Current Research in Microbiology and Biotechnology
Vol. 6, No. 1 (2018): 1501-1505
Research Article
Open Access

ISSN: 2320-2246

Knowing of accumulation capacity of [*Ceratophyllum demersum* L. and *Hydrilla verticillata* plant] when one plant is used to remove the copper element in a laboratory-contaminated water-polluting ecosystem

Zena F. Ahmed[1], Qusay A. Abdul Ameer[1,*], Rana Fadhil Abbas[2] and Saad H. K.[1]

[1] *Ministry of science and technology, Environment and Water Directorate, Iraq*
[2] *Ministry of Higher Education and Scientific Research, Mustansiriyah University, Iraq*

* Corresponding author: Qusay A. Abdul Ameer; e-mail: qusay6666@yahoo.com

Received: 08 January 2018 Accepted: 20 January 2018 Online: 24 January 2018

ABSTRACT

This study was carried out to identify the ability of *Ceratophyllum demersum* L. and *Hydrilla verticillata* together with hydra alone to remove some heavy elements from the water, it was a copper element. A concentration of 40 mg / L $^{-1}$ was used for 28 days per plant, Plant efficiency was estimated in removing heavy elements from water as percentage of removal. The results showed that the plant concentrates the elements in its tissues in large quantities. Significant differences were found between the concentration of the plant and the plant separately (Hydrilla) at P≤ 0.05 during the duration of the experiment. Significant differences were observed between the concentrations on the third day and the end of the 28th day of the experiment. The experiment showed that the Hydrilla plant was more vital compared to the ceratophyllum through the yellowing of the plant and when comparing between the use of one plant and two plants of the results and the quantity of the remaining element shows that the Hydrilla plant with the ceratophyllum can absorb more quantity by weaving from the Hydrilla alone, so the plant can be used in the biological treatment of contaminated water. The plant showed a high percentage of removal of the copper component and was between (43.2 - 98.6%) of the concentration of 40 ppm studied during the days of the experiment respectively for the plant of the two plants, while the percentage of removal of the element copper between (13.2-30.4%) respectively of the Hydrilla plant alone after The day of the 28th day of the experiment was recorded for the hydra plant. The concentrations of the elements were measured after 3, 7, 14, 21 and 28 days of experiment for each concentration. It was observed that the Ceratophyllum plant leaves began to wilt when treated with the copper component at 40 mg / L^{-1} concentration. It was also compared with the hydrilla plant in the basin. The experiment also showed a rapid absorption speed for the high resistance of the two plants. The pollutant was distributed on the body of the plants.

Keywords: *Ceratophyllum demersum* L., *Hydrilla verticillata*, Phytoremediation, water pollution.

1. INTRODUCTION

Water is the mainstay of life and its availability is essential to the existence of life, so its pollution is one of the main dangers that threaten the life of all organisms, especially human life, Drinking water must be free from chemical, physical and biological contaminants, and that the water is palatable to be colorless and to taste and smell. The focus was on water pollution in particular because it is one of the most dangerous types of environmental pollution, Because the water covers a large area of the earth, Air and soil contaminants are all destined for water bodies, either directly or indirectly, Water is also the largest part of the composition of different living cells and no vital process can take place in the water [1,2]. Most researchers agree that the most dangerous contaminants of surface water are organic compounds,

heavy metals, detergents, phosphorus compounds, synthetic organic compounds and radioactive materials.

The pollution of heavy elements of the global problems that cause environmental degradation and the proportion of pollution varies from one region to another according to the presence of sources of pollution from industrial plants and others [3].

The accumulation of heavy elements in plant bodies has received considerable attention from many researchers because the plants have the ability to remove heavy elements from industrial waste and the research evidence that aquatic plants have the ability to absorb heavy elements. There may be some differences for these plants, on the adsorption of certain metals from other types. The use of plants in the purification of industrial waste water is low cost compared to the devices and chemicals used for this purpose [4]. The idea of using plants with the ability to absorb and accumulate pollutants is called plant therapy and is a form of bioremediation and means the use of certain plants have the ability to reduce the levels of pollution by booking or removal or analysis of different pollutants [5].

Two plants of aquatic plants are used in the research (*Ceratophyllum demersum* L. and *Hydrilla verticillata*) which are the plants of the group of submersible water bushes and have the ability to absorb heavy elements by the roots and is a pollutant of water, including copper? Hydrilla is the most common in aquatic environments for its high efficiency in growth under different conditions of water, whether saline, acidic or alkaline, and the two plants are available in the waters of the Tigris [6, 7]. The study aims to study the ability of the plant Ceratophyllum and Hydrilla to remove the copper element.

2. MATERIALS AND METHODS

2.1 Source Plants

The ceratophyllum and Hydrilla plants were collected from the water of the University of Baghdad Canal at the Jadiriyah complex. The plants were transferred to the laboratory and were well washed from impurities and placed in glass basins 25×35cm And a height of 30 cm and put 10 liters of water without chlorine water tap (left for 24 hours with exposure to sunlight) in the ponds, 35 g of plant was used in each basin and individuals had close weights.

The ponds were developed in a plant preparation system for plant development, which is a wooden box with doors, where it was prepared for the processing of the plant under the normal conditions of the intensity of light and ventilation using fans and air ventilators and supplied with dissolved oxygen using air compressors used in ponds and fish It is equipped with 24 hours of power. Six ponds were used for each concentration as well as for the period (3, 7, 14, 21, and 28) day.

2.2 Preparation of heavy element solutions

The cu salt, which is the chemical formula, is used in water copper sulfate CuSo4 5H2o While 3.928 g of water copper sulfate was dissolved in 100 ml of distilled water with continuous stirring by magnetic stirrer and for 30 minutes and then completed to 1 liter of distilled water, This was done depending on [8].

2.3 Accumulation of elements in the plant

A number of plants were dried in an oven at a temperature of 70 m for 48 hours. After drying, the samples were grinded and 0.5% of the dry matter was taken in Baker and digested with sulfuric acid, nitric acid and HCFC4 f by 1: 1: 2 Respectively, for a period of 2-4 hours, taking into account the specimen coverage and complete size to 50 mL with distilled water [8], The concentration of copper was estimated by the atomic absorption spectrometer.

2.4 Statistical analysis

Statistical analysis system was used in the analysis of data to study the effect of different factors (concentration and time) in the percentages studied, the differences between the mean and the least significant differences were compared (LSD).

Figure 1: *Ceratophyllum demersum* L.

Figure 2: *Hydrilla verticillata*

3. RESULTS AND DISCUSSION

The hydrilla and ceratophyllum showed high efficiency in removing the copper element from the water medium by removing 43.2% on the first day. The removal ratio of the hydra plant was 13.2%. The removal rate for the third day was 19.7% for the hydra plant. Hydrilla with ceratophyllum was 79.8%. After seven days, the component was removed by 44.2% and 89.1%, respectively, of both hydrilla and ceratophyllum.

After 14 days, removal rates were 38.3%, 94.1%, and after 21 days were 30.4% and 98%, respectively. The proportion of copper remaining in the water when using the plants was respectively (5.7, 1.2, 56.3, 20.1, 10.6) %, While the remaining element of the copper element Hydrilla was (89.4, 79.9, 54.9, 61.3, 69.2) %.

The results of the statistical analysis and the least significant difference of LSD at the probability level 0.05 showed a significant effect of the factors in the study (time and concentration) in the level of absorption of copper dissolved in water by the plant. The following is the graph of the absorption form (3,4).

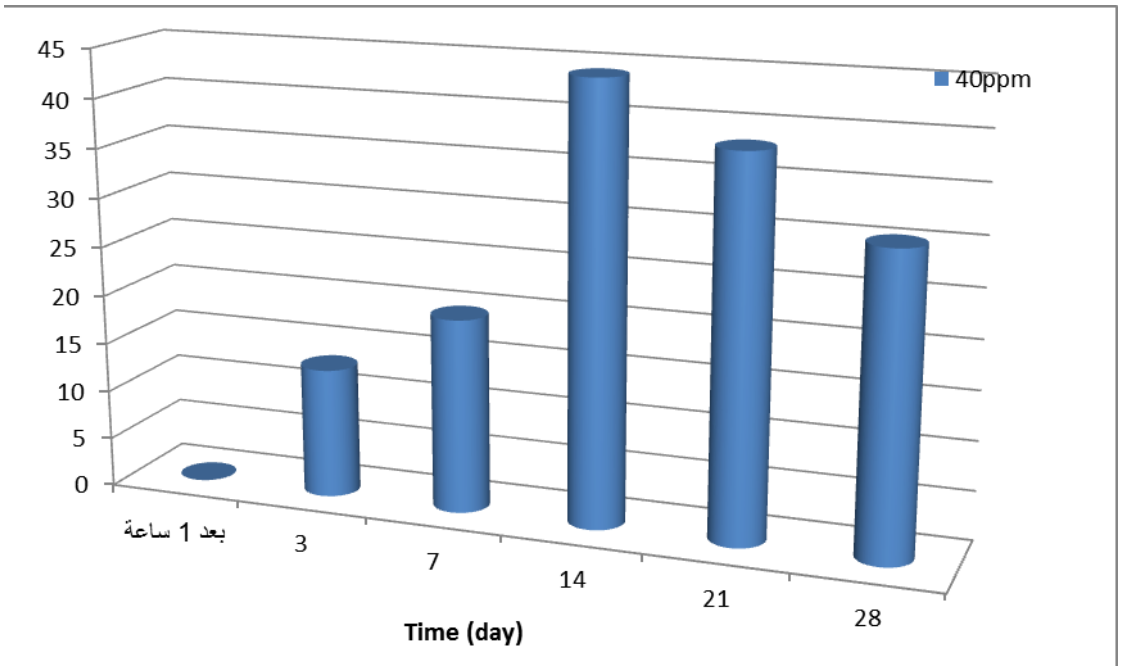

Figure 3: Percentage (%) of concentration of the copper element accumulated in *Ceratophyllum demersum* L.

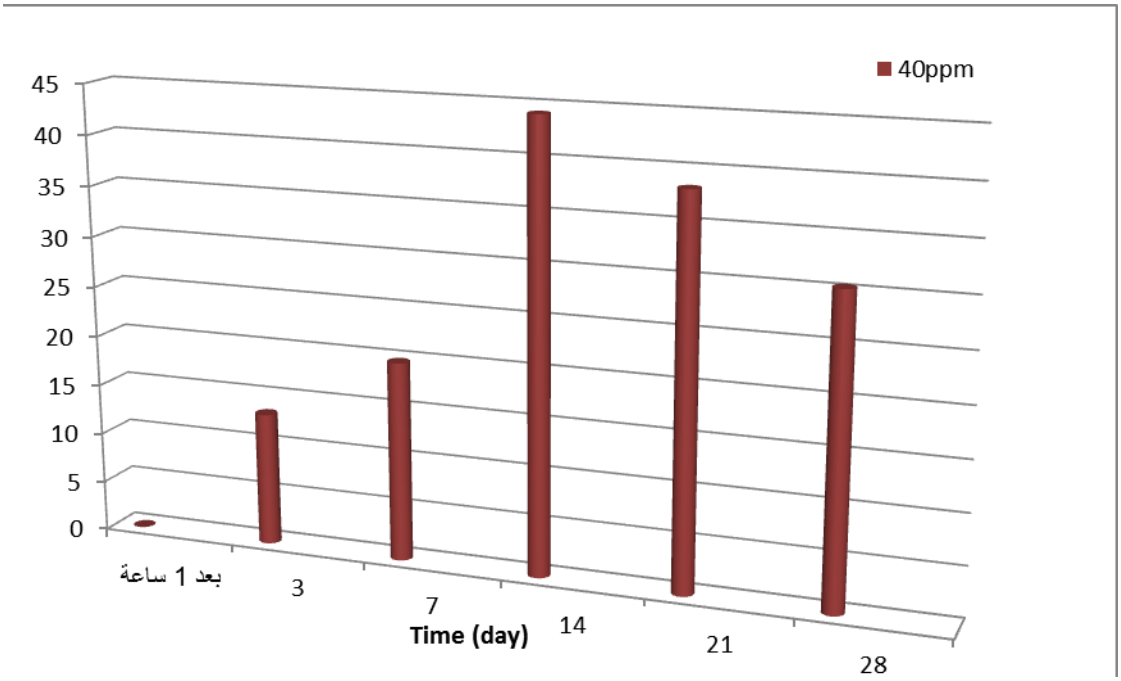

Figure 4: Percentage (%) of concentration of the copper element accumulated in *Hydrilla verticillata*.

The results of statistical analysis showed there were significant differences at a potential level p< 0.05 between focusing through max the vegetarians where the ratio was advanced and high during the third day of retailing in copper-treated plants, also there were significant differences between focusing for each day from retailing and showed from retailing gradual progressive removal with increased concentration in the plant body during the days of the experiment except the concentration treatment 40 mg L^{-1} for hydrilla plant. Apart, the effect of plant efficiency may indicate the removal of the element at higher concentrations.

There were significant differences between time and concentration in the absorption capacity of the copper plant and the effect of time was evident in the absorption index. We note an increased concentration of copper in the plant as the experiment progressed. The results of the statistical analysis showed significant differences in the probability level of P <0.05 during the third day of experiment plants with copper element. The highest percentage increase in copper concentration in the plant was associated with the concentration treatment of the two plants on day 28, where the amount of copper on the first day was higher than that of the sample site where it was 0.6 $mgkg^{-1}$ and the maximum efficiency For plant absorption of contaminants in the water, including copper, reached 28 days for both plants.

The concentration of this element within the two plants may be due to the concentration of 40 mg L^{-1}, it may be due to the fact that the copper element is one of the minor essential elements needed for aquatic regeneration and is absorbed by the plant in small quantities but is toxic by high concentrations also the current results accepted with results of [9, 10, 11].

The results showed an increase in the concentration of the copper element in the plant body by increasing the concentration of the element in the center. These results indicate that the susceptibility of the plant to the transfer of the copper element from the ocean to the plant tissues during the days may be due to increasing the concentration of this element within the plant at the concentration of 40 mg L^{-1}. Copper is one of the minimum essential elements of the plant. The plant needs small amounts and good nutrition depends mainly on the balance between the nutrients needed by the plant. The closer the degree of balance between these nutrients, the better and the optimum of the plant needs, the better the production, where the plant growth period is clearly observed in this concentration.

The experiment shows that the collecting of multiple properties of absorption increases the removal of contaminants with high efficiency compared to the use of one plant. Of the presence of vectors in the plant and *Ceratophyllum demersum* and shipping difference between the walls of the cells of the *Ceratophyllum demersum* and between the element to the properties enjoyed by the *Hydrilla verticillata* of the polarization of the element by stimulating the enzymes produced by Metallothionein, also *Hydrilla verticillata* it has a wide surface area and is suitable for owning the hydra plant to the roots.

In the case of copper element, the effect of the hydrilla plant on the removal of the copper element was high but was higher when the plants were collected [hydrilla and *Ceratophyllum demersum*]. The plants differ in their ability to collect heavy elements depending on the

amount of these elements in water and the ability of aquatic plants to concentrate these elements with their initial concentrations. The removal of the copper element by hydrilla and *Ceratophyllum demersum* may be due to the presence of negatively charged ions on the cell wall of the plant that withdraws(uptake the positively charged copper element ions from the water of the ponds and this conclusion is consistent with the note [12]. He confirmed that there are negative charges on the wall of the cell back to the aggregates Carboxylic acid of the bacteria and thus the negative charges attract positive charges and prevent them from going back to the center or may be due to the hypothesis of the difference in voltage.

A study [13] showed the efficiency of two types of aquatic plants namely *Centella asiatica* and *Eichhornia crassipes* in copper removal. Their results showed that the two plants had a high capacity to remove copper. The percentage was 99.6% for *Centella asiatica* plant and 2.5 ppm. For concentration *Eichhornia crassipes* 97.30 ppm for plant 1.5 ppm for concentration during the 21-day experiment, also the studied three species of aquatic plants was from plant.

Hydrilla vercillata, *Elodea Canadensis* plant and *Salvinia* sp to ability of these three plants to remove copper, iron and nickel from the water contaminated with these elements. The ability of these plants to grow at a concentration of 5 ppm for each element was observed in one water basin of iron and 95% of copper 90% of nickel during the 10-day trial period.

We conclude from this research the possibility of using plants in the biological treatment of water contaminated with heavy elements in Iraq for availability in Iraqi waters. It has been noted that the *hydrilla* and *Ceratophyllum demersum* plants proved to be highly efficient in the biological treatment of copper element in water. The presence of these two plants together in the water have the ability to remove the copper component from water.

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