تقدير بعض العناصر الثقيلة في نبات الحنطة والترب المزروع فيها لمنطقة معامل الطابوق الأهلية (الكور) في مدينة بابل

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الخلاصة:

تم في هذه الدراسة تقدير العناصر الثقيلة(الرصاص و الخارصين و المنغنيز والنحاس والحديد) التي تعتبر المصدر الرئيسي لتلوث النباتات والترب ، إذ تم جمع ٢٠ عينة من ترب مختلفة (بعمق ١٠ سم)، ومن نبات الحنطة (جذور وأوراق) من المواقع الشمالية والغربية والجنوبية من معامل الطابوق الاهليه. العناصر المتجمعة في نباتات الحنطة تتوزع في الغالب في أنسجة الجذور لتلك التي نمت بالقرب من معامل الطابوق الأهلية التي بنيت في المناطق القريبة من ضواحي مدينة بابل(بالقرب من جامعة بابل). جمعت كذلك عشرة عينات من نباتات الحنطة والترب من مناطق بعيدة عن مصدر التلوث لاستخدامها كعينات سيطرة(قياسية) للمقارنة.وجد بان تراكيز هذه العناصر عالية جدا في النماذج القريبة من مصدر التلوث مقارنة بعينات السيطرة. معدل تركيز العناصر في نماذج النبات كانت (٠.٣٢؛٠.٤٩ ppm)،(0.63;0.44 ppm)، (٠.٣٣؛٠.٦٣ ppm)، (٣.٣٨؛٥.٦ppm) ، (٠.٣؛٠.٥٦ ppm) و(٠.٢١؛٠.٣ppm)(أوراق؛جذور) لعناصر الرصاص والخارصين والمنغنيز والنحاس والحديد على التوالي.معدل تركيز العناصر في نماذج الترب كان ٠.٧ ، ٠.٩١٥ ، ٩.٣٨ ، ٠.٦٨ و ٩.٣٣ جزء بالمليون للعناصر المذكورة على التوالي.

Abstract:

In the present study, the determination of the heavy metals (Pb, Zn, Mn, Cu and Fe) which considered the main source of pollution in plants and soils, was carried out. (20) Samples are collected from different soils (depth 10 cm) and plant (roots and leaves of Wheat) from the northern, eastern and the southern sites to the illegal Bricks Factories. The metals accumulated by wheat plants were mostly distributed in root tissues , which grown near the illegal Bricks Factories which built close to environs of Babylon city (near to Babylon University) , and also (10) samples from plants and soils were collected from the region far from the illegal Bricks Factories as a control samples, it was found that the concentrations of these metals are very high compared with the control samples. The average concentration of metals in samples of plant was Pb (0.49; 0.32ppm) , Zn (0.63; 0.44 ppm) , Mn (5.6; 3.38 ppm) , Cu(0.56; 0.3 ppm) , and Fe (0.3; 0.21 ppm) (Root; Leave) consequently. The average concentration of metals in samples of soils was Pb (0.74 ppm) , Zn (0.915 ppm) , Mn (9.38 ppm) , Cu 0.68 ppm) , and Fe (9.33 ppm).

Key words: heavy metal, Nutrition – plants Pollution , Soil , Plants.

Introduction

Soil ecosystems have been extensively contaminated with heavy metals due to various human activities , These activities can cause severe pollution of highly toxic heavy metals (such as Cu, Cd, Pb and Hg) in aquatic and terrestrial ecosystems, and even to the atmosphere (Deng et al., 2006; Leung et al., 2006). Heavy metals are non-biodegradable, thus persisting for long periods in environmental ecosystems. Soils contaminated by heavy metals from either aerial depositions or irrigation are likely to induce a corresponding contamination in harvested crops (Nan et al., 2002). Crops in or close to contaminated sites can uptake and accumulate these metals, and then exert potential risk to humans and animals (Gupta and Gupta, 1998; Jarup, 2003). Heavy metals not only accumulate in the surface soil (0–30 cm), but are also highly distributed at the main entrance of irrigation water into individual paddy fields (Zeng *et.al*.,2010). Possibly including mobilization of these metals up in the food chain, thereby threatening human health. Providing a direct physical link between soil and plant roots they can increase plant

uptake of nutrients especially the relatively immobile elements such as P, Zn and Cu . As it was known environmental problems such that- caused by the rapid increasing of population, distorting urbanization and decreasing green areas, chemicals used in industry , thermic power and fuel stations are the ones that their solutions are searched not only in our country but also in all over the world. Air , water and soil pollution related to the irregular industrialization and urbanization is above the biological tolerance limits(Bradford,1976). Especially the overlapping of the settlements and industrial areas has been the reason for increasing air pollution in recent years in Hilla City (Taha and *etl* 2005). Slags from metallurgical or waste incineration plants etc. are frequently used in landscape construction or hydraulic engineering . They reportedly contain heavy metals in chemically very inert binding forms(Leonard,1991). However , if exposed to environmental influences or if mixed with soils, chemical processes such as pH changes may alter the chemical binding of metals and eventually increase their mobility and bioavailability (Luoma,1983). .

Consequently growth and heavy metal accumulation as well as the usefulness of these extractants for the prognosis of heavy metal transfer to plants are discussed.

Figure (1): Developed chemical formula of some lead coordination and organolead compounds.

In this study, determination of some heavy metals levels (Pb, Zn,Mn, Cu and Fe) in the plant and its soils around illegal Bricks Factories (kura) in south of Babylon city in three sites and knowledge of TF values.

Practical Part :

A- Instruments:

1. Flame atomic absorption spectrophotometer (Pye-unicam SP9).
2. VEB- ML W Labortechnik IL MENAU, Supplied from GDR.
3. Digital balance , sartours, (Bb,3015), Germany.
4. Water bath, Gesellschaft fur Labortechnik, Germany.
5. Oven, Heravs, Germany.

B- Procedure:

A (2) gm of each plant leaves and roots sample was cut into small pieces and dried in an oven for 30 min. at a temperature of 50-80Cº , then the sample is digested with perchloric acid and nitric acid mixture (1:3)(Perry, and Young,1977) [9], then after that the Three samples are taken for each element were filtered and the filtrate is taken for the measurement of the desired elements using flame atomic absorption spectrophotometer.

The translocation factor (TF) for metals within a plant was expressed by the ratio of (Metal) Shoot / (Metal) Root to show metal translocation properties from roots to shoots (Stoltz and Greger, 2002) .

Results and Discussion:

Heavy metals consider the main source of pollution in plant and soil. Samples were taken from different plants (leaves and roots for the same plant) in the areas near to illegal Bricks Factories (kura).

Two samples were taken as control from two different areas far apart from bricks factories and any pollution sources in Babylon city.

The results in tables (1) shows the concentrations of the samples elements in plant and soil in three sides and the standard**.**

Table(1): Concentrations of the samples elements(in ppm) in plant and soil in three Sites and the standard

Standard Values		Wheat in Site(2)		Soil in Site(2)	Wheat in Site(1)		Soil in Side(1)	Wheat in Southern Site		Soil in Southern Side	No.	Element
Plant (leaves)	Soil	Leave	Root		Leave	Root		Leave	Root			
0.07	0.08	0.32	0.44	1.99	0.23	0.54	0.91	0.41	0.51	0.79	-1	Lead
				0.86			0.63			0.54	-2	
				0.61			0.54			0.44	-3	
				0.64			0.66			0.38	-4	
0.36	0.34	0.56	0.82	1.0	0.32	0.45	1.32	0.44	0.62	0.98	-1	Zinc
				0.59			0.41			1.0	-2	
				1.0			1.17			0.924	-3	
				1.17			0.94			0.48	-4	
0.1	0.11	0.21	0.5	5.312	0.43	0.5	9.55	9.5	15.93	11.03	-1	Manganese
				3.75			11.63			10.28	-2	
				5.93			8.35			11.14	-3	
				11.03			10.91			13.71	-4	
0.08	0.13	0.12	0.5	0.49	0.65	1.0	0.25	0.13	0.2	0.66	-1	Copper
				1.0			0.10			0.5	-2	
				0.66			0.22			1.0	-3	
				0.29			2.54			0.5	-4	
0.05	0.12	NO A.						0.21	0.3	11.76	-1	Iron
										8.75	-2	
										9.09	-3	
										7.74	-4	

*Data is average of five reading except standard samples (two reading)

The results in table (2) shows the T-Values of TF in three sites**.**

Table (2) :T values of TF parameter in three sites

Parameter	Site	Elements			
		Pb	Zn	Mn	Fe
TF	Southern	0.80	0.70	0.59	0.7
	(1)	0.42	0.71	0.86	NO A.
	(2)	0.72	0.68	0.42	

The translocation factors (TF) , the ratio of the shoot to root metals, indicate internal metal transportation . The data presented in table (2) showed that the rate and extent of translocation within plant. Zn for example accumulated by wheat it was largely translocated to shoot as shown by general TF values < 1.

The uptake of toxic heavy metals from contaminated soils by food and forage plants comprises a prominent path for such elements to enter the food chain and will finally be ingested by humans. Ingestion and eventual accumulation of toxic heavy metals pose a threat to human health and should, therefore, be minimized.

It was also reported that the uptake of heavy metals by crop plants may vary in different cultivars of a particular species.

Table (3) : Relative mobility and availability of trace metals (modified from Salomons, 1995) [11]

Metal species and association	Mobility
1. Exchangeable (dissolved) cations	High. Changes in major cationic composition (e.g. estuarine environment) may cause a release due to ion exchange
2. Metals associated with Fe-Mn oxides	Medium. Changes in redox conditions may cause a release but some metals precipitate if sulfide mineral present is insoluble
3. Metals associated with organic matter	Medium/High. With time, decomposition/oxidation of organic matter
4. Metals associated with sulfide minerals	Strongly dependent on environmental conditions. Under oxygen-rich conditions, oxidation of sulfide minerals leads to release of metals
5. Metals fixed in crystalline phase	Low. Only available after weathering or decomposition

Plant uptake of trace elements is generally the first step of their entry into the agricultural food chain. Plant uptake is dependent on (1) movement of elements from the soil to the plant root, (2) elements crossing the membrane of epidermal cells of the root, (3) transport of elements from the epidermal cells to the xylem, in which a solution of elements is transported from roots to shoots, and (4) possible mobilization, from leaves to storage tissues used as food (seeds , tubers, and fruit), in the phloem transport system. After plant uptake, metals are available to herbivores and humans both directly and through the food chain. The limiting step for elemental entry to the food chain is usually from the soil to the root . This critical step usually depends on element concentrations in soil pore solutions, which are controlled by by local soil physical and chemical conditions including water content, pH, and other factors.

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