A. H., Wang, Q., Li, R., & Zhang, Z. (2016). Challenges and opportunities in the phytoremediation of heavy metals contaminated soils: A review. *Ecotoxicology and Environmental Safety*, *126*, 111-21.
18. Qassim, A. A., &. Al-Jawasim, M. H (2019). Effects of Heavy Metals on Physiological Status of Plants. *Plant Archives*, *19*(2), 2865-2871.
19. Mohammed, R. T., Qassim, A. A. AL. J., & M. A. AL. Karim, Q. (2024). Effect of cobalt chloride on the protein content and chlorophyll for schoenoplectus litoralis and elodea Canadensis. *International Journal of Biology Research*, *9*(1), 22-24
20. Mahar, A., Wang, P., Ali, A., Awasthi, M. K., Lahori, A. H., Wang, Q., ... & Zhang, Z. (2016). Challenges and opportunities in the phytoremediation of heavy metals contaminated soils: A review. *Ecotoxicology and environmental safety*, *126*, 111-121.
21. Qassim, A. A. AL Janabi., Ahmed, H. A. S., & M. A. Hussein Kazem (2024). Effect of some heavy metals on the protein content and chlorophyll for Myriophyllum verticillatum and Hydrilla verticillata. *International Journal of Environmental and Ecology Research*, *6*(1), 17-21.
22. Saha, P., Shinde, O., & Sarkar, S. (2017). Phytoremediation of industrial mines wastewater using water hyacinth. *International journal of phytoremediation*, *19*(1), 87-96.
23. Qassim Ammar Ahmood AL-Janabi, Mustafa Abdul AL-Kareem Qasim, Mohammed Raheem Tarrad. (2024). Effect of nickel chloride on the protein content and chlorophyll for *Schoenoplectus litoralis* and *Elodea Canadensis.* International Journal of Ecology and Environmental Sciences, 6(3), 29-33.