Use Potomogeton pectinatus plant as vital indicator of contamination of heavy elements in the Tigris River passing through Baghdad

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Abstract: The results of this study were obtained possibility of using plant Potomogeton pectinatus as a vital indicator of pollution in the Tigris River for its portability absorbed heavy elements. Results showed there is a connection in the concentrations of elements (Pb, Zn, Ni, Cu, Co, Cd) in water and plant samples in different areas of the study, which was a bit high in the plant as compared with water. Physical and chemical properties of water also revealed an increase in PH and TDS values As well as an increase in some of the concentrations of Cation and negative ion , PO4-2, HCO3 in the waters of the river, especially in some stations located in the Zafaraniyah area and respectively down to the Diyala River, which refers to the water pollution in the study areas, as a result of sewage effect and processes of soil washing lands surrounding the river as well as industrial waste flowing into the river, as well as the nature of the river basin, which abound where Plaster and saline soils, leading to a change in the hydrochemical characteristics and quality of water.

Keywords -Aquatic plants. Pollution. Heavy elements

1. Introduction:

The Tigris River, an important water source due to its nature of biological revival. Pollution that occurs as a result of the mixing of river water sewage, toxic chemicals or metals or oil or any other materials can affect water quality in the river water and organisms in it. [1]. Water pollution occurs when there is large amounts of waste in any water system to become a problem and not a phenomenon beyond the ability of the water surface on the natural self-purification or cleaning [2]. The interference between the organism such as plants respond to environmental influences, such as resistance to the lethal effects of the interaction of the components of the cell, which is reflected in the internal processes as processes of accumulation topic of attention of many researchers [2]. Use many organisms, plants and invertebrates as an indicator of the quality of water pollution [1,3]. When increase the pollutants within the plant tissue, plant is either collected it especially in the root or stem sites, or converts to other forms of non-toxic as possible be distributed and used again in metabolic processes, many researchers have studied the accumulation and transmission heavy elements in different aquatic plant parts such as [4,5,6,7,8]. In Iraq [9,10,11,12,13,14,15,16] because interest environmental realities of the city Baghdad, a vital requirement that these represent the capital city as well as the population and most of the industrial and commercial activities and agricultural activity has study aimed to:

1. The possibility of using *Potomogeton pectinatus* as a vital indicator to signify the pollution in the Tigris River in Baghdad, passing through it.

2. Measuring the concentrations of pollutants in the river water and the extent of the impact of human activities and industrial activities on the quality of the river water.

2. Material and Method

Collection of samples and analysis of elements (Water, Plant):

Samples were collected from the Tigris River passing through the city of Baghdad in January 2013, was selected (8) distributed along the river from the beginning of its entry of Baghdad to the confluence of the Diyala River south of the city . Sampled of *Potomogeton*

pectinatus (Family: Potamogetonaceae) (Order: Alismatales) dominant in all study areas by 5 replicates for each. The areas have difference in environmental conditions from some elements Pb, Zn, Ni Cu, Co, Cd analysis samples for water and plant your atomic absorption spectrometer (AtomicAbsorption Spectrometer) after preparing her standard solutions. Washed plant samples with water river and transported to the laboratory within plastic bags clean mentor, in the laboratory samples washed tap water and then distilled warm water temperature in 38C to remove plankton [6] Then washed parts plant with distilled water free of ions again and dried at a temperature of 70 C then taking 0.5 g dry weight to grind samples and passed through a sieve in a tube digestion and added to 5 ml of nitric acid, the samples left for 16 hours and then digested putting on 100 C degrees for one hour. Then add 3 ml of Perchloric acid 70% and make the samples escalation for 30 minutes at a temperature of 200 m until the solution is clear, then completed a sample size of 50 ml using distilled water and placed in a special plastic containers to analysis of some heavy metals per micrograms / g. The water samples were placed in plastic containers sterile one-liter and divided into two parts the first to make some measurements of chemical and physical water are as follows (, PH TDS,, HCO3,, SO4, NO3, PO4) by way adopted in [17], The second part of the analysis metals (Pb, Zn, Ni, Cu, Co, Cd) in water and plant samples.

2.5: Statistical analysis

Results of the study were analyzed according to (T-Test) to determine the differences between the factors using LSD (Least Significant Difference) level of probability ($P < 0.05$) depending on the average ± standard deviation using (Analysis Variance) ($P< 0.05$).

3: Results and Discussion

Chemical and physical analysis of water samples:

Table (1) the results of the physical and chemical analysis of the water study areas as well as the Iraqi limitations Water quality in the Iraqi aquatic environment

PH	T.D.S	HCO3	SO4	NO3	PO4	Station
8.1	595	134.2	158	4.3	4.4	Dora refinery
7.28	680	164.7	114	2.88	4.3	Electric Dora
7.74	695	164.4	197	2.41	2.7	Medical City
7.3	472	201.3	140	3.04	4	Jadiriya
7.2	490	225.7	132	3.24	2.8	Kadhimiyah
7.9	768	122	107	3.8	3.7	Zafaraniyah
8.99	1200	140.3	122	8.34	5.3	Forum Diyala with Tigris
7.88	466	167.3	172	4.04	2.4	Oils area
6-9.5	1500	170	200	50<	3<	Iraqi limitations

The results of the physical and chemical analyzes of water samples show the presence of differences in pH values (pH) in most of the study areas, if there is an increase in values (pH), especially in the stations meeting place of the Tigris River, oils and Dora refinery due to the impact of industrial water waste into the river in that as a result of industrial processes stations. The results also showed differences in the concentrations of dissolved substances which recorded the highest value at the crossroads of the Tigris River station River Diyala (1260 mg / L), while the lowest value was in Jadiriya station (472) mg / L, is attributed high concentrations of total dissolved substances (TDS). Water level lower of the river, Industrial waste ,sewage ,irrigation water ,soil erosion and rain an important role in increasing the concentrations of total dissolved substances, results were generally less than the Iraqi limited. Difference concentrations (HCO3) in the waters of the Tigris River areas studied due to the difference in the proportion of rainfall and the value (pH), the viability of carbon dioxide on the decomposition and mixing with other elements.Concentration (HCO3) as varied

difference result of air temperature and air pollution due to the interaction of gas (CO2) with rain water and gases to the atmosphere transforms (HCO3). Also possible to change focus (HCO3) in the water as a result of soil processes (CO2) resulting from the decomposition of life for the bacteria reacts with the river water is composed (HCO3). When comparing the ion sulfate concentration with the Iraqi limitations find that most of the concentrations did not exceed the permissible limits except station (3) Medical City was the sulfate concentration in the river water (197 mg / L) close to the limits and is less than 200 mg / liter. And increased phosphate in the Tigris River within the study area as a result of industrial waste and sewage and irrigation water for agricultural soils, which have the final fate of the river water and containing on the high concentrations of phosphorus [1]. Which explain the significant increase in the growth of aquatic plants along the river course as phosphate nutrients for plants, which leads to eutrophication [1].

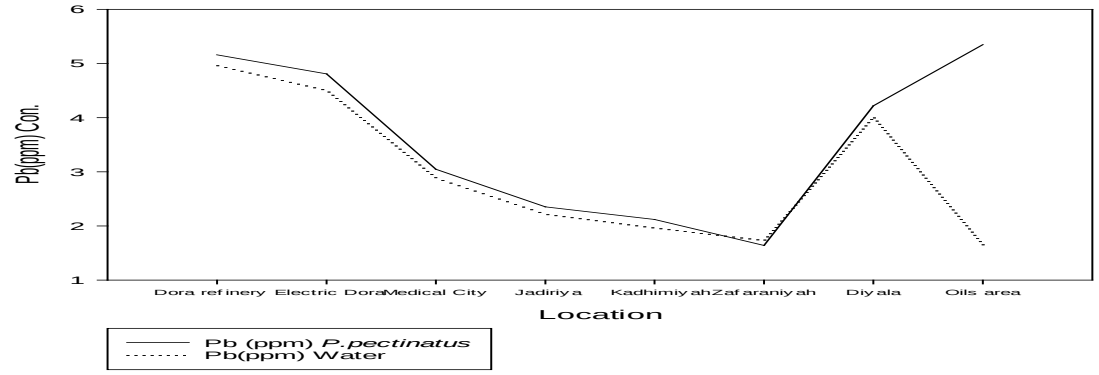
Concentrations of heavy metals in the plant and water:

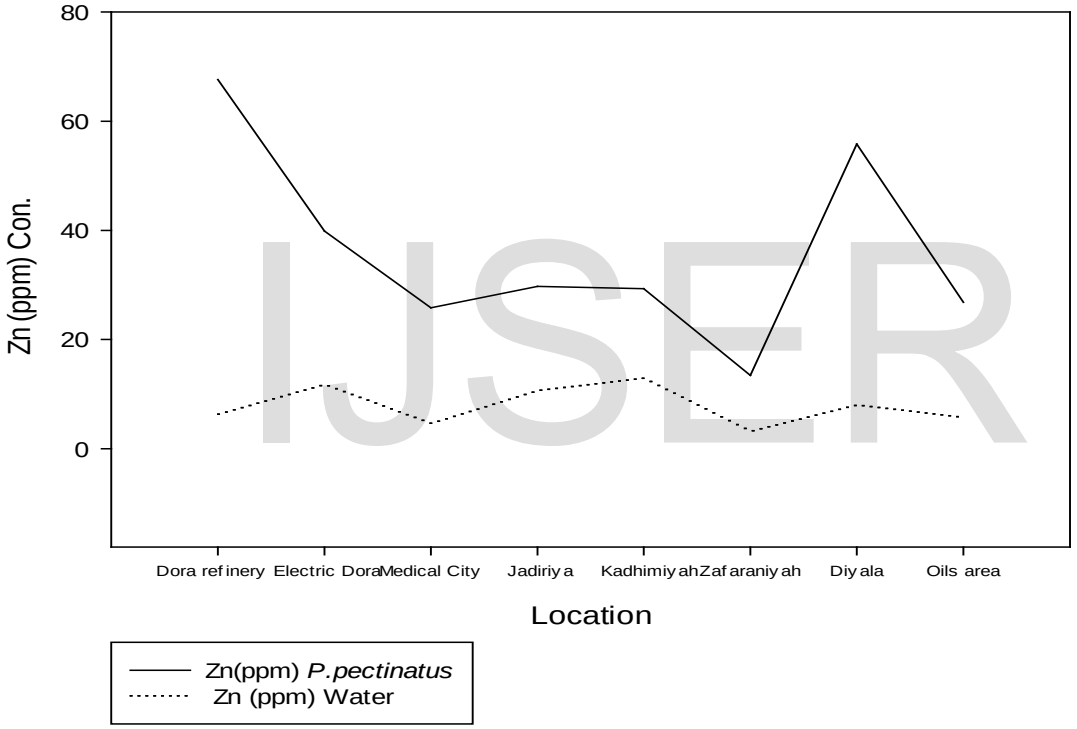
1- Pb , Zn, Ni

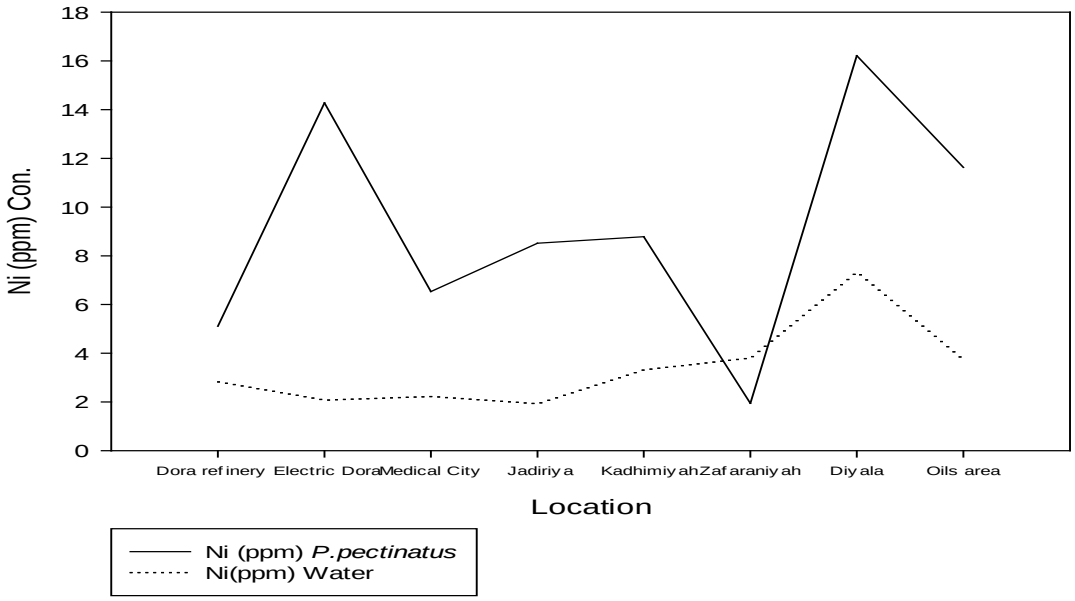
From Table (2-a) Fig (1,2,3) Lead concentration is a high component in the plant compared to the water samples areas that's mean *P. pectinatus* plant absorption and accumulation element of pollutants with increasing concentrations of contaminants in surrounding environment which usually includes aspects such as growth and reproduction in response, as well as the behavior [19] addition reason to increase the concentration of zinc in the Tigris River in this study area to the impact of remnants of the industrial enterprises that put pollutants into the river without effective treatment, such as spinning coefficient and textile dyes and nearby areas of study. This element enters the process of revitalization of some enzymatic systems in plants and can collect amounts of it (1-200 ppm), without causing damage to the plant [20,21] and the strongest essential micronutrients in plant growth and ranges concentration in plant tissue between ppm (5-25) of dry matter [19]. The highest concentration has reached nickel valuable Tigris River at the crossroads of Diyala and less concentration in Zafaraniyah area. As the results showed the presence of nickel concentrations rates higher than allowed in the border plants (0.5-2) ppm [22] Table and Fig (2-a) which shows the concentrations of the elements Pb, Zn, Ni (ppm) in the waters of the Tigris River and the plant *Potomogeton pectinatus* under the study area .

	Ni (ppm)		Pb (ppm)		Zn (ppm)	
	P.pectinatus	Water	*P.pectinatus*	Water	*P.pectinatus*	Water
Dorarefinery	5.106	2.82	5.16	4.96	67.64	6.3
Electricdora	14.28	2.07	4.81	4.5	39.88	11.74
Medical City	6.53	2.22	3.046	2.88	25.83	4.61
Jadiriya	8.52	1.922	2.352	2.212	29.752	10.63
Kadhimiyah	8.789	3.316	2.119	1.96	29.34	12.9
Zafaraniyah	1.94	3.8	1.64	1.73	13.42	3.18
Diyala	16.22	7.33	4.22	4.01	55.83	7.99
Oils area	11.63	3.72	5.35	1.65	26.83	5.73

Table (2-a) shows the comparison concentrations of elements (Pb, Zn, Ni) (ppm) of *P.pectinatus* and water under the study area


Pb(ppm) Con.
6
5
4
3
2
1
Dora refinery
Electric Dora
Medical City
Jadiriya
Kadhimiyah
Zafaraniyah
Diyala
Oils area
Location
Pb (ppm) P.pectinatus
Pb(ppm) Water


Zn (ppm) Con.
80
60
40
20
0
Dora refinery
Electric Dora
Medical City
Jadiriya
Kadhimiyah
Zafaraniyah
Diyala
Oils area
Location
Zn(ppm) P.pectinatus
Zn (ppm) Water



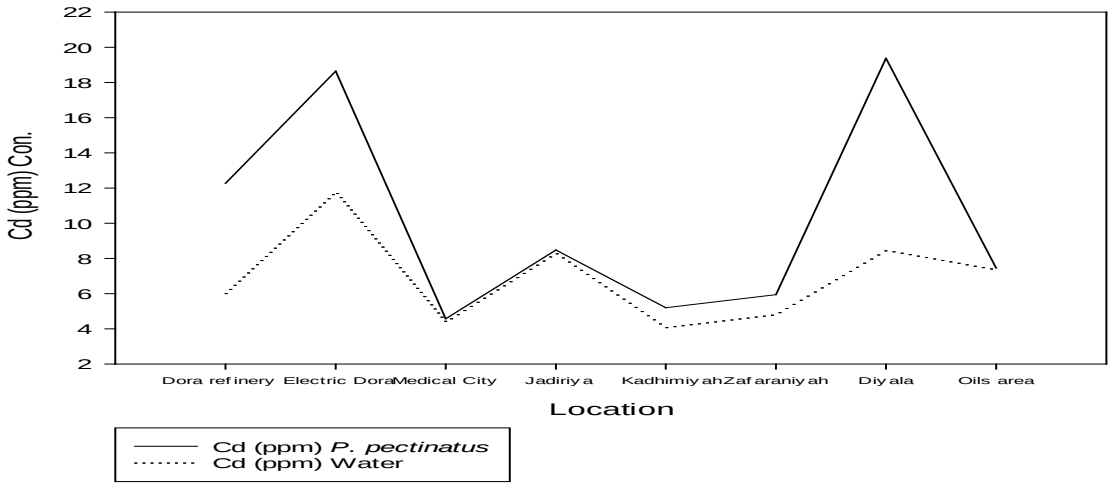
2-Cd, Co, Cu:

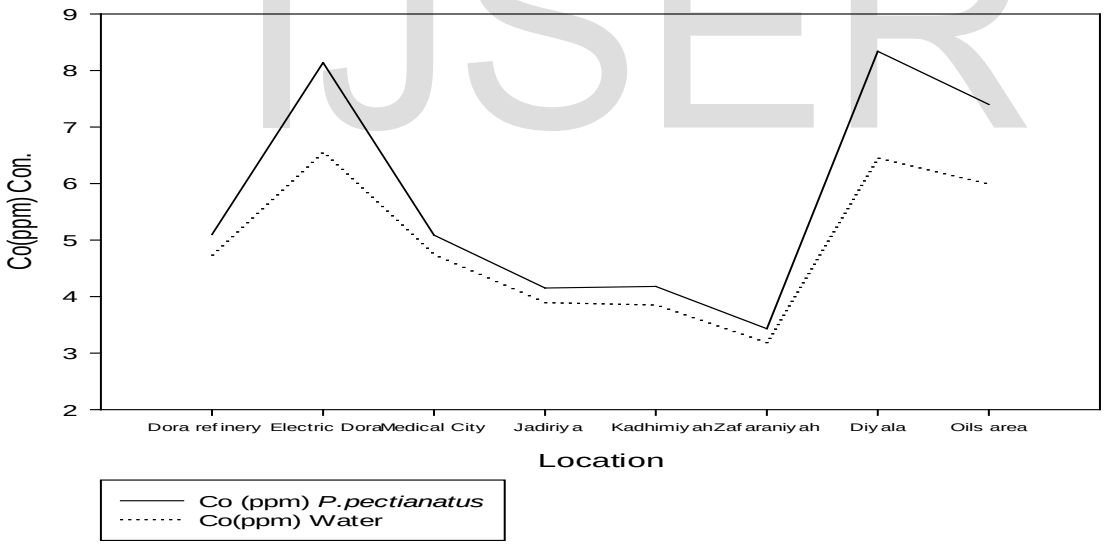
From Fig 2-b shows the concentration of cadmium in water was higher than normal limits permitted by the Iraqi determinants (0.05 0.2) ppm in river water (WHO) where (8.286_19.38) in water and plant respectively note that sources indicate that the highest allowable concentration of cadmium in plants is (5-30) ppm [19. As the plant is characterized by absorption, storage and re-use of this metal. It depends on the shape of the plant phenotypic drift of leaves, roots or submersible). As for copper, not exceed the permitted in the waters of the studied areas and the results show that it was less than 50 ppm, which is permitted as mentioned [24,25], and between [26] that the cause of increasing concentrations of copper in water Clearly, the river goes back to the influence of industrial starters and the impact of the Diyala River on the Tigris River to the content of copper salts, as well as the flooding that has occurred during this winter season (2013), which leaves the impact leads to signs of plant poisoning [27]. While cobalt log normal concentration (5-10) ppm (WHO). The mechanisms plant high levels of the elements may be through the container SH group, called Phytochelatins or through Metallothioneins which is found in plant cell proteins that play an important role in removing toxic elements through the plant cell. Fig (2-b) shows the concentrations of elements Cu, Co, Cd in the waters of the Tigris River and plant *Potomogeton pectinatus* under the study area.

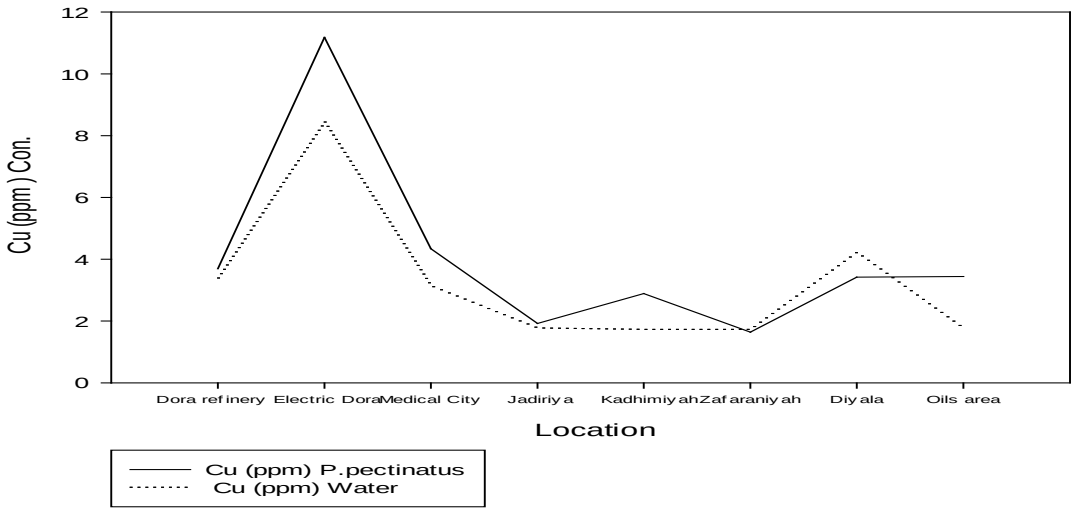
	Cd (ppm)		Cu (ppm)		Co (ppm)	
	P.pectinatus	Water	*P.pectinatus*	Water	*P.pectinatus*	Water
Dorarefinery	12.27	0 .6	3.69	3.39	5.1	4.73
ElectricDora	18.65	11.78	11.182	8.45	8.14	6.56
Medical City	4.57	4.38	4.34	3.14	5.09	4.74
Jadiriya	8.48	8.286	1.9215	1.775	4.15	3.89
Kadhimiyah	5.2	4.06	2.89	1.73	4.18	3.85

Zafaraniyah	5.94	4.8	1.64	1.73	3.43	3.18
Diyala	19.38	8.45	3.42	4.23	8.34	6.45
Oils area	7.45	7.34	3.44	1.77	7.4	5.99

Table(2-b) shows the comparison concentrations of elements (Cd, Cu, Co) (ppm) of *P.pectinatus* and water under the study area







CONCLUSION

The physical and chemical properties of water have been varies from region to region as it recorded the highest in activities industrial and energy production areas (Dora refinery ,Electric Dora and Forum Diyala with Tigris) depending on the nature of the events that occur in those areas . in this study has relationship between concentrations of elements in the plant and water . which may be due to plant growth in the same water source showed (Tigris River) a significant difference which indicates between the plant's ability to withstand various concentrations of heavy and portability accumulation within the plant tissue and between the element type and conditions of the surrounding environment and the different type and area elements. There was a significant correlation between the concentrations of Zn, Pb and Ni in the leaves of *P. pectinatus* .This result suggested the plant can be regarded as biomonitors on the metal pollution of the water body. For Cd, Cu and Co a significant relationship was found in the leaves of plants significant relationships were observed between heavy metal concentrations in aquatic plant leaves and water The metal accumulation by aquatic plants was more effective this like with [25.26] In the present study, the primary source of metals in the plants of *P. pectinatus* may be direct uptake by the leaves from the river water, It is higher in the water than on the plant and this indicates the viability of the plant as an indicator to absorb heavy vital element in all regions.

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