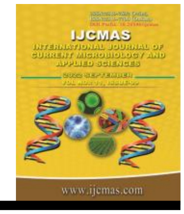
Int.J.Curr.Microbiol.App.Sci (2022) *11*(09): 1-6

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 11 Number 09 (2022)**
Journal homepage: http://www.ijcmas.com



Original Research Article https://doi.org/10.20546/ijcmas.2022.1109.001

Plants Differ in their Ability to Treat Lead-Contaminated Water in Different Concentrations

Nashmeel Ali Hassan*

Directorate General of Baghdad Education, Rasafa third, Iraq

**Corresponding author*

Keywords

Aquatic plant, Polluted water, Phytoremediation

Article Info

Received:
02 August 2022
Accepted:
28 August 2022
Available Online:
10 September 2022

ABSTRACT

Aquatic macrophytes play an important role in the structural and functional aspects of aquatic ecosystems by altering water movement regimes, providing shelter to fish and aquatic invertebrates, serving as a food source, and altering water quality by regulating oxygen balance, nutrient cycles, and accumulating heavy metals (Bradl, 2005). The ability to hyper accumulate heavy metals makes them interesting research candidates, especially for the treatment of industrial effluents and sewage waste water (Pumple *et al.*, 2013). The use of aquatic macrophytes, such as *Eichhornia Crassipes* with hyper accumulating ability is known to be an environmentally friendly option to restore polluted aquatic resources. The present review highlights the phytoaccumulation potential of macrophytes with emphasis on utilization of *Eichhornia Crassipes* as a promising candidate for phytoremediation. The impact of uptake of heavy metals on morphology and metabolic processes of *Eichhornia Crassipes* has also been discussed for a better understanding and utilization of this symbiotic association in the field of phytoremediation.

Introduction

Contaminated water is a water that has undergone physical and chemical changes in water quality directly and indirectly, the negatively affects living organisms and it is unfit for required uses and therefore affects the life of neighbouhoods and may be a reason for termination of life on earth, this pollution results either naturally or chemically (Dubey, 2011). As for waste water which is a type of contaminated water, but this pollution is caused only from man-made and its intervention (Memon *et al.*, 2001). It is a liquid waste that has been negatively affected by human impact on it, which includes effluent discharged from residential, commercial, industrial complexes. This water includes a large number of pollutants in different concentrations (Maestri *et al.*, 2010). Neighbouhoods through water being affected by polluting sub stances for example the high acidity of water, which may not be contaminated with the lives of some neighbouhoods.

And thus lead to their death. heavy metals may affect the work of the respiratory system of fish, for example, lead which is the subject of our research is the most toxic and accumulate element in the bodies of living organisms and here lies its danger because they are not biodegradable or chemical or bacteriological shattered when they are collected in the bodies of living organisms which causes poisoning with heavy metals (Bubb & laster, 1991).

The term of phytoremediation comes from a Greek prefix "Phyto" and attached to latin word remediation "to correct" (Qian *et al.,* 1999). Simply, it refers to utilize green plants to remove contaminants from soil and water (Anon, 1976). It is cost effective, as ethically accepted, and it is less disturbed to the environment (Zhu *et al.*, 2013). The plants used in this ecofriendly technology must have a considerable capacity of metal uptake. There are many ways by which plants remediate contaminated sites.

Materials and Methods

Collecting and Growing of aquatic plants

Vaillceneria, *Ceratophyllum demersum, Hydrilla verticellata, Eichhornia Crassipes* Plant samples were collected from Tigris River in Iraq. Plants were well washed and placed in two glass containers (40 *50 *80) cm separately filled with water from the same river. After a month period plants put to experimental containers (10 *20 *30) cm, their capacity 4L of water. Care was taken to prevent the decrease in water level by adding the oxygenated water.

Physical and Chemical Measurements

Some Physical and chemical measurements were done for river water directly as following:

Temperature was measured by water thermometer.

pH was measured by pH meter type Milwaukee, Romania

Electrical conductivity and salinity were measured by Conductivity meter type Milwaukee, Romania.

Total dissolved solids (TDS) were measured by TDS meter type Milwaukee, Romania.

Plant Acclimatization

Plants were transferred to laboratory and put in glass container contain 30L of distilled water, the laboratory temperature was adjusted to 20 ± 2 C°. 10 the plant samples were putting in each container to avoid the crowing.

Preparation of Heavy Metals Concentration

Heavy metals solutions were prepared by dissolved in 1litter of distil water to prepare 1 liter of concentrations 10, 20 and 30, mg\ L of Pb. (APHA, 1998).

Heavy Metals Measurement

Leaves, stems and roots left in the sun to dry. 1 gram of dry plants sample was digested by 16 ml of mixture from HNO3 (64%) (BDH, England) and H2O2 (30%) (BDH, England) in ratio 6:2 and the mixture was put in the oven at 120 C° for two hours. After cooling the digested samples, 10 ml of distilled water were added, the mixture was filtered through filter papers (0.45μM, Whatman) and diluted to 50 ml (Senila *et al.*, 2011). Flame Atomic Absorption Spectrophotometer type (VGP 2010 Buck, England) figure (1) was used to measure the heavy metal concentrations in plant samples.

Results and Discussion

Comparison of four plants growing in the basins of polluted water in their ability to accumulation of lead charts (1, 2, 3, 4 and 5). can be observed comparing the results between these aquatic plants (*Vaillceneria, C. demersum, H. verticellata, E. Crassipes*) in their ability to accumulation of lead in tissues showed plant *E. Crassipes* has the ability to accumulate of lead more than other plants in experiment (8.64, 17.42, 22.28) ppm constrations (10, 20, 30) ppm of water polluted in the age of thirty-day experiment as shown in the table (1). While for the plant vallisneria have the least accumulate of lead, as we can see in the charts (1,2,3,4 and 5).and it was the highest accumulation of his in the thirty day (3.03,4.42,5.17) at focus (10, 20, 30) ppm. Results of statistical analysis showed that there were significant differences concentrations in fifteen days and thirty day of life experience, and the showed no significant at all plants in the first and fifth and tenth day of life experience. Consistent results of this study with (Phukan *et al.*, 2016).

Due to the fact *E. Crassipes* high growth speed and productivity, which made them effective in the treatment of types of contaminated water (Wilson *et al.,* 2005). But Vallisneria plant its tolerance is weak and his growth is slow and sensitive. (Ramey, 2001).

Table.1 Compared to the concentrations of lead in plants (*Vaillceneria*, *C. demersum, H. verticellata, E. crassipes*) after treatment different concentrations of polluted water is expressed in units of ppm by different times

Time of Experimental	Plant	Concentration (ppm)			LSD
		10	20	30	
First day	*Vallisneria sp.*	0.54	0.97	1.40	*0.03
	Ceratophyllum demersum	1.46	3.84	5.90	* 2.06
	Hydrilla verticellata	1.95	4.45	7.02	* 2.79
	Echhornia crassipes	2.13	5.32	8.14	* 2.55
	LSD	1.22	* 1.33	*2.78	----
Fifth day	*Vallisneria sp.*	1.17	2.01	2.88	*2.11
	Ceratophyllum demersum	3.57	7.26	3.57	* 3.69
	Hydrilla verticellata	3.46	9.29	3.46	* 3.42
	Echhornia crassipes	4.36	9.66	4.36	* 2.97
	LSD	1.76	2.69	1.76	---
Tenth day	*Vallisneria sp.*	1.79	2.90	3.08	*2.77
	Ceratophyllum demersum	5.18	11.14	15.13	* 3.76
	Hydrilla verticellata	6.09	13.09	16.21	* 4.09
	Echhornia crassipes	6.88	13.19	18.29	* 3.65
	LSD	1.96	2.68	* 2.53	---
Fifteenth day	*Vallisneria sp.*	2.45	2.66	4.72	1.02
	Ceratophyllum demersum	6.11	11.81	16.70	* 3.91
	Hydrilla verticellata	7.06	14.21	18.90	* 4.88
	Echhornia crassipes	7.64	14.42	20.28	* 4.63
	LSD	* 1.24	* 2.08	* 1.24	---
Thirteenth day	*Vallisneria sp.*	3.03	4.42	5.17	2.03
	Ceratophyllum demersum	6.84	13.23	17.07	2.73
	Hydrilla verticellata	7.55	16.04	19.09	3.92.
	Echhornia crassipes	8.64	17.42	22.28	4.83
	LSD	1.39	3.11	2.48	---

Fig.1 Flame Atomic Absorption Spectrophotometer

Chart.1 Compared to the concentrations of lead in plants (*Vaillceneria, C. demersum, H. verticellata, E. crassipes*) after treatment different concentrations of polluted water is expressed in units of ppm in first day

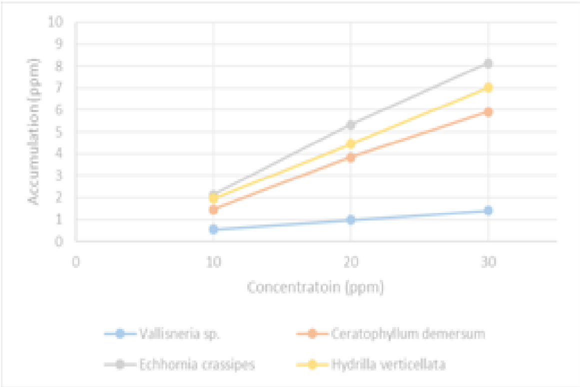


Chart.2 Compared to the concentrations of lead in plants (*Vaillceneria, C. demersum, H. verticellata, E. crassipes*) after treatment different concentrations of polluted water is expressed in units of ppm in fifth day

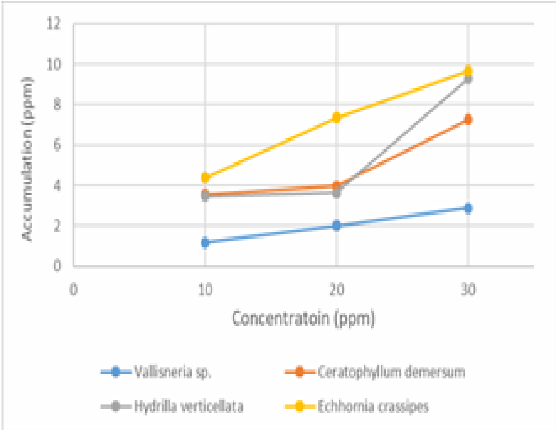


Chart.3 Compared to the concentrations of lead in plants (*Vaillceneria*, *C. demersum, H. verticellata, E. crassipes*) after treatment different concentrations of polluted water is expressed in units of ppm in tenth day

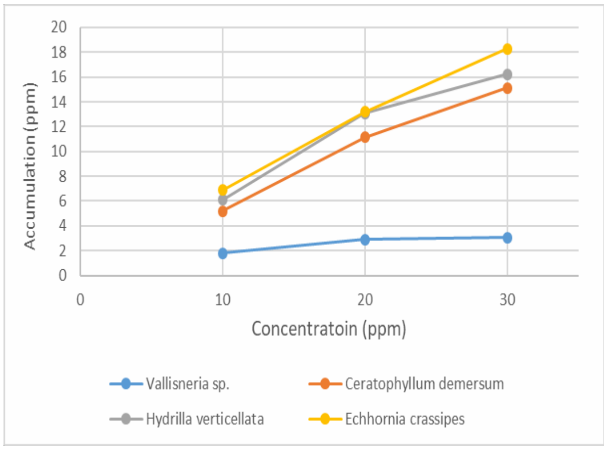


Chart.4 Compared to the concentrations of lead in plants (*Vaillceneria*, *C. demersum, H. verticellata, E. crassipes*) after treatment different concentrations of polluted water is expressed in units of ppm in fifteen day

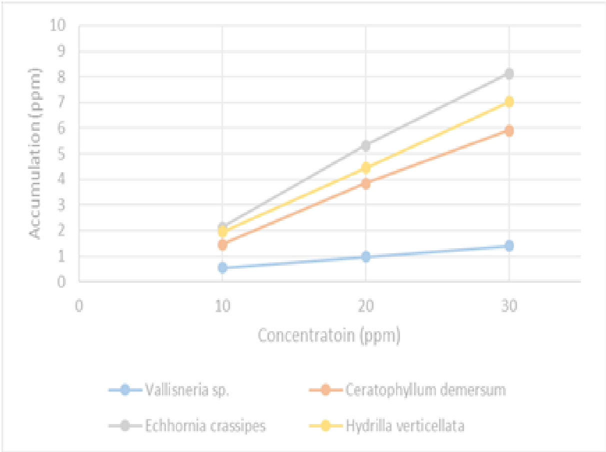
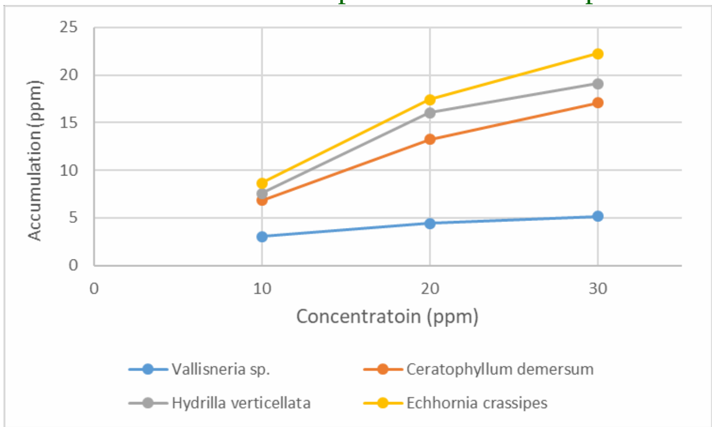


Chart.5 Compared to the concentrations of lead in plants (*Vaillceneria*, *C. demersum, H. verticellata, E. crassipes*) after treatment different concentrations of polluted water is expressed in units of ppm in thirty day



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How to cite this article:

Nashmeel Ali Hassan. 2022. Plants Differ in their Ability to Treat Lead-Contaminated Water in Different Concentrations. *Int.J.Curr.Microbiol.App.Sci.* 11(09): 1-6.
doi: https://doi.org/10.20546/ijcmas.2022.1109.001