International Journal of Biology Research
www.biologyjournal.in
ISSN: 2455-6548
Received: 27-09-2024, Accepted: 28-10-2024, Published: 12-11-2024
Volume 9, Issue 1, 2024, Page No. 35-37

Testing the efficiency of *Phragmitus australis* in reduce Nickel(ii) chloride and Cobalt(ii) chloride concentrations

Qassim Ammar Ahmood AL-Janabi*, Hasan Ahmed Ali Albieg, Hasansin Ali Talib AL-Masudi
Department of Environment, Collage of Environment Science, Al-Qasim Green University, Iraq

Abstract
The present study was conducted to determine the ability of Phragmitus australis plant to reduce the concentration of metals in its solutions, where Phragmitus australis plant was exposed to three different concentrations (10, 20, 30) ppm of Nickel(II) chloride and Cobalt(II) chloride concentrations for 30 days. The results of the study showed an increase in the concentration of zinc and iron in Phragmitus australis tissues at the end of the study compared to the control.

Keywords: Nickel(II) chloride, Cobalt (II) chloride, physiological, and response plants

Introduction

The ability to absorb and accumulate heavy metal pollutants in waterbodies is possessed by a number of macrophytes, or aquatic plants, that thrive in ponds and streams [1]. A greater concentration of heavy metals in water supplies has deleterious consequences on all living things, even though aquatic plants need them to develop [2]. By removing heavy metals from contaminated water sources, macrophytes function as a natural filter, or biofilter. Contaminated water is biofiltered by the macrophytes' bioaccumulation and biomagnification of heavy metallic ions [3]. Bioaccumulation and biosorption are the methods by which heavy metals are absorbed by plant species. The affinity of aquatic plants for heavy metals determines their absorption capacity. Accumulates the absorbed metal ion in various parts of it, The process is simple and cost-effective [4]. The plants are also suitable for usage in soils and water that have been tainted by chemicals, organic solvents, radioactive materials, chemical fertilizers, pesticides, etc. Using Azolla caroliniana, a cultured solution of chromium and mercury ions was treated [5]. The heavy metals were easily captured in an environmentally responsible manner using the phytoremediation procedure. Plant tissues or roots are where heavy metals accumulate and break down innocuously [6]. Therefore, a large amount of heavy metals are stored using botanical organisms in phytoremediation processes. Changing the pH causes the active metal–ligand complex to be destroyed, which removes the heavy metals that have been absorbed from beetroot fibers. This led to the effective removal of the metal from aquatic biomass [7]. Benefits of beetroot fiber biofilters include their inexpensive cost, ability to function throughout a broad pH and temperature range, effectiveness in treating hardness and salt in water, and removal of low concentration metal pollutants [8]. The greater humic acid content of these plant parts is thought to be the cause of their ability to bind metals and retain water. In the acquisition of heavy metals from polluted water, Phragmites australis and Typha latifolia have demonstrated synergistic effects [9]. A viable sustainable method for wastewater treatment is the use of macrophytes to facilitate the bioaccumulation and natural biodegradation of heavy metals [10]. According to this strategy, heavy metals should be completely removed by plant species. Furthermore, the research demonstrates that consumers may be impacted by greens cultivated in contaminated water [11].

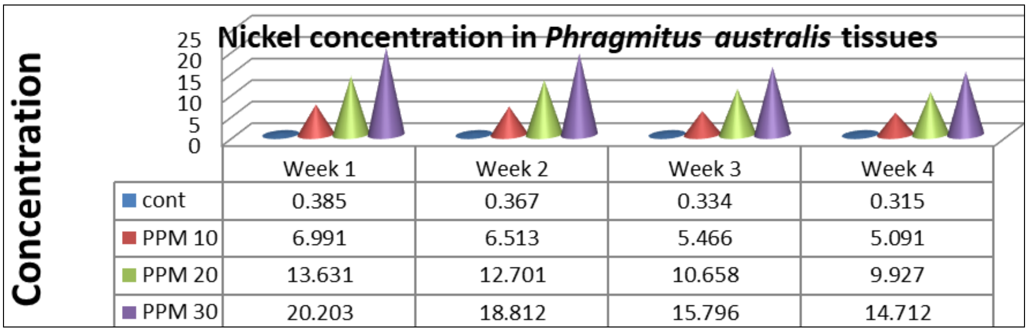
Materials and Methods

The purpose of the experiment was to determine whether the Phragmitus australis plant could lower the concentrations of lead and cadmium chloride by weighing 50 g of the plant. Each plant was planted separately in four ten-liter plastic pots. According to the necessary test, growth monitoring and sampling continued for four weeks. Weekly plant samples were taken from the ponds to estimate the concentrations of heavy metals in aquatic plant tissues and the rate at which nickel (II) chloride and cobalt (II) chloride concentrations were removed.

Results & Discussion

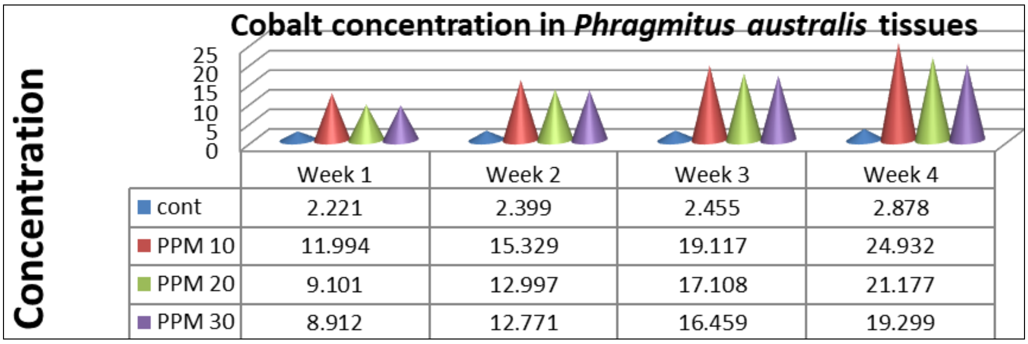
The results showed that Phragmitus australis was accumulating the element. Ni Figure 1, due to the fact that aquatic plants take heavy elements from sediments and water for the purpose of growth and development, and they also work to accumulate some toxic elements that have no importance in the plant, the Figure (2) showed that Phragmitus australis is accumulating the element Co. These findings support the hypothesis put forth by Guo-Xin *et al*. (2005) that the ability of aquatic plants to tolerate varying concentrations of heavy elements and to continue growing is due to the potential for a balance in the levels of both molecular and enzymatic antioxidants, including proline, peroxidase, total phenols, and others, as well as the potential for an increase in the secretion of cellular metabolic products like glutamine and cysteine. In contrast, Al-Wahaibi (2007) reported that when plants absorb heavy elements, they promote the production of plant compounds called plant chelates, which encircle the polluting element atoms and hold them in vacuoles found in plant tissues' cells or through the cells of plants and animals. These compounds are crucial in eliminating toxicity because they bind to the elements inside the cell. These components can be kept from building up at the target areas by being transformed into inert forms (harmless salt crystals) and then stored in insensitive locations like vacuoles or transformed into other non-toxic forms that can be dispersed and utilized once more in metabolic processes (Memon *et al*., 2000).

The results showed that the highest removal rate of Ni was at a concentration of 10 ppm compared to other concentrations as in Figure (3), and the highest removal rate of Co was at a concentration of 10 ppm also compared to other concentrations as in Figure (4), and the removal rate of lead was higher than cadmium by Phragmitus australis, which means that plant tissues affect the adsorption and absorption processes and the ability of aquatic plants to accumulate heavy elements, The hazardous elements are attached to the cell walls in the roots or leaves, which stops them from moving through the plant sap. Alternatively, they are ejected to insensitive locations within the cell or stored in the gaps by a unique process. This is how the elements build up inside the plant body. According to research on the papyrus Typha domingensis, the thousand-leaf Myriophyllum verticillatum, and Ceratophyllum dimerism, the quantities of these elements in aquatic plants are higher than those in water (Alkam 2002, Salman 2006). In addition to variations in the physiological, chemical, and molecular mechanisms of the accumulation process, the bioaccumulation of heavy elements in plant tissues is contingent upon the species of the plant, the physical and chemical characteristics of the soil and water, and the specificity of element absorption and transfer (Scheers, 2013). Because plant tissues undergo adsorption and absorption processes, they are more suited to represent pollution than water (Guo-Xin *et al*., 2005).



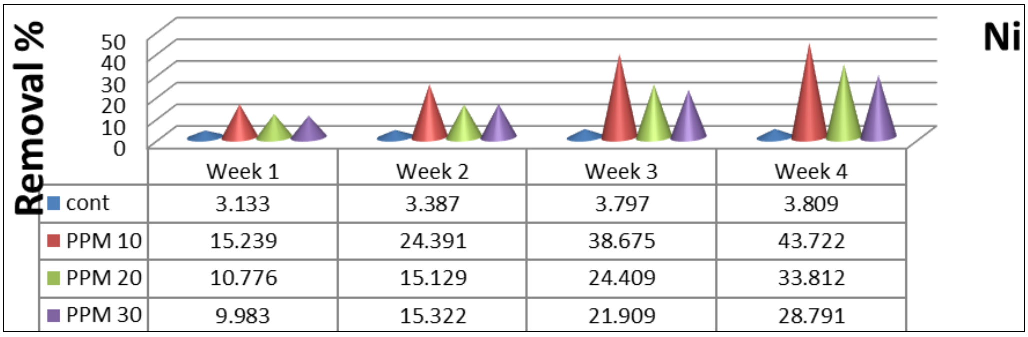
	Week 1	Week 2	Week 3	Week 4
cont	0.385	0.367	0.334	0.315
PPM 10	6.991	6.513	5.466	5.091
PPM 20	13.631	12.701	10.658	9.927
PPM 30	20.203	18.812	15.796	14.712

Fig 1: Variation in Nickel concentration during the experiment period in *Phragmitus australis* tissues (mg/g dry weight)



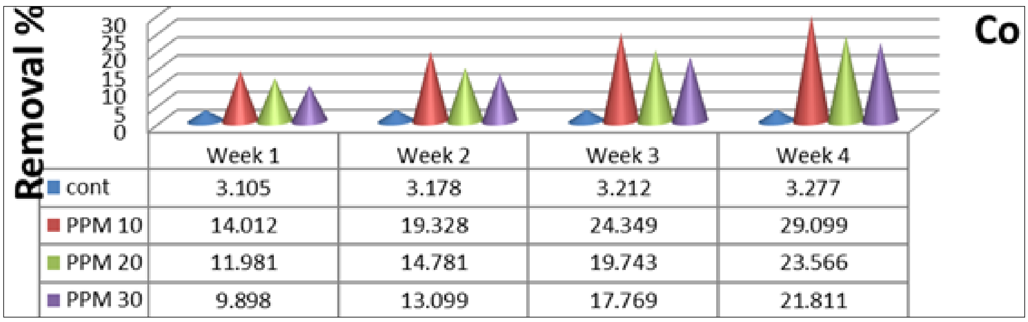
	Week 1	Week 2	Week 3	Week 4
cont	2.221	2.399	2.455	2.878
PPM 10	11.994	15.329	19.117	24.932
PPM 20	9.101	12.997	17.108	21.177
PPM 30	8.912	12.771	16.459	19.299

Fig 2: Variation in Cobalt concentration during the experiment period in *Phragmitus australis* tissues (mg/g dry weight)



	Week 1	Week 2	Week 3	Week 4
cont	3.133	3.387	3.797	3.809
PPM 10	15.239	24.391	38.675	43.722
PPM 20	10.776	15.129	24.409	33.812
PPM 30	9.983	15.322	21.909	28.791

Fig 3: Percentage of removal nickel from its aqueous solutions by the *Phragmitus australis* plant



	Week 1	Week 2	Week 3	Week 4
cont	3.105	3.178	3.212	3.277
PPM 10	14.012	19.328	24.349	29.099
PPM 20	11.981	14.781	19.743	23.566
PPM 30	9.898	13.099	17.769	21.811

Fig 4: Percentage of removal of cobalt from its aqueous solutions by the *Phragmitus australis* plant

References

1. Abd Allah EF, Hashem A, Alqarawi A, *et al*. Calcium application enhances growth and alleviates the damaging effects induced by Cd stress in sesame (*Sesamum indicum* L.) J. Plant Interact,2017:12(1):237–243.
2. Qassim Ammar Ahmood AL Janabi, Ahmed Hadi Abdul Saheb, Muhammad Abdul Hussein Kazem. Effect of some heavy metals on the protein content and chlorophyll for *Myriophyllum verticillatum* and *Hydrilla verticillata* International Journal of Environmental and Ecology Research,2024:6(1):17-21.
3. Awasthi P, Mahajan V, Jamwal VL, *et al*. Cloning and expression analysis of chalcone synthase gene from Coleus forskohlii. J. Genet, 2016.
4. Cheng YF, Wei HM, Sun R, *et al*. Rapid method for protein quantitation by Bradford assay after elimination of the interference of polysorbate 80[J] Anal Biochem,2016:494:37–39.
5. Deng F-F, Yang S-L, Gong M. Regulation of proline metabolism in abiotic plants by cell signaling molecules [J] J. Plant Physiol,2015:51(10):1573–1582.
6. Qassim Ammar Ahmood AL-Janabi, Mustafa Abdul AL-Kareem Qasim, Mohammed Raheem Tarrad. Effect of nickel chloride on the protein content and chlorophyll for *Schoenoplectus litoralis* and *Elodea Canadensis.* International Journal of Ecology and Environmental Sciences,2024:6(3):29-33.
7. Jia L, Liu Z, Chen W, Ye Y, Yu S, He XY. Hormesis effects induced by cadmium on growth and photosynthetic performance in a hyperaccumulator, Lonicera japonica. Thunb. J Plant Growth Regul,2015:34(1):13–21.
8. Liyuan Li, Jun Li, Xiao-juan T, *et al*. Photosynthetic light response simulation of leaves of Quercus variabilis and Robinia pseudoacacia under different light environments[J] Chin. J. Appl. Ecol,2016:29(7):2295–2306.
9. Mohammed Raheem Tarrad, Qassim Ammar Ahmood AL Janabi, Mustafa Abdul AL Karim Qasim. Effect of cobalt chloride on the protein content and chlorophyll for *schoenoplectus litoralis and elodea Canadensis.* International Journal of Biology Research,2024:9(1):22-24.
10. Rady MM, Hemida KA. Modulation of cadmium toxicity and enhancing cadmium-tolerance in wheat seedlings by exogenous application of polyamines. Ecotoxicol Environ. Saf,2015:119:178–185.
11. Rizwan M, Ali S, Abbas T, Zia-ur-Rehman M, Hannan F, Keller C, *et al*. Cadmium minimization in wheat: a critical review. Ecotoxicol. Environ. Saf,2016:130:43–53.
12. Tian X, Dumat C, Pierart A, *et al*. Measurement of metal bioaccessibility in vegetables to improve human exposure assessments: field study of soil–plant–atmosphere transfers in urban areas South China. Environ. Geochem. Health,2016:38(6):1283–1301.
13. Qassim Ammar Ahmood AL-Janabi, Ziad Bassim Hameed1, Saad Kadhim AlaAllah Al- Kalidy. Effect of Heavy Metals on the Protein and Chlorophyll Content of *Phragmitus australis* and *Typha domingensis*, Indian Journal of Ecology,2019:46(8):65-71.
14. Wang F-K, Xu W-Z, Huang F-R, *et al*. Photosynthetic light response curve of Populus microphylla under different slope orientation[J] Water Soil Conservat. Res,2015:22(113):182–187.
15. Wei X, Wei YX, Guo D, Sun B, Wang XD, Liu C. Effects of different breaking dormancy ways on the photosynthetic characteristics and activities of protective enzymes of 'misty' blueberry leaves. *Sci. Agric. Sin*,2015:48(22):4517–4528.
16. Qassim Ammar Ahmood AL-Janabi, Mohammed Raheem Tarrad1, Hasan Ahmed Ali Albieg. Effect of Manganese Chloride and Zinc Chloride on Physiological Characteristics of *Myriophyllum verticillatum* and *Schoenoplectus litoralis,* South Asian Research Journal of Agriculture and Fisheries, 2024, 6(5).
17. Xiyou C. Study on Growth of Sassafras in different Mixed ways[J] Anhui Forest. Sci. Technol,2015:4:9–11.
18. Xu JJ, Liu NN, Qin L, *et al*. Effects of Cd stress on antioxidant enzymes activity of *Sonchus asper* L. Hill and *Zea mays* L. in intercropping system[J] J. Yunnan Agric. Univ. Nat Sci. Ed,2016:30(2):348–355.
19. Qassim Ammar Ahmood AL-Janabi, Mustafa Abdul AL-Karim Qasim and Mohammed Raheem Tarrad. Effect of Zinc and Manganese chlorides on *Schoenoplectus litoralis* and *Elodea Canadensis* physiological status, South Asian Research Journal of Agriculture and Fisheries, 2024, 6.
20. Zhang YL, Xing HW, Guo N, *et al*. The physiological characteristics of ornamental kale for cold resistance[J] Act. Agric,2016:31(4):168–176.
21. Qassim Ammar Ahmood AL-Janabi, Mohammed Raheem Tarrad and Mustafa Abdul AL-Karim Qasim. Effects of cadmium and lead on physiological characteristics of *Schoenoplectus litoralis* and *Elodea Canadensis*, South Asian Journal of Agricultural Sciences. South Asian Research Journal of Agriculture, 2024.
22. Zou J, Wang G, Ji J, Wang J, Wu H, Ou Y, Li B. Transcriptional, physiological and cytological analysis validated the roles of some key genes linked Cd stress in Salix matsudanaKoidz. *Environ. Exp. Bot*,2017:134:116–129.