Effects of heavy metals on physiological status for Schoenoplectus litoralis & Salvinia natans L

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Abstract:
This study investigated the removal of three concentrations of heavy metal salts, namely nickel chloride, manganese chloride, cobalt chloride and zinc chloride in the Phytoremediation of two aquatic plants (Schoenoplectus litoralis and Salvinia natans), and the determination of the level of total chlorophyll and protein by the exposure to two water plants (Schoenoplectus litoralis and Salvinia naturalans). Two samples of each plant were taken every ten days to determine the heavy metal, protein and chlorofyll after 30 days. The experiment was completed. At the end of the experiment, the results of the study showed different concentration levels of heavy metals in tissue in the plant and showed decreasing total chlorophyll and protein concentrations for the aquatic plant.

keywords: Phytoremediation, Heavy metal, aquatic plants.

Introduction: Heavy metal is a natural phenomenon in the environment, although it is anthropogenic activity that also adds heavy metals to the environment. In many parts of the world heavy metals as contaminants are of concern in environmental terms and may, in particular, cause adverse effects for agriculture among the potentially toxic metals (Mn, Zn, Co, Ni) [1]. Metal contamination is damaging to biological systems and is not biodegraded. Toxic heavy metals such as Pb, Co and Cd can be distinguished from other pollutants because they are not biodegradable but are accumulable in living organisms and thus cause disease and disorder at a relatively lower level. Heavy metals, it is well known, cannot be degraded chemically, and must be physically removed or turned into non-toxic substances [7]. Plants
play an important role in environmental conservation; by taking up soil or water metals, they can remedy contaminated soil and reduce the adverse effects of anthropogenic atmospheric pollution through photosynthesis by absorption of CO2 from combustion processes [2]. Plant-based technology for remediating metals from contaminated areas was used ("Phytoaccumulation or Phytoremediation") and found to be cost-effective and eco-friendly [10]. The emerging plant technology is the Phytoremediation of contaminants such as metals, pesticides, explosives, oil, excess nutrients and pathogens from soil and water, which are degraded, extracted, contained or immobilized on a plant [11]. Phytoremediation is a generic term derived from the Greeks Phyto which means "plant" and the Latin word remedium which means a restoration of balance. The technology has been designated as a more efficient noninvasive, publicly acceptable method for removing contaminants in the environment, than chemicals and physical methods[12]. Phytoremediation causes plants, by natural biological, chemical, or physical activities and processes, to remove, detoxify or immobilize environmental contaminant in a growing matrix including soil, water or sediment[13]. Plants are unique organisms with significant metabolic and absorption capabilities and transportation systems that can selectively use nutrients or contaminants from the matrix of growth[14]. The advantages are the efficiency of this technology in reducing contaminants, reducing costs, making it applicable in a wide range of contaminants and overall environmentally-friendly[9]. This technology has recently been receiving attention as an innovative, cost-effective alternative to more established treatment methods used in hazardous waste sites[12]. Phytoremediation can be used, as possible, in the purification of selected hazardous sites[16], as the most clean and cheapest technology. Phytoremediation involves numerous different techniques for the degradation of contaminants[8]. Phytoremediation is a cheap and cheap way to remediate environmentally-friendly media, especially in large sites with relatively low pollution levels[17]. Lately this is an innovative and cost-effective alternative to more established processes used at hazardous waste locations[16]. These techniques have been widely used. Plants can be used to clean up or remedy contaminated sites in a number of ways. Plants can break up or degrade organic pollutants or contain and stabilize metal contaminants by acting as filters or traps to remove pollutants from soil, sediment, and/or water.
Contaminants in plants are mainly taken up by the root system, in which the primary toxicity control mechanism is located.

The aims of the study is to understand the potential of certain water plants to treat heavy metal contaminated water

Materials and Methods:
Two aquatic plant species, which are (Schoenoplectus litoralis & Salvinia natans) were used to study heavy metal effects on total chlorophyll and protein. The experiment was conducted on a laboratory scale by taking 250 gm wet weight of each plant and adapted in 15 L plastic containers. Five sets of microcosms were set in triplicates, which were untreated control, treated with NiCl2, treated with MnCl2, treated with CoCl2, and treated with ZnCl2 for both Schoenoplectus litoralis & Salvinia natans. (Schoenoplectus litoralis & Salvinia natans). Three concentrations; 10, 20, 30 mg/L, were used for each heavy metal salt. The experiment was terminated after 30 days and the samples of the two plants were taken each 10 days to determine heavy metal, protein, and chlorophyll.

Heavy Metal concentration:
Aquatic tissues were collected after 30 days of growth to determine the concentrations of heavy metal. At a rate of 70 °C, the tissues of the plants had been dried. A Pyrex digestive tube was fitted with 0.5 g of grounding and seven plant tissues. After adding 5mL of HNO3, the samples were left for 16 hours. The samples were then digested for one hour at 100 to C. Then, for each sample, 3 mL of 70 percent perchloric acid and reflux were added to samples in 30 minutes at 200 μC, before a clear solution was achieved. The samples were centrifuged in the sample solution for 10 minutes during 2000 round/minute. The samples were filled with deionized water and filtered by 0.45 μm. The atomic spectrophotometer [5] measured the concentration of heavy metals in μg / g plant tissue[6].

Concentration of chlorophyll:
Total concentration of chlorophyll in aquatic plant tissues as described[4]. Upon adding 2 mL of 80 percent acetone, take 0.15 gm of fresh water plant tissues and were smashed by a ceramic mortar. Through Whatman No . 1 filter paper 0.45 μm the broken fabrics of the plant were filtered. The extract was collected and the size with 80 percent acetone was finished at 15 mL. Spectrophotometer Sp-300 at 645 nm and 663 nm was used to measure absorbance.
Protein concentration:
The total amount of protein was calculated using the Bradford method for plant tissues. The ceramic mortar smashed 0.5 g of fresh plant tissues, and 1ml of regular phosphate solution and 5 ml of the solution from Bradford were then added. Spectrophotometer Sp-300 was used to measure the protein content of 595 nm wavelength and mg / g plant tissue.[3] The protein was measured by sample spectrophotometer Sp-300.

Results & Discussion
The study results showed that at the end of the experiment the concentration of heavy elements in the aquatic plants studied was increased. Ni, (3.51, 3.19, 2.90), (4.36,3.96,3.60) and (4.06,3.69,3.35) Ni and (4.35) Zn, Schoenoplects littoralis (3.48, 3.16 and 2.87, 3.13) In concentrations (30, 20, 10) ppm compared with control sample Figure (1). Salvinia natans (3.56, 3.23, 2.94) from Ni (4.01, 3.65, 3.32) Mn, (4.22, 3.84, 3.49) In the concentrations of ppm (30, 20, 10) compared to the control sample in Figure(2).
This indicates that aquatic plants studied may accumulate this element within the tissue of the plant, or have a specific mechanism for high concentration tolerance of the elements or that highly concentrated elements may be absorbed, which may be transformed into inactive forms of gaps. [18] The sources demonstrate that plants produce plant clams when exposed to heavy elements which in turn interferentiate with the elimination of toxicity and natural balance. [19]. This is done by the Phytochelatin synthase enzyme, that activates glutathione as a base material for the presence of heavy-element ions[20].
Noted that a number of external factors have an impact on the concentration and effect on physical and chemical processes that control rate of heavy metal in tissues of the organism such as salinité, pH degree and efficiency of complex organic and inorganic molecules, Metabolic processes such as temperature, light intensity and oxygen. The concentration of the element in the environmental medium, the element 's environmental properties, the organism type and the exposure period also depends upon bioaccumulation.
At the end of the experiment, results showed a decrease in total chlorophyll concentrations in the aquatic plants studied. Chlorophyll concentration in Mn (0.67, 0.75, 0.84), Co and (0.65, 0.71, 0.78) in Schoenoplectus littoralis (0.48, 0.53, 0.58) of Nin (0.66, 0.73, 0.81). Concentrations at (30, 20, 10) ppm, in comparison to the Figure (3) control sample. The chlorophyll in ni(0.30, 0.33, 0.36) and in Mn(0.37, 0.30, 0.40, 0.45) and (0.33, 0.37, 0.54) was
low in Salvinia natans. *Salvinia natans* was low in chlorophyll at (0.26, 0.32). The concentrations of (30, 20, 10) ppm are compared with control sample Figure(4).

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. It inhibits its synthesis by inhibiting the action of the enzymes responsible for its production, such as the aminolevulinic acid dehydratase and Porphobilinogen deaminase, 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[21]. Enzymatic effect of exposure to these elements[23], 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 [24].

This can be attributed to the fact that, because of their inhibitory effect on the work of the enzymes that contribute to the synthesis of chlorophyll and carotene, the contents of heavy elements of plant tissue increase. Nasser enters some enzymes which contribute to chlorophyll construction[22]. The protein content in aquatic plants also decreased (0.68, 0.75, 0.82) of Mn (0.73, 0.89), of Mn (0.53, 0.58, 0.64) of Co and (0.79, 0.87, 0.85) of Zn in the experiment. Protein content in aquatic plants at the end of the experiment decreased. In the levels (30, 20, 10) ppm respectively compared to the control sample in Figure (5). The low protein content of Ni (0.69, 0.86, 0.84) of Mn (0.09, 1.20, 1.32) of Co, and (0.81, 0.90, 0.99) of Zn was also low for *Salvinia natans* (0.72, 0.79, 0.87); In concentrations (30, 20, 10) ppm, in comparison with of the control sample Figure (6).

The reduction in protein content in all plants is due to the use of protein in the tissues of these plants in some of the vital activities or the metabolic processes which occur in the plant to resist the element concentration, thus reducing the protein content proportion in the tissue. With the exposure time, that percentage decreases until the exposure ends [24].

**Conclusion and Recommendations:** Heavy metals have a negative effect on the processes of vital growth, increasing as contaminant concentration rises promptly. In *Schoenoplectus litoralis* (Ni & Zn), the most effective metals were to lower chlorophyll. And (Ni & Mn) have been the metals with the most affected chlorophyll content decrease in *Salvinia natans* while in Schoenoplectus litoralis (Ni & Co) proteins have been decreased in *Schoenoplectus litoralis* and in *Salvinia natans* (Zn & Mn). Plants are an efficient biological tool to remove contaminants from heavily contaminated environments, and the process of selecting plant species is based on contaminant type and environmental concentration.
Figure (1) Three different concentrations of Ni, Co, Zn, and Mn during the experiment period in *Schoenoplectus litoralis* tissues.
Figure (2) Three different concentrations of Ni, Co, Zn and Mn during the experiment period in *Salvinia natans* tissues.
Figure (3) Three different concentrations of Ni, Co, Zn, and Mn effects during the experiment period on the concentration of chlorophyll in *Schoenoplectus litoralis* tissues.
Figure (4) Three different concentrations of Ni, Co, Zn, and Mn effects during the experiment period on the concentration of chlorophyll in *Salvinia natans* tissues.
Figure (5) Three different concentrations of Ni, Co, Zn, and Mn effects during the experiment period on protein content in *Schoenoplectus litoralis* tissues.
Figure (6) Three different concentrations of Ni, Co, Zn, and Mn effects during the experiment period on protein content in *Salvinia natans* tissues.
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