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Effect of nickel chloride on the protein content and chlorophyll for *Schoenoplectus litoralis* and *Elodea canadensis*

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Abstract
The goal of this study was to determine how different concentrations of heavy element salts affected the physiological conditions of a few aquatic plants. To this end, plants *Schoenoplectus litoralis* and *Elodea Canadensis* were subjected to three different concentrations of nickel chloride (10, 20, 30 ppm) for a month in order to measure the amount of total chlorophyll and its protein content. The results of the investigation showed that, in contrast to the control sample, the concentrations of the components in the water plants used in the analysis rose near the end of the investigation. The effects of heavy metal exposure on the protein and chlorophyll levels of water plants were studied.

Keywords: Elements, physiological, *Schoenoplectus litoralis* and *Elodea canadensis*

Introduction

Phytoremediation refers to the technologies that use living plants to clean up soil, air, and water contaminated with hazardous contaminants [1]. It is defined as "the use of green plants and the associated microorganisms, along with proper soil amendments and agronomic techniques to either contain, remove or render toxic environmental contaminants harmless" [2]. Phytoremediation is proposed as a cost-effective plant-based approach of remediation that takes advantage of the ability of plants to concentrate elements and compounds from the environment and to detoxify various compounds. The concentrating effect results from the ability of certain plants called hyper-accumulators to bio-accumulate chemicals. 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. Several field trials confirmed the feasibility of using plants for environmental cleanup [3]. Phytoremediation may be applied to polluted soil or static water environment. Examples where Phytoremediation has been used successfully include the restoration of abandoned metal mine workings, and sites where polychlorinated biphenyls have been dumped during manufacture and mitigation of ongoing coal mine discharges reducing the impact of contaminants in soils, water, or air. Contaminants such as metals, pesticides, solvents, explosives, [4] and crude oil and its derivatives, have been mitigated in Phytoremediation projects worldwide. Many plants such as mustard plants, alpine pennycress, hemp, and pigweed have proven to be successful at hyper-accumulating contaminants at toxic waste sites. Not all plants are able to accumulate heavy metals or organic pollutants due to differences in the physiology of the plant [5]. Even cultivars within the same species have varying abilities to accumulate pollutants [6].This technology has been increasingly investigated and has been employed at sites with soils contaminated with lead, uranium, and arsenic. While it has the advantage that environmental concerns may be treated in situ, one major disadvantage of Phytoremediation is that it requires a long-term commitment, as the process is dependent on a plant's ability to grow and thrive in an environment that is not ideal for normal plant growth [7].

Materials and method

The research study was designed to determine the ability of some aquatic plants, such as *Schoenoplectus litoralis* and *Elodea canadensis*, to remove some heavy metals. A weight of 500 grams was used for each plant, and they were grown individually in plastic containers with a capacity of 15 liters. Each container contained 10 liters of water contaminated with three different concentrations (10, 20, 30) mg/liter of heavy metal salts, which are nickel chloride [8]. The study continued for a month according to the required test, and samples were taken every 10 days. Plant samples were collected from the ponds for the purpose of estimating the concentrations of heavy metals and the amount of chlorophyll and protein. The protein level in plant tissues was determined using the Bradford method [9], and the total chlorophyll content in aquatic plant tissues was estimated using the chlorophyll meter [10].

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 nickel chloride in the aquatic plant *Schoenoplectus litoralis* tissues (2.443, 3.319***1***, 4.343) and the aquatic plant *Elodea Canadensis* tissues (3.781, 3.992, 4.571) compared with the control (1.553 and 3***2.276***) respectively. This indicates the capacity of the investigated aquatic plants to maintain this substance within the tissue of the plant, or that they have a unique way to tolerate a substantial amount of elements, or that they take in elements with high concentrations, which transform into inactive forms of gaps [11]. The variations in the concentration of elements collected within plant bodies may be because of differences in plant species, plant physiological status, and receptivity to the element [12]. According to the sources, plants that are exposed to heavy metals develop plant clams, which obstruct the plants' ability to remove toxicity and maintain a healthy balance of heavy elements. The enzyme phytochelatin synthase is responsible for this, as it uses glutathione as a base material to activate the presence of heavy ions. [13] observed that a variety of external conditions, such as salinity, pH level, the efficiency of complex organic and inorganic compounds, and their impact on physical and chemical processes that regulate the pace of heavy metal accumulation in the organism's tissues, as well as metabolic processes such as oxygen content, light intensity, and temperature, Additionally, the level of the element in the natural environment and the characteristics of the environment affect bioaccumulation [14].

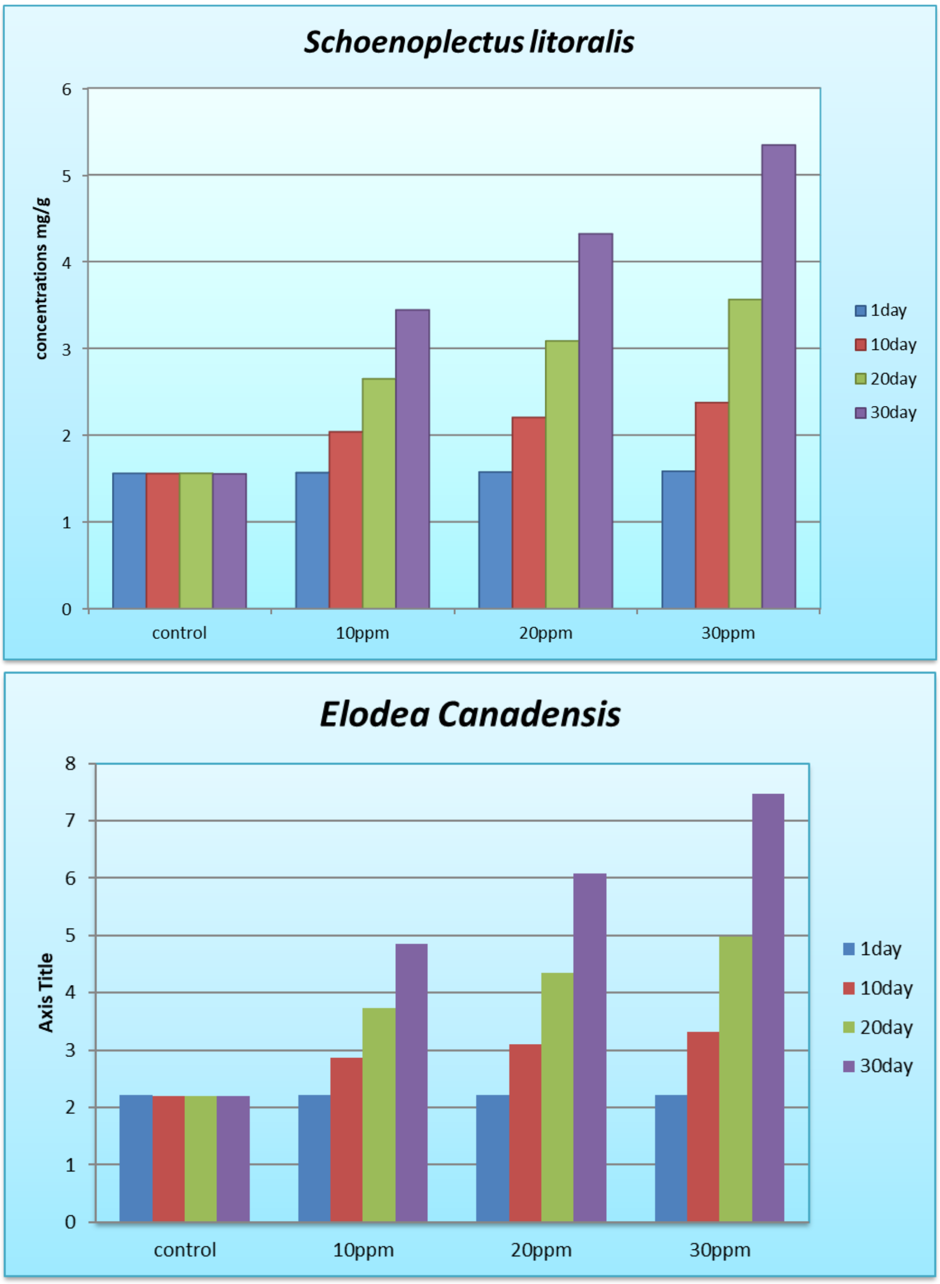
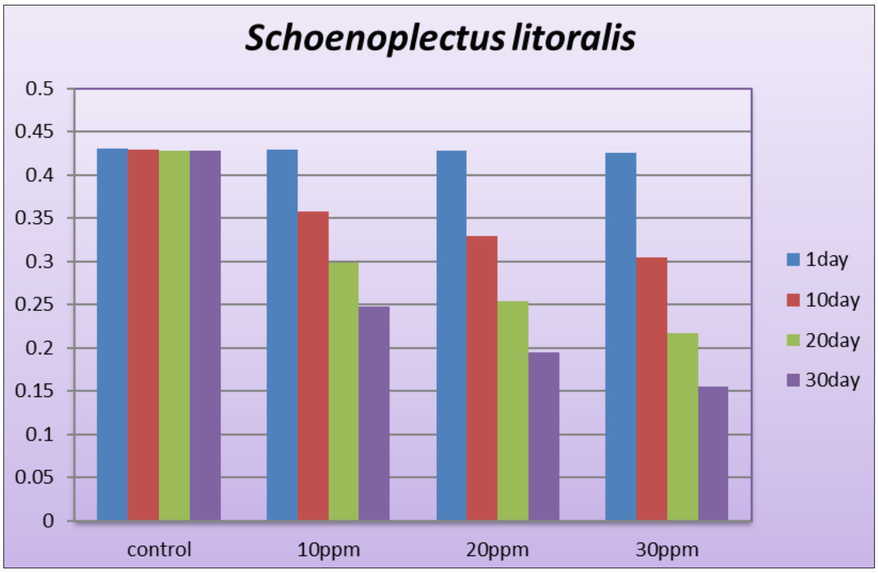


Fig 1: Effect three different concentrations of nickel chloride during the experiment period in *Schoenoplectus litoralis* and *Elodea Canadensis* tissues

Figure (2) shown effect three different concentrations of nickel chloride on chlorophyll in *Schoenoplectus litoralis* tissues (0.248, 0.195, 0.155) and *Elodea Canadensis* tissues (0.167, 0.131, 0.104) compared with the control (0.428 and 0.293) respectively. These very hazardous compounds, which have the ability to accumulate in plant tissue, are the cause of the reduction in chlorophyll concentrations in the experimental plants [15]. By inhibiting the activity of the enzymes that produce it, such as aminolevulinic acid dehydratase and porphobilinogen deaminize, which form porphyrin, it prevents its creation [16]. Research has shown that the formation of chlorophyll, the process of photosynthesis, and the synthesis of other colors like efficacy and carotenoids can all have an impact on certain heavy metals [17]. The impact of these components on the enzymatic system is [18]. The total amount of protein and chlorophyll in the tissues of the plants used in the experiment and exposed to the various concentrations of heavy elements used throughout the experiment was found to differ significantly at the probability level ($p < 0.05$) by [19]. The reason for this might be that when the concentration of heavy metals in plant tissues increases, the enzymes involved in the synthesis of carotene and chlorophyll are inhibited, resulting in a decrease in the amount of chlorophyll in the plant tissues [20]. Nasser starts the process of installing a few enzymes that aid in the synthesis of chlorophyll [21].



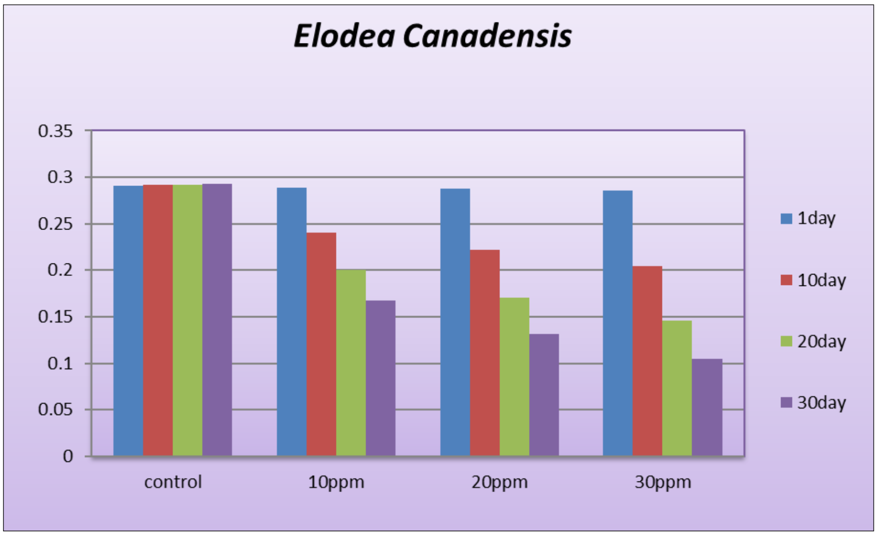
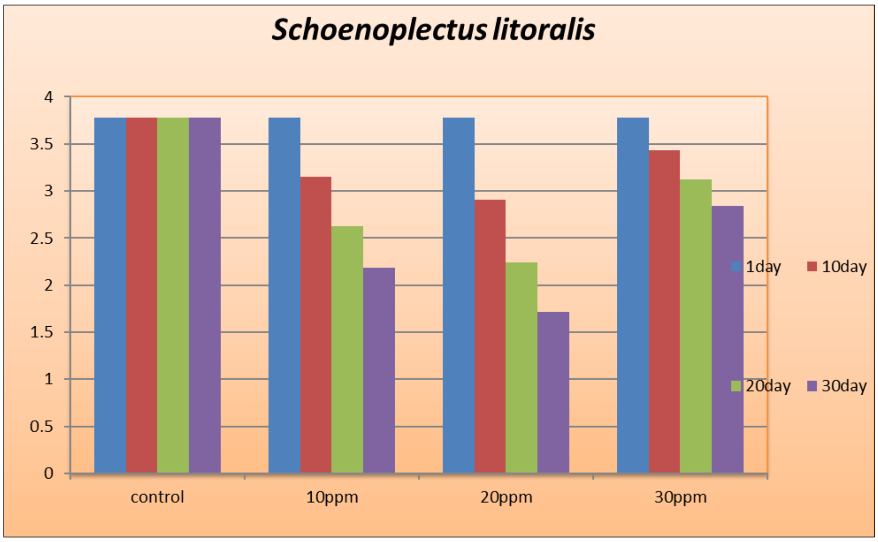


Fig 2: Effect three different concentrations of nickel chloride during the experiment period on the concentration of chlorophyll in *Schoenoplectus litoralis* and *Elodea Canadensis* tissue

Figure (3) shown effect three different concentrations of nickel chloride on the protein content in *Schoenoplectus litoralis* tissues (2.188, 2.720, 2.988) and *Elodea Canadensis* tissues (2.788, 2.612, 2.545) compared with the control (3.781 and 2.937) respectively. The consumption of the protein content in these plants' tissues for certain essential activities or the metabolic processes that take place within them to withstand the concentration of the elements are the causes of the decrease in all plants' protein content, which lowers the proportion of protein content in their tissues [22]. As exposure time increases until the end of experience, this proportion declines [23].



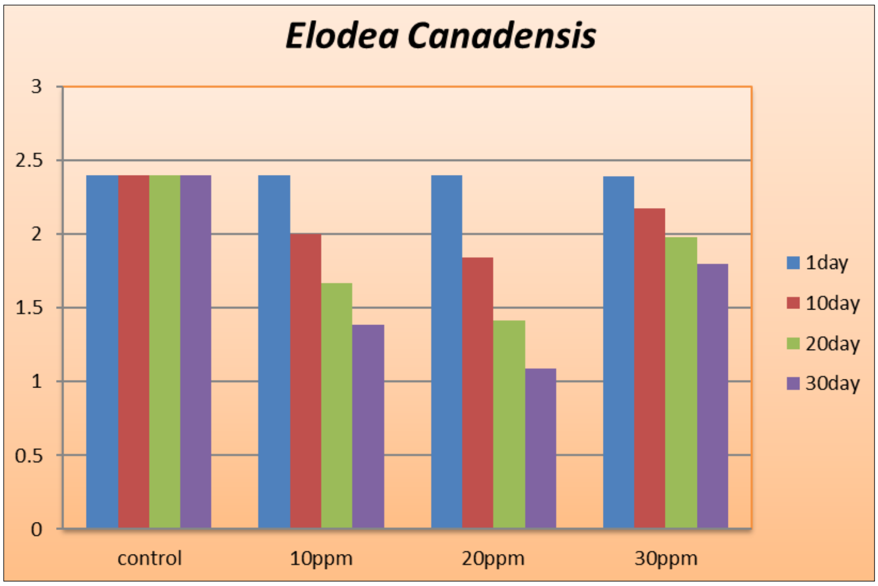


Fig 3: Effect three different concentrations of nickel chloride during the experiment period on protein content in *Schoenoplectus litoralis* and *Elodea Canadensis* tissues

Conclusion and Recommendation

The detrimental effects of heavy metals on essential development processes increase in a time-dependent manner with the concentration of contamination. The metals that had the greatest effects on lowering the levels of chlorophyll in *Schoenoplectus litoralis* and *Elodea canadensis* were Ni, Zn and Mn, respectively. On the other hand, the metals that had the greatest effects on lowering the levels of protein in Schoenoplectus litoralis and Elodea canadensis were Ni, Co, and Mn. The kind of contaminant and its concentration in the environment are taken into consideration when choosing plant species, as plants are an efficient biological instrument for eliminating pollutants from highly polluted areas.

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