International Journal of Environmental and Ecology Research
www.environmentaljournal.in
Online ISSN: 2664-7117, Print ISSN: 2664-7109
Received: 18-05-2024, Accepted: 06-06-2024, Published: 28-06-2024
Volume 6, Issue 1, 2024, Page No. 17-21

Effect of some heavy metals on the protein content and chlorophyll for *Myriophyllum verticillatum* and *Hydrilla verticillata*

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Abstract
The purpose of this study was to assess the impact of differing heavy element salt concentrations on the physiological conditions of a few aquatic plants. The two plants *Myriophyllum verticillatum and Hydrilla verticillata* were exposed to varying concentrations of heavy elements [10, 20, and 30 mg/L] for a month in order to measure the concentration of total chlorophyll and its protein content. The study's findings demonstrated that the components' concentrations in the water plants utilized in the examination increased at the conclusion of the study in a different way than in the control sample. It was investigated how the protein and chlorophyll contents of water plants exposed to heavy metals responded.

Keywords: Heavy elements, physiological state, and response of aquatic plants

Introduction

Heavy elements are available in nature, where they are released through geochemical cycles into the environment. High concentrations of heavy elements in the aquatic environment represent a danger to living organisms due to the ability of these organisms to accumulate and concentrate these elements within their bodies, which leads to a defect in their vital functions in addition to the transfer of these elements through the food chain. Heavy metals are classified as pollutants that have near-lethal effects on living organisms, and which have received increasing attention recently due to their harmful effects on the environment [1]. They also have harmful effects on human health and living communities alike. Aquatic and terrestrial ecosystems as well as their effects on the system, These harmful effects of heavy metals are due to them being highly toxic, non-biodegradable and having a long biological half-life as well as their ability to bioaccumulate in different parts of the body and their ability to cause cancerous tumors [2]. The emergence of devastating effects on the environment, especially the aquatic environment, as a result of the civilizational, industrial, agricultural, economic and scientific progress of man, as he was preoccupied with providing his needs and requirements without realizing that he had caused an imbalance in the natural balance of the surrounding environment, as the tremendous industrial progress had led to the emergence of new additions of materials. Chemicals that were not known [3] show that heavy metals have impacts on the environment. The balance in the environment they receive, as well as the diversity that occurs in the organisms present (Ashraq, 2005). Therefore, it has become necessary to treat ecosystems polluted with heavy metals, as the water of rivers and streams around the world is often polluted with heavy metals from various sources that may be natural due to the influence of rocks and soil or due to human sources. Resulting from lack of care in disposing of city waste, in addition to erosion and rainfall [4]. Domestic and industrial waste management explained that aquatic plants take heavy elements from sediments and water for the purpose of growth and development, such as iron, manganese, copper, Mo, and nickel [5]. They also accumulate some toxic elements that have no apparent effect. Importance in plants such as Ag, Cd, Cr, Co Hg, Pb and Se. The phenomenon of accumulation of heavy elements in accumulative plants is of great interest to researchers because of its important applications in phytoremediation, in which plants are used to restore the environment or treat it from pollutants [6]. By removing pollutants, reducing their toxicity, restricting their movement in soil or water, or through their biological, chemical and physical efficiency, many water plants have been used to treat various environmental pollutants, including heavy metals, as in phytotechnology, and that Because of its ability to collect large amounts of heavy elements in its tissues, sometimes up to 106 times higher than in the aquatic environment, it has a high ability to withstand pollutants [7].

Materials and Methods

The experiment was conducted to test two plants *Myriophyllum verticillatum and Hydrilla verticillata*, by taking (50 g) of the fine weight of each plant. The plants were planted individually in (10) plastic containers with a volume of (15) litres. Each container contains (10) liters of chlorine-free water (left for 24 hours with exposure to sunlight) in the ponds. Growth monitoring and sampling continued for five weeks according to the required test, where plant samples were collected from the ponds every week for the purpose of estimating the concentrations of heavy metals and the amount of chlorophyll and protein. Elemental salts were also used in the experiment, namely (nickel chloride, manganese chloride, cobalt chloride, zinc chloride) at three different concentrations (10, 20, 30) mg/L [8]. The protein level in plant tissues was determined using the Bradford method, and the total chlorophyll content in aquatic plant tissues was estimated using a chlorophyll meter [9].

Results & 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 heavy elements in the aquatic plant *Myriophyllum verticillatum* (3.215, 2.795, 2.423) Ni, (5.322, 4.621, 2.979) Mn, (3.691, 3.218, 2.793) Co and (4.731, 4.132, 3.594) Zn respectively compared with the control. While Figure (2) shown accumulation of heavy elements in the aquatic plant *Hydrilla verticillata* (5.009, 4.376, 3.806) Ni, (5.397, 4.709, 4.095) Mn, (4.667, 4.077, 3.546) Co and (5.738, 4.816, 3.999) Zn respectively compared with the control.

This indicates the ability of the studied aquatic plants to accumulate this element within the plant tissues, or that they possess a special mechanism to tolerate high concentrations of elements or that they absorb the elements with high concentrations, which are transformed into inactive forms of gaps [10] The differences in the concentration of elements accumulated in plant bodies may be due to differences in plant species, plant physiological status, and receptivity to the element [11]. The sources show that when exposed to heavy elements, plants produce plant clams which in turn interfere with the removal of toxicity and natural balance of the heavy elements in plants. This is done by the enzyme Phytochelatin Synthase, which activates the presence of heavy element ions using glutathione as a base material [12]. noted that many external factors influence the concentration of heavy metals in the tissues of the organism, including salinity, degree of pH, the effectiveness of complex organic and inorganic molecules, and their effect on physical and chemical processes that control the rate Metabolic processes such as temperature, the intensity of light and amount of oxygen. Bioaccumulation also depends on the concentration of the element in the environmental medium, the environmental properties of the element, the type of organism, and the period of exposure.

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 (3) shown the concentration of chlorophyll in *Myriophyllum verticillatum* (0.275, 0.301, 0.333)Ni (0.335, 0.366, 0.405) Mn (0.146, 0.161, 0.179) Co and (0.198, 0.216, 0.239) Zn respectively compared with the control, while Figure (4) shown the concentration of chlorophyll in *Hydrilla verticillata* (0.185, 0.202, 0.224)Ni (0.238, 0.261, 0.287)Mn (0.114, 0.126, 0.140)Co and (0.159, 0.174, 0.252) of Zn respectively compared with the control.

The decrease in chlorophyll concentrations in the experimental plants is due to the presence of these highly toxic substances and has the potential to accumulate in the plant tissue [13]. It inhibits its synthesis by inhibiting the action of the enzymes responsible for its production, such as the aminolevulinic acid dehydratase and Porphobilinogen deaminize, which is responsible for the formation of Porphyrin, The studies have indicated that some heavy metals are affected by the process of photosynthesis, chlorophyll production and the synthesis of other dyes such as carotene and efficacy [14]. Enzymatic effect of exposure to these elements [15]. the results showed a significant difference at the level of probability ($p < 0.05$) in the total amount of chlorophyll and protein in the tissues of the plants used in the experiment and exposed to the different concentrations of heavy elements used during the duration of the experiment and this was found by [16]. This may be attributed to the fact that by increasing the concentration of heavy elements in plant tissues, their chlorophyll content decreases because of its inhibitory effect on the work of enzymes that contribute to the synthesis of chlorophyll and carotene. Nasser enters the installation of some enzymes that contribute to the building of chlorophyll [17]. Figure (5) shown The protein content in *Myriophyllum verticillatum* (3.293, 2.661, 2.936) Ni (2.477, 2.001, 2.209) Mn (2.869, 2.313, 2.558) Co and (3.474, 2.806, 3.096) Zn respectively compared with the control, the figure shown The protein content in *Hydrilla verticillata* (2.086, 1.685, 1.861) Ni (3.411, 2.754, 3.041) Mn (2.878, 2.325, 2.568) Co and (2.461, 1.988, 2.194) Zn respectively compared with the control. The decrease in the protein content of all plants is due to the consumption of the protein content found in the tissues of these plants in some vital activities or the metabolic processes that occur within it to resist the concentration of the elements, thus reducing the proportion of protein content in their tissues [18]. this percentage decreases with the duration of the exposure until reaching End of Experience [19].

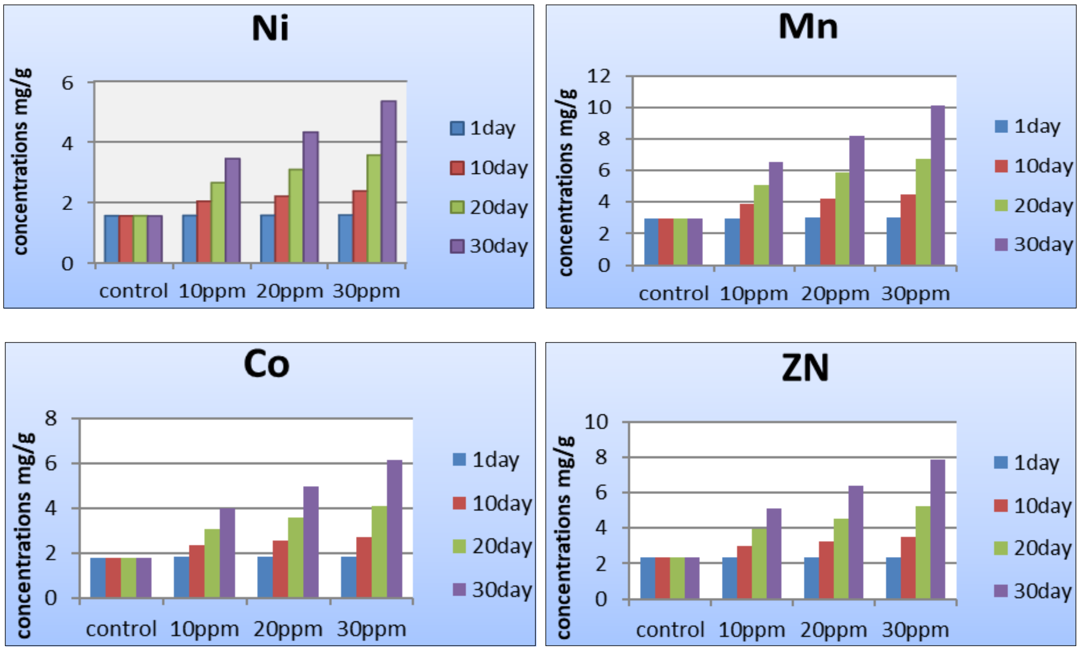

Fig 1: Three different concentrations of Ni, Mn, Co and Zn during the experiment period in ***Myriophyllum verticillatum*** tissues

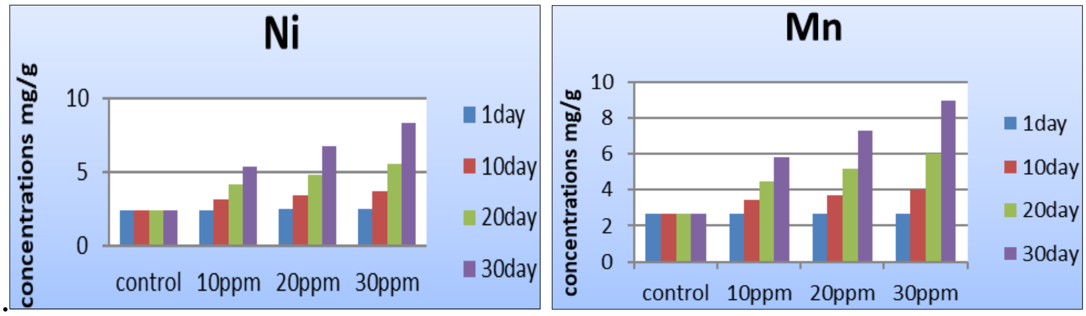

Fig 2: Three different concentrations of Ni, Mn, Co and Zn during the experiment period in *Hydrilla verticillata* tissues

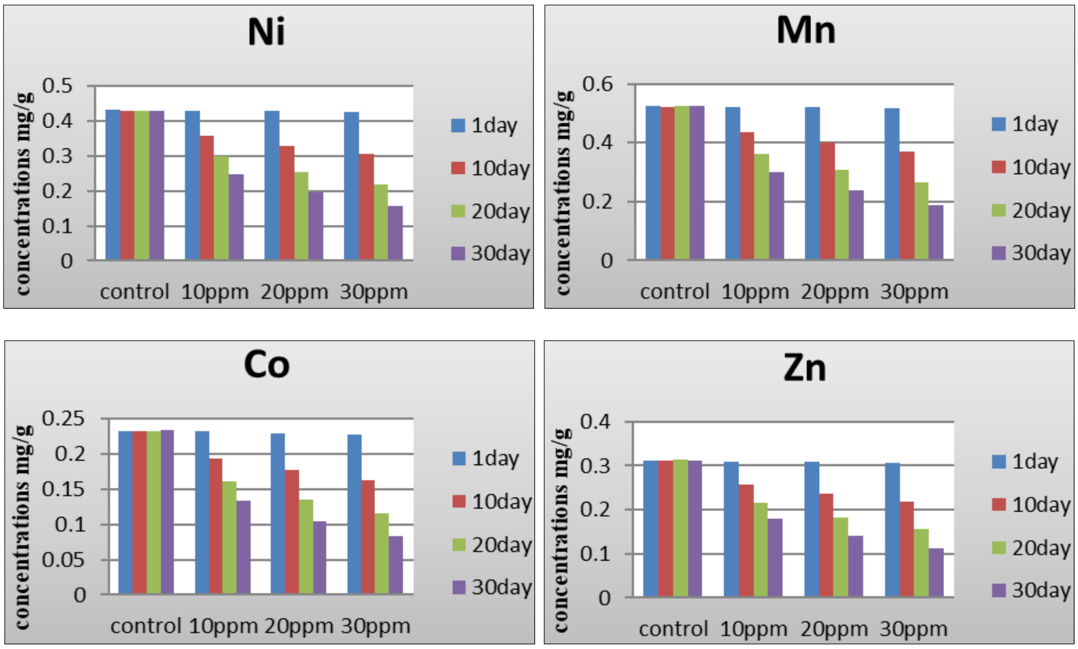

Fig 3: Three different concentrations of Ni, Mn, Co and Zn during the experiment period on the concentration of chlorophyll in *Myriophyllum verticillatum* tissue

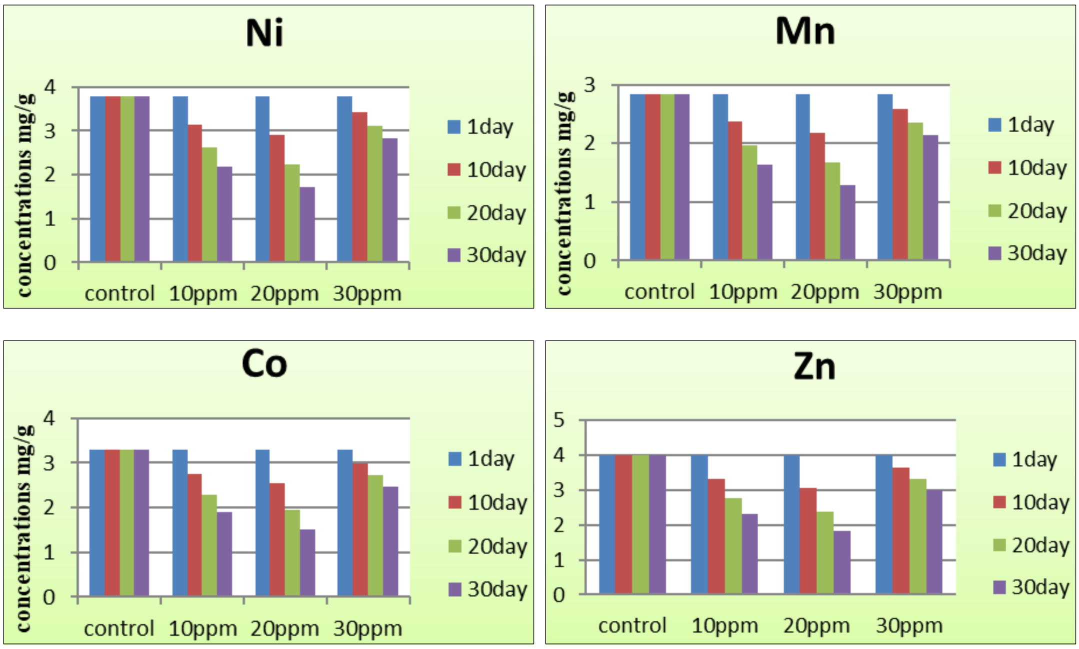

Fig 4: Three different concentrations of Ni, Mn, Co and Zn during the experiment period on protein content in *Myriophyllum verticillatum* tissues

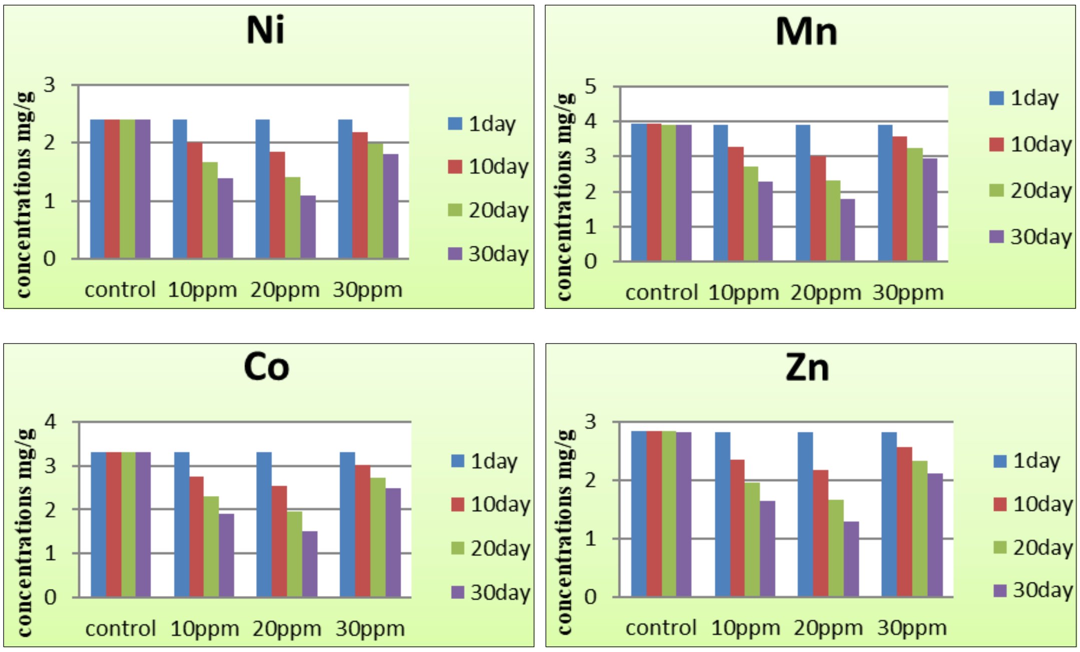

Fig 5: Three different concentrations of Ni, Mn, Co and Zn during the experiment period on protein content in *Hydrilla verticillata* tissues

Conclusion and Recommendations

Heavy metals negatively affect the vital growth processes, and the effects increase as the concentration of contaminant increase in a timely-dependent way. (Ni & Zn) were the most effected metals in lowering chlorophyll content in *Myriophyllum verticillatum* and (Ni & Mn) were the most affected metals in lowering chlorophyll content in *Hydrilla verticillata*, while (Ni &Co) reduced protein content in *Myriophyllum verticillatum* and (Zn & Mn) reduced protein content in *Hydrilla verticillata*. Plants are an effective biological tool in removing contaminants from heavily contaminated environments, and the selection process of plant species is based on the contaminant type and its concentration in the environment.

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