

# Determination of heavy metal pollution products, vegetable gardens Ardabil

Pooriya Rafiee\*

Department of Environmental Engineering, Ardabil Branch, Islamic Azad University, Ardabil Iran

## ARTICLE INFO

### Article history:

Received 11 June, 2018

Accepted 16 Aug 2018

Published 29 Sept. 2018

### Keywords:

Bioaccumulation,

Cadmium,

Lead,

Spinach,

King, Ardabil

Determining The Amount Of Heavy

Metals Pollution In Vegetables

Productions Of Ardabil

## ABSTRACT

Security Food population At Now Growth With Attention To References natural Limited One From Topics a lot Important At the world To the count The Is. Aggregation Metals heavy At materials Food And increase Density They And arrive To Range the danger The Can health Man And Casethreaten serious The To this intended purpose At this Study amount Metals heavy Lead And Cadmium At Vegetable Spinach And Shahi Rearing 10 Garden Range City Ardabil Case review The Was, this Study From Kind Cross - sectional Been And A total of 8 1 Sample Water - Soil -spinach And Shahi during the moon Of June - July And August 13 94 Preparation And So From ready Of According to Way Standard From Device Absorption Atomic Model Perkin Elmer Made in the USA For Determination amount Metals The lead was heavy cadmium And Analysis And analyze data From Soft Applications SPSS Use Was. The results showed that the average amount Lead And Cadmium At All Sample And little Wet From Standard EPA Respectively. between Garden Of Case Study From Nizmyangyn amount Cadmium And Lead Difference meaning Arrow Observation Not. results Test t Independent sign The From Opinion amount Cadmium between Two Species Spinach And Shahi At Level 5% difference meaning Arrow There was As amount Cadmium At Spinach more From Shahi were. With Attention To The Density Metals heavy In all Sample Of levels Second And Third At July And August the moon Zero Been Is but At the level First At June the moon Contamination Metals heavy In some Sample And There By Is Specified The Is Sample Of vegetable China The first three garden Ratio To China Second And Third have Contamination More is And At this Case Issue Concentration Contamination Metals heavy At Dream Winter in some vegetable gardens Ardabil Likely The Is.

## INTRODUCTION

Food security, population growth, according to the Natural Resources Limited is one of the most important issues in the world is. The most important sources of heavy metal contamination of natural resources are Ghyrnqth. Annual global scale, thousands of these elements in the soil system (Taylor et al, 1999). Since agricultural products contaminated with heavy metals resulting in decreased quality of agricultural products on the one hand and the other hand is a serious threat to human health, the environmental aspects are very important. Accumulation of heavy metals and increase their concentration and achieve the exposure can be by entering the human food chain, his health was seriously threatened (Sui et al, 2005). Among the heavy metals, some of them, such as zinc, copper, and cobalt values are essential for many biological systems, including humans (Samarkand, 1379, Shokrzadeh, 1390). While some other heavy metals such as cadmium, lead and arsenic in plants, animals and humans are highly toxic (Kabata, 2011; Li X, et al, 2004). Cadmium is a known carcinogen in the development of most cancers (Valks, 2003, a tour Duggan et al, 2003). And it seems to be crucial factors in the development of heart disease and high blood pressure (Edmonds, 1996). Lead can also affect the blood system and kidneys, causing metabolic disorders and neuro-physical defects in children. Hmchnyngzarsh that if large amounts of heavy metals such as lead, into the body of the

pregnant women, premature birth and babies with severe mental retardation will be greatly increased (WHO, 2003; Zadrvdzky et al, 2003). Plants can see without damage high levels of cadmium in their gathering (Alva, 1995) stated that relatively high concentrations of cadmium can accumulate in the edible parts of plants, without obvious symptoms affecting plant be. Cd accumulation in plants can increase the potential of this nutrient by humans and this is done in the case that these plants are part of the diet (Kabata, 2011). Radu and colleagues, (2006) to raise awareness in public opinion in Egypt for evaluation of heavy metals to agricultural products from analysis of several samples of agricultural products, including strawberry, cucumber, dates and batch of their vegetables. With respect to the carcinogenic effects of two cadmium, lead, zinc and copper, and usefulness of the diet in adequate level in the four elements measured in the products listed. Although the results of their study showed that leafy vegetables such as lettuce and spinach had the highest levels of lead and cadmium in other products, were but they estimate the value of the daily intake of these nutrients in agricultural products tested, this value is less than the reported WHO and FAO knew. Removing heavy metals from contaminated soils by plants, especially agricultural products is one of the most important ways of entering the food chain elements (Fuji et al. 11, 2008). Annually, about 38,000 tons of cadmium and almost a million tons of lead in

\*Corresponding author: Pooriya.Rafiee@gmail.com

DOI: <https://doi.org/10.24200/jrset.vol6iss04pp6-13>

soils worldwide added that large amounts of the dust atmosphere, scattering the ashes and municipal waste and low concentrations of the chemical fertilizers and sewage sludge is (Anryagv and et al. 12, 1988). Two heavy metals lead and cadmium is a crucial element in the development of cancer, particularly gastrointestinal cancer known (Valks, 2003; Tvrdvgn et al., 2003). The aim of this study was to evaluate the concentration of lead and cadmium in products Shah spinach vegetable garden cultivated lands in the city of Ardabil. Food safety is one of the underlying principle of all societies, which all countries in the provision of due diligence with regard to the facilities and conditions to work Brnddr among vegetables as a member of the food basket of stressed health experts and the traditions of Islam as well as the vegetables mentioned as a table ornament. Naturally healthy vegetables can play a significant role in the health of consumers. After the industrial revolution and the scientific progress of mankind login environmental pollutants to water, soil and air as well as increased entry of these compounds to plants, especially vegetables through water, soil and the use of pesticides threaten the health of consumers has made a serious matter. Heavy metals into the food chain and reach a critical concentration of metabolic and physiological adverse effects on living organisms rather than leave cadmium atomic weight element is 4/112 that may cause kidney damage, hypertension, cancer, mutant Shvd.srb job atomic number 82 are three important system of the human body, the hematopoietic system, nervous system and kidneys are sensitive to it (principal, and et al., 1389). This study aimed to determine the amount of lead and cadmium in products as hazardous heavy metals (spinach and watercress) Ardabil vegetable gardens. According to the consumption of contaminated vegetables and consequently illnesses associated with the consumption of certain types of cancer, kidney disease, nervous system and .... direct and indirect costs to society of each country.

So it is necessary to impose appropriate research related with this in Ardebil vegetable gardens are fulfilled.

### Geographic and climatic issues

#### Location

Ardabil province with an area of about 17867 square kilometers, about 1.1 percent of the country's total area in the North West of Iran (East Azerbaijan and Northern Plains), is located.

Ardabil city, in an area with geographical coordinates 48° and 47° to 39° 48 degrees east longitude and 56 degrees 37 to 33 and 38 north latitude, is located. The city of Ardabil Plain at an altitude of 1340 meters above the sea level.

According to the latest population census in 1390 in Ardebil city population is 485,153 people. (Statistical Yearbook governor of Ardebil 1391)

Due to cold weather conditions Ardabil in the year just within five months of June to October planting vegetables takes place in the city of Ardabil (urban and rural) 40 Vegetable garden is the active part in this study because of limitations (time, access laboratory, etc.) 10 within the range of Ardabil Bagh Dar selection and preparation began on March 93 was set Specification Sheet vegetable gardens and during the months of June, July and Persian date Mordad 1394 sampling preparation and testing was done.

#### Study area

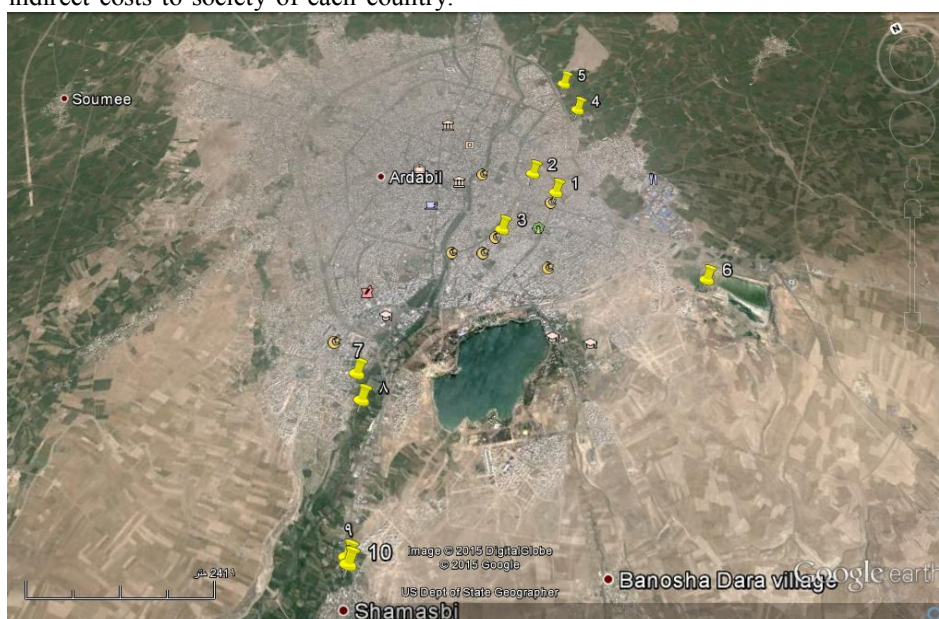
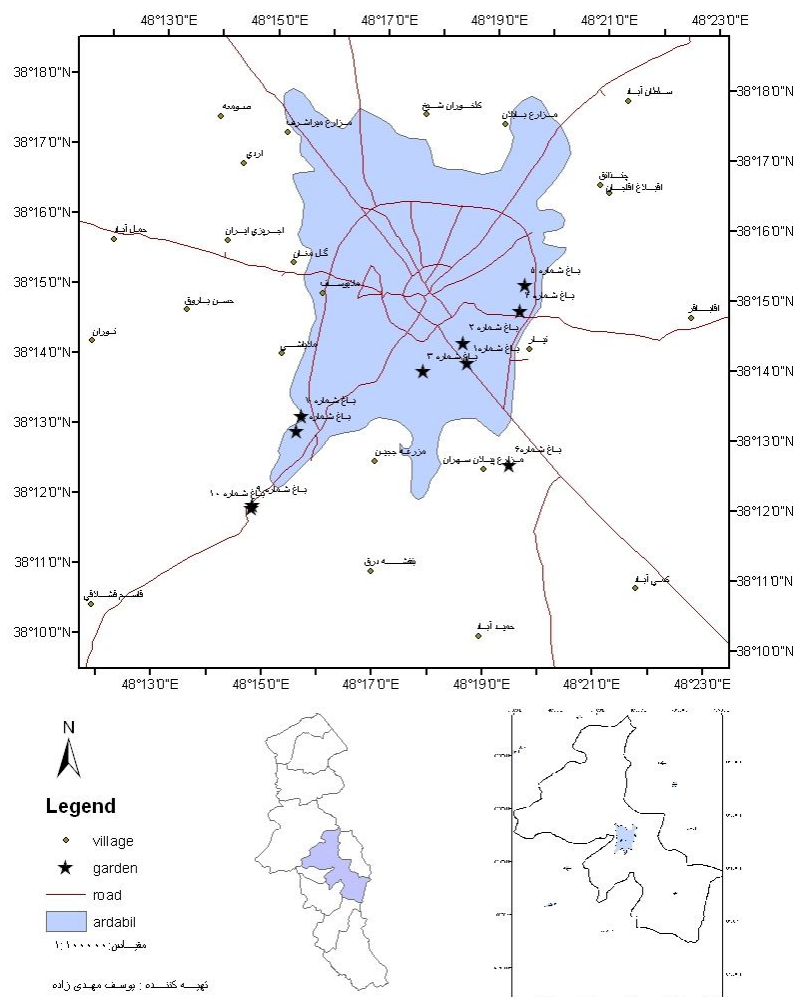


Figure 1 satellite image study vegetable gardens position Ardabil

#### Geographical locations studied



**Figure 2 points Geo Case Study Research Methodology**

The study was a cross-sectional Bvdhv amount of heavy metals (cadmium and lead) in Shah spinach farmed vegetables in gardens within the city of Ardabil were investigated. First, the water used to irrigate gardens as well as cultivated soils were sampled.

Sample of spinach, cress was performed three times in June, July and Persian date Mordad 1394. The samples using standard preparation procedures and atomic absorption using a Model Perkin Elmer build Islamic Azad University to determine the amount of lead and cadmium was used for analysis of variance was used spss software. Samples of soil and water and vegetable products (spinach and watercress) 10 months of June, July and vegetable garden Persian date Mordad 1394 was performed. In the case of plants during three sampling in June Tiro Persian date Mordad 94 13 per Mrhlhnmvnh taking a sample of any vegetable garden cress, spinach and a sample was taken that the total sample was 81. How sampling of vegetables so that each garden plots cultivated spinach and watercress random sampling of at least 10 plants weighing about 200 g and the samples were mixed with each other.

**Table 1 shows the results of measurement of lead and cadmium in soil and water samples spinach and watercress vegetable gardens were the first sampling stage (June 1394)**

Water samples (10 samples) after being transported to the laboratory by adding 5 ml of nitric acid in 100 mL of water to stabilize Grdyd.nmvnh soil (10) for the preparation of a composite sample of 5 to 6 points of the garden from the depths zero to 30 cm were prepared. after drying air was passed through the sieve.

#### **Data collection method**

Through field studies, library and tools (sampling and test) was performed. Information from databases, owners and stakeholders were prepared gardens.

#### **Data collection**

Information required by authorities library resources and online sampling and analysis in the laboratory, respectively.

#### **Methods of data analysis**

The results of the measurement of heavy metals in any product in the garden for each month via standard EPA were compared for differences between products as well as gardens in the city of ANOVA for comparison of the t-test was used to analyze and analyzed using SPSSsoftware was performed.

#### **The results of the sampling**

Garden Number	Water cadmium (Ppm)	Lead water (Ppm)	Cd (Ppm)	Lead dust (Ppm)	Cadmium spinach(Ppm)	Lead spinach(Ppm)	Cd King(Ppm)	Lead King (Ppm)
1	0.407	0	0.72	9.97	- *	-	-	-
2	0.083	0	0.76	10:02	0	0	0	0
3	0.055	0	0	10:02	7.5	0	0	100.17
4	0	0	0.62	0	0	0	0	0
5	0	0	0.66	0	0	0	0	0
6	0	0	1.28	10:21	9.8	0	0	400.4
7	0	0	0.53	0	0	0	0	0
8	0	0	0.58	0	0	0	0	0
9	0	0	0.79	7.3	-	-	0	0
10	0	0	0.93	0	8.8	0	0	0

Source: research findings

- Dark sign (-) indicates a lack of culture while sampling assay results table is.

**Table 2 shows the results of measurement of lead and cadmium in samples of spinach Shah in the second stage of sampling (July 1394)**

Garden Number	Cadmium spinach (ppm)	Lead spinach (ppm)	Shahi cadmium (ppm)	Lead King (ppm)
1	- *	-	-	-
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
5	0	0	0	0
6	0	0	0	0
7	0	0	0	0
8	0	0	0	0
9	-	-	0	0
10	0	0	0	0

Source: research findings

- Dark sign (-) indicates a lack of culture while sampling assay results table is.

**Table 3 shows the results of assessment of cadmium and lead in samples of spinach and watercress water sampling in the third phase (August 1394)**

Garden Number	Water cadmium (Ppm)	Lead water (Ppm)	Cadmium spinach (ppm)	Lead spinach (ppm)	Shahi cadmium (ppm)	Lead King (Ppm)
1	0	0	- *	-	-	-
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	0	0	0	0	0	0
5	0	0	0	0	0	0
6	0	0	0	0	0	0
7	0	0	0	0	0	0
8	0	0	0	0	0	0
9	0	0	-	-	0	0
10	0	0	0	0	0	0

Source: research findings

- Dark sign (-) indicates a lack of culture while sampling assay results table is.

Plant samples were weighed Table Table 4 for more and after drying in the oven

Garden Number	Fresh spinach and watercress (G)	Dry weight of spinach after Feb (G)	Shahi dry weight of Feb (G)
1	80	85/9	39/10
2	80	13/16	-
3	80	35/10	12
4	80	88/10	68/13
5	80	15/9	9
6	80	55/9	18/8
7	80	80/7	73/9
8	80	96/11	57/10
9	80	52/11	48/10
10	80	36/8	88/12

Table 4 shows the weight of spinach and watercress sampled after drying in the oven has fallen 87% and only 13% remain.

Table 5 pH soil survey studied gardens

Garden Number	Soil pH
1	13.8
2	25/8
3	1/8
4	1/8
5	03/8
6	96/7
7	57/8
8	96/7
9	61/7
10	93/7

Source: research findings

Results of statistical analysis for cadmium and lead

Table 6 ANOVA results for cadmium and lead in the gardens to

		sum of squares	Degrees of freedom	average of squares	F	The significance level
Cadmium	Intergroup	843/39	9	427/4	702/0	701/0
	Intergroup (error)	893/163	26	304/6		
	Total	736/203	35			
Lead	Intergroup	648/36933	9	739/4103	Vary from 850	579/0
	Intergroup (error)	759/125533	26	221/4828		
	Total	407/162467	35			

Results Decomposition Variance Quantities of heavy metals lead and cadmium in the samples of the gardens Case Study sign The That TheAmount Cadmium Venice Amount Lead Difference Meaning You have There. (Sigcd = 0.701 And sig pb = 0.579) (Table 6)

Table 7 shows the results of analysis of variance to cadmium and lead resources (water, soil and plants)

	sum of squares	Degrees of	average of	F	The significance
--	----------------	------------	------------	---	------------------

			freedom	squares	level
Cadmium	Intergroup	273/15	2	637/7	337/1
	Intergroup (error)	462/188	33	711/5	276/0
	Total	736/203	35		
Lead	Intergroup	942/7541	2	971/3770	803/0
	Intergroup (error)	464/154925	33	711/4694	456/0
	Total	407/162467	35		

Results analyze Variance Showed that the amounts of heavy metals lead and cadmium measured in terms of resources (water, Soil Plants)studied vegetable gardens dispute Meaning You have There were 0.276 sig cd = And sig pb = 0.456) (Table 7)

#### T test results between the cadmium standard in water

**Table 8 test results t A sample for comparison with the standard amounts of Cadmium in water EPA**

Standard EPA : 005/0						
	Test t	Degrees of freedom	The significance level	The mean difference	O 95%	
					Lowest	Topmost
Cadmium	551/1	9	155/0	099/0	0454 / 0-	2434/0

Source: research findings

Results Test t The comparison of the measured values of cadmium in vegetable gardens irrigation water showed that With Standard EPA dispute Meaning You have There. (Sig> 0.05) (Table 8)

#### T test results between the cadmium and lead in the soil standard

**Table 9 test results t For lead in soil**

Standard EPA 50						
	Test t	Degrees of freedom	The significance level	The mean difference	O 95%	
					Lowest	Topmost
Lead	187 / 28-	9	0.000	248/45	8794/48	6166 / 41-

Source: research findings

Results A sample t test showed The That From Opinion Amount Lead At Soil Among Average By measuring the amount of soil Area WithStandard EPA in Level Perhaps 1% (sig = 0.00) were significant. As Average Lead At Area fewer From Standard Was (4.7 <50) (Table 9)

**Table 10 test results t For cadmium in soil**

Standard EPA 1						
	Test t	Degrees of freedom	The significance level	The mean difference	O 95%	
					Lowest	Topmost
Cadmium	061/3	9	014/0	313 / 0-	5443 / 0-	0817 / 0-

Source: research findings

A sample t test showed The From Opinion Amount Cadmium also the average value measured in the study area Average Cadmium At Area fewer From Standard Respectively. (0.68 <1) (Table 10)

#### A sample t test results between the cadmium and lead standards in plant

**Table 11. t test results for cadmium in plant**

Standard EPA : 3					
Test t	Degrees of freedom	The significance level	The mean difference	O 95%	
				Lowest	Topmost

Cadmium	55 / 1-	15	142/0	36875 / 1-	251/3	5135/0
---------	---------	----	-------	------------	-------	--------

Source: research findings

Test results An example of a show t The That From Opinion  
Amount Cadmium Posts Area With Standard EPA  
Difference Meaning You have No(sig = 0.142). (Table 11)

**Table 12 test results t To lead plant**

Standard EPA 300						
Test t	Degrees of freedom	The significance level	The mean difference	O 95%		
				Lowest	Topmost	
Lead	584 / 10-	15	0.000	71438 / 268-	8279 / 322-	6009 / 214-

Source: research findings

Results Test t One Sample Oh you Comparing the mean values measured with the standard EPA lead in the studied plants showed that the average lead EPA standards At Level 1% to Phrasal With About Trust 99% Difference Meaning Arrow The (sig = 0.00), As Comparison Average signThe

That Amount Lead At plants Case Study fewer From Standard EPA Been Is. (31.28 <300) (Table 12)

**Results Test t Independent From Opinion cd, pb Among Two Species Case Study**

**Table 13 test results t Independent From Opinion cd, pb Among Two Species Case Study**

Levine test					T-test				
	F	The significance level	t	df	The significance level	The mean difference	The standard deviation	O 95%	
								Lowest	Topmost
Cadmium against assuming unequal	776/80	0.000	03/2	14	062/0	26/3	6/1	18 / 0-	7.6
			03/2	7	082/0	26/3	6/1	53 / 0-	06/7
Given the lead times Assuming unequal	195/1	018/0	25 / 1-	14	23/0	57 / 62-	82/49	43/169	29/44
			25 / 1-	7	249/0	57 / 62-	82/49	39/180	25/55

Source: research findings

Results T test Independent One example shows The That From Opinion Amount Cadmium Among Two Species Spinach And Cress At Level 5% difference Meaning Arrow The (sig = 0.05), As Amount Cadmium At Spinach More From Cress Been Is (3.26 > 0). At If the From Opinion Amount Lead Among Two Species Case Opinion Difference Significant Existence No (sig = 0.230) (Table 13).

### Conclusion

As At results Analysis Variance Specified Is Fortunately average amount Lead And Cadmium At All Sample Of Water , soil , Spinach And Shahi Case review Kmtrazhd Standard The Is And this order Marker Lack Contamination Acute gardens Under Research With Metals heavy The Is. At Case Sample Of Water gardens At Sample Of First during June the moon 1394 Sample Water Garden Number 1 Contamination Cadmium Thels And Water gardens Number 2 and 3 amount little Wet Pollution Cadmium have And water Other gardens Lacking Contamination Cadmium The Is. The reason? Actually Become gardens 1, 2, 3 Range City And Use From Water Well For Irrigation To special Garden Number 1 Inside Area Urban, That Adjacent With Home Of Residential The Is. Contamination Cadmium The Can Due From Influence Wastewater Azchahhay Catchy The residential area Is but in the water gardens 4 to 10 At Area Agriculture And To far way From

areas Residential The Is nothing Species Contamination Cadmium Observation Not Is.

The measurement results values pH soil Of gardens The study showed that all soil And Alkaline Been And pH It And higher May 7 Is. Measure the amounts of heavy metals in soil showed a mean vegetable gardens Cadmium And Lead little Wet From Limit Standard The Is.

On Basis results T test Independent Specified Was That amount Absorption And Aggregation Cadmium At Spinach more From Shahi The Is And this Marker this Is That Each How many plant Flat Leaf Wet Is Possibility Aggregation Cadmium more Is. The results chary (2007) in India around the Musi River showed a risk factor for heavy metals in leafy vegetables, especially spinach and amaranth is high. Because the conductivity and transpiration rate is high in these vegetables as well as broad leaf plants more susceptible to physical contamination by dust from the soil that the survey correspond with the study.

point Jalbvkydy this Research this Is That between results the level First Sample Vector At June 94 months levels Second And Third At July And August the moon Difference Clear Existence has it To As At Some From Sample And At the level First Cadmium And Lead However, Most less From Standard Observation Was but At All Sample Of levels Second And Third Including From Water, Spinach



And Shahi amount Cadmium And Lead Zero measurement Was.

At review Cause Issue Discuss Of Different Can be involved. Including With Attention To this That At Area The Ardabil About Five the moon Culture And Removal vegetable To Action The Is And Actually more From Six the moon Water Well And the gardens are not used Cadmium accumulation of cadmium in the samples of the first phase of gardens in wells 1, 2 and 3 in the metropolitan area is located adjacent to residential homes Have Happening The Falls And To Consequently It Products China First Spinach And Shahi too Contamination little Cadmium And sign The Day but At Effect Use From Water And too Removal Of Multiple Vegetable Actually this Integration And Aggregation Metals heavy At China Of Second And Third Zero The Is. So consideration The Is Products vegetable China Of First From Opinion Metals heavy Polluted From China Of Second And Third The Is.

In the case of cadmium spinach in China, one in three gardens 3, 6 and 10. It is explained in the garden (3) the amount of cadmium in the water garden is higher than that in spinach condensed also is in the gardens of 6 and 10 Cadmium a small amount of garden soil that is high in spinach condensed product is then taken as a result of bioaccumulation is spinach.

## References

1. Tiller KG, McLaughlin MJ, Roberts AHC. 1999. Environmental impacts of heavy metals in agro ecosystems and amelioration strategies in Oceania. In: Huang PM, Iskander IK, editors. Soils and groundwater pollution and remediation. Boca Raton, Florida: CRC Press; p. 1-35.
2. Cui Y, Zhu YG, Zhai R, Huang Y, Qin Y, Liang J. 2005. Exposure to metal mixtures and human health impacts in a contaminated area in Nanning, China. *Environment International*. 31 (6): 784-90.
3. Statistical Yearbook 1391 governor of Ardebil.
4. Shokrzadeh, Muhammad, pillar, Mahmoud Ali Mousavi, Seyed Reza. (1390). The effects of heavy metals on quantitative and qualitative characteristics of rice irrigation water in the region Marki Province (Mvram Kla' Vice City, Sid neighborhood and neighborhood Sari Kla' brook), Mazandaran University of Medical Sciences, Volume 22, Issue 98, pp. 247- 234.
5. Kabata-Pendias A. 2011. Trace Elements in Soils and Plants. 4th ed. Raton Boca, Florida : CRC Press.
6. X Li, Lee SL, Wong SC, Shi W, Thornton I. 2004. The study of metal Contamination in urban Soils of Hong Kong using a GIS-based approach. *Environmental Pollution*; 129 (1): 113-24.
7. Waalkes MP 2003. Review cadmium carcinogenesis. *Research Mutation*; 533: 107 - 20.
8. T ü Rkdo ğ an MK, Kilicel F, Kara K, Tuncer I, Uygan I. 2003. Heavy metals in soil, vegetables and fruits in the Endemic upper gastrointestinal cancer region of Turkey. *Environmental Toxicology and Pharmacology*; 13 (3 ): 175-79.
9. WM Edmunds, Smedley PL. 1996. Environmental Geochemistry and Health. London : Geological Society.
10. Alloway BJ. Heavy Metals in Soils. 1995. 2nd ed. Glasgow : Blackie Academic and Professional ;.
11. Radwan MA, Salama AK. 2003. Market basket survey for some heavy metals in Egyptian fruits and vegetables. *Food and Chemical Toxicology*. 2006; 44 (8): 1273-78.
12. Fu J, Zhou Q, Liu J, Liu W, Wang T, Zhang Q, et al. 2009. High levels of heavy metals in rice (*Oryza sativa* L.) from a typical E-waste recycling area in southeast.
13. Nriagu JO, Pacyna JM. Quantitative assessment of worldwide contamination of air, water and soils by trace metals. *Nature*. 1988; 333: 134-39.
14. Nazmi, Saeed; Asgari, AR and Rai, M. (1389). Study of heavy metals in vegetables farmed countryside anymore, *Journal of Health and Environment, Environmental Health Science and Research Journal* Volume III, Issue II, pp. 202-195.
15. Samarkand, MR; Karimpour, Muslim and angina, GH (1379). Study of heavy metals in vegetables farmed by water contaminated with these metals in the suburbs of Hamedan, the secrets of the *Journal of Medical Sciences*, Sabzevar seventh year, No. 1, pp. 156-172.