



RESEARCH ARTICLE

Estimation of some inorganic Contaminant (Heavy metals & minerals) in imported vegetables and fruits

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Manuscript Info

Manuscript History:

Received: 21 January 2015
Final Accepted: 26 February 2015
Published Online: March 2015

Key words:

Estimation, Inorganic contaminant, Heavy metals, Minerals, Imported vegetables and fruits

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Abstract

To Estimate an inorganic contaminant of a heavy metals and minerals in some of imported vegetables and fruits, samples of 18 kinds of vegetables and fruits are collected randomly from different markets located at city of Baghdad, along the period from 01/01/2014 till 01/09/2014. Flame atomic absorption (AAS) and inductively coupled plasma technology (ICP) are used for the detection of toxic heavy metals and minerals, an obtained results showed a significant variation in the results of this study for the results of previous studies by World Health Organization (WHO) and Food and Drug Administration (FDA). Most of results showed, detection limits are under the allowed limits of (WHO) and (FDA), just a few samples, two samples from 18 samples are contaminated with Cadmium (Cd), also five of samples are contaminated with Antimony (Sb). That mean there were a resources of contamination such as batteries industry and other culture and urban activity, therefore fruits and vegetables must pass under control because they for a long time are dependent food for many persons due to the quantity of minerals and vitamins.

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INTRODUCTION

The impact of heavy metals and other elements are found both in food and human health, some are useful and well-known biological function, others aren't have a known biological function, may be impact human health negatively, for example an organic mercury compounds considered as a toxic nerve Neurotoxins (Murray, et al, 2000). The contamination of soil and plant by heavy metals attributed to human activities such as multiple smelting of metals and painting also all other metal acts results from industrial activity as well as leather tanning, an addition to subtract from gases and smoke and leakage of chemicals to the water in addition to a solid waste. It also contributes to pollution which resulting from environment activities breadth of cities and their development, accompanying multiple residues are known collectively "due to the wastes which results from urban activities at the cities, as well as the remnants of fertilizers and pesticides in agricultural activities (WHO, 1984). Contaminated by toxic cadmium is so easy to spread widely due to using in batteries industry, paints and plastics, as it is used in the plating of various steel products to prevent erosion, also contributes to throw solid waste and phosphate fertilizer. There for the exposure to heavy materials for a long time can induce an increasing of catalase enzyme in liver and peroxidase glutathione in brain, where increasing the initial oxidation products of fat (Volodymyr et al., 2001).

At present decades, demands of vegetables was increased from consumers in accordance to consumers due to increasing of vegetables consuming because of their numerous benefits. There are a possibility of vegetables contamination due to environment contaminating, and some of them can play an important role in accumulation of

some heavy metals. Recently, there are many accurate methods to detect lowest concentrations, a modern methods are more accurate and more sensitive than previous methods which adopted in improvement of tables of heavy metals concentrations in books and references of food composition (FAO and WHO, 1998).

Materials and methods

Sampling

A number of 18 different samples of imported fruits and vegetables are collected randomly from different local markets at Baghdad city, along the period from 01/01/2014 until 01/09/2014 and they are chosen a good specifications of the phenotypic fresh samples

Determination of metals and toxic heavy metals

The collected Samples are prepared for analysis, separately, each sample are cut and suspended well after mixing, then dried in special furnaces after that, a method is used in order to digest samples as well as analysis techniques are used in atomic absorption spectrometer (AAS) and inductivity coupled plasma (ICP - OES) (Haswell, 1978).

Determination of Iron (Fe), Copper (Cu), Zinc (Zn) by using Atomic Absorption Spectrometer

The heavy metals Iron (Fe), Copper (Cu) and Zinc (Zn) are determined by Atomic absorption spectrometer device (Flame Atomic Absorption Spectrometer Technique FAAS) type SHIMADZU Model AA7000 Japan (Haswell, 1978). A weight of 2 g from the samples after drying at 70 °C, samples are put in a graduated beaker with a volume of 100 ml then 40 ml of concentrated nitric acid High purity (HNO₃) was added, and left over night, later samples were heated for one hour on the heater at a 105 °C until emergence of vapors, after cooling samples, added a 3 ml of concentrated Perchloric acid (HClO₄), later same beaker put on heater again and reheating near drying, after cooling the samples, 2ml of concentrated hydrochloric acid (HCl) and 3 ml of distilled water with heating another time at 75 °C, then left for cooling, cold samples filtered in volumetric flasks capacity of 25 ml with complete volume with distilled water to the mark. To accomplish of stander curve of the elements (Fe), (Cu) and (Zn), four standard solutions for each element separately were prepared in concentrations (0.1, 0.5 and 2.4), (0.1, 0.2, 0.4 and 0.8), (0.1, 0.2, 0.5 and 1) respectively, with expression of units by part per million (ppm) figures (1, 2 and 3).

Determination of (Cadmium (Cd), Arsenic (As), Antimony (Sb) by using inductivity coupled plasma

The elements (Cd, As, Sb) determined by using technique of the inductivity coupled plasma (ICP- OES) Optical Emission Spectrometer type HORIBA Model JY 2000-2 French origin (Haswell, 1978), the procedure of digestion for the samples as a described above. The standard curves of the elements (Cd), (As), (Sb) are accomplishing by prepare five standard solutions for each element (25, 50, 100, 150, 200) respectively with expression of units by part per billion (ppb), figures (4, 5 and 6).

The following equation is used to calculate the concentrations of detected elements (Fe), (Cu) and (Zn) from the obtained reading of device as in following device.

Final concentration (ppm) = reading device × dilution factor / weight of sample (g) (Cooksey and Barne, 1979).

Also according to (Cooksey and Barne, 1979) the following equation is used to calculate (Cd), (As) and (Sb).

Final concentration (ppb) = reading device × dilution factor / weight of sample (g)

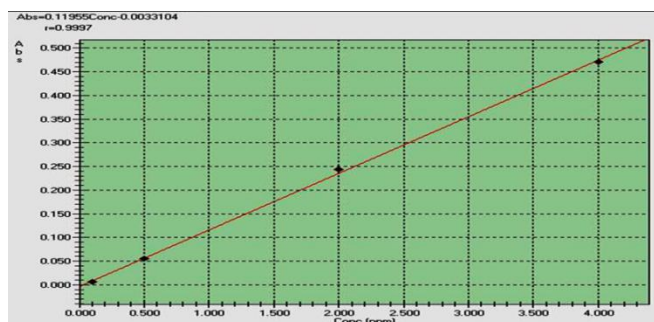


Figure (1): Standard curve of Cooper (Cu) obtained by Atomic Absorption Spectrometer

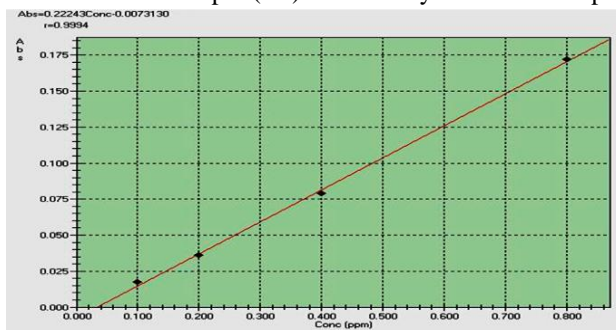


Figure (2): Standard curve of Zinc (Zn) obtained by Atomic Absorption Spectrometer

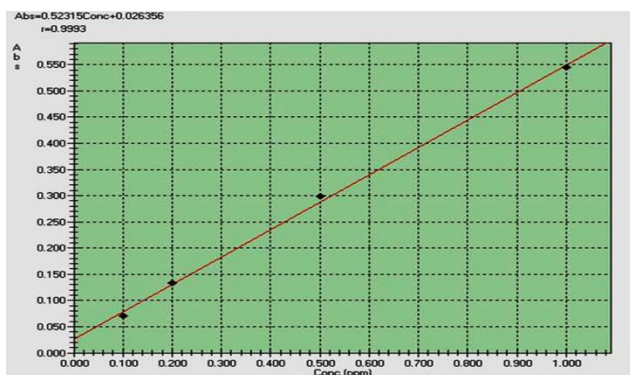


Figure (3): Standard curve of Cadmium (Cd) obtained by Atomic Absorption Spectrometer

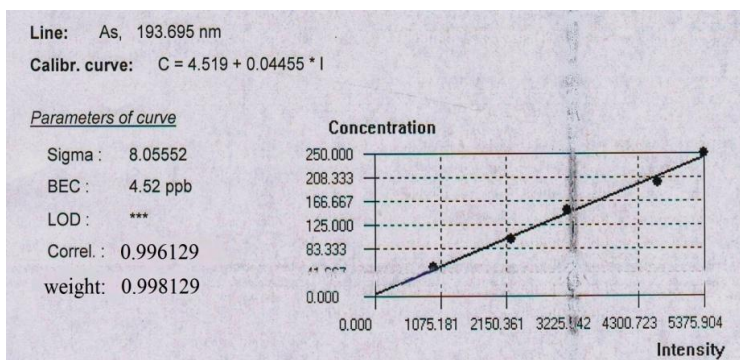


Figure (4): Standard curve of Arsenic (As) obtained by inductivity coupled plasma

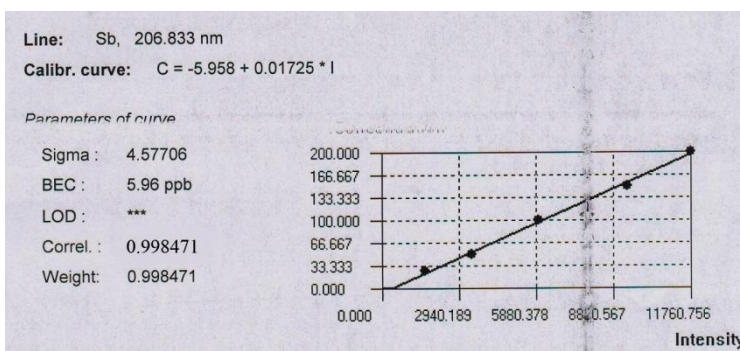


Figure (5): Standard curve of Antimony (Sb) inductivity coupled plasma

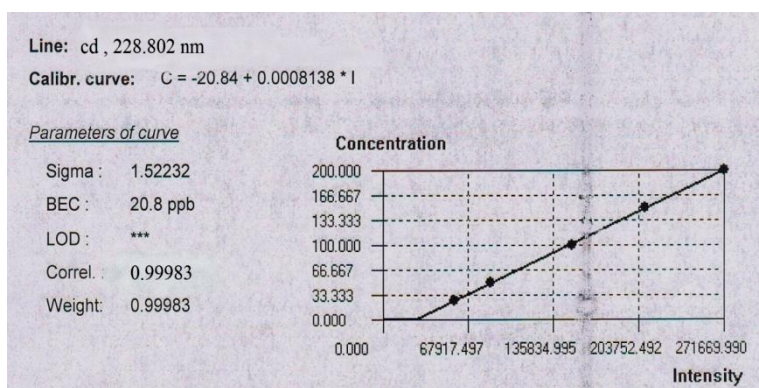


Figure (6): Standard curve of Cadmium (Cd) inductivity coupled plasma

Result and discussion

The final results were calculated for each of the elements (Fe), (Cu) and (Zn) with expression to the results with part per million (ppm) for the concentrations, as shown in table (1).

Table (1): Concentration of elements in vegetables and fruits samples, calculated part per million (ppm)

Limits acceptance WHO	Zn	Cu	Fe	Origin	samples	No.
Fe= 200	5.37	1.39	71.46	Jordan	Peach Miski	1
	4.28	1.32	238.0	Syria	Green apple	2
	5.85	1.42	347.1	Syria	Red apple	3
	6.78	11.33	343.7	Jordan	Peach msaoof	4
	4.97	1.26	139.5	Africa	Orange	5
Cu= 20	8.42	3.85	15.62	Turkey	Yellow lemon	6
	37.00	6.52	58.74	Iran	Cucumber	7
	11.69	6.29	45.35	Iran	Tomato	8
	6.48	2.20	17.31	Ecuador	Bananas	9
	3.47	2.96	23.94	Turkey	Yellow grape	10
	10.94	3.71	35.48	Egypt	Pomegranate	11
Zn= 99.40	2.93	6.38	6.15	Egypt	Grape fruit	12
	7.89	2.07	14.08	Turkey	Pear	13
	9.33	3.38	51.30	Turkey	Tangerine	14
	2.85	2.16	48.44	Egypt	Orange	15
	2.38	1.30	19.57	China	Apple/Hajiang	16
	11.68	6.32	56.09	Syria	Potato	17
	10.14	5.15	19.68	Iran	Onion	18

The results showed as the existence of significant differences in concentrations between fruits and vegetables and attributed this increasing to the quantities which used as chemical fertilizer in order to improve the quality of vegetables at the lowest possible period of time and vice versa of fruit is one of the perennial plants so the use of fertilizers, which is less compared to the vegetables (Liu RH, .2003). Results showed the concentration of iron (Fe) as contained (3) samples out of (18) samples are contaminated with (Fe), which reached to (347.1) ppm and this exceeds the permitted for this element in fruits and vegetables, this result is more than allowed limits of (Fe) which fixed as (200) ppm according to the World Health Organization (WHO., 2012). An increasing of (Fe) in human

body, can cause leukemia, as well as get disorders and convulsions nervous cramps unprecedented, can impact human body negatively and lead to occurrence of acute anemia (Kachenko and Singh, 2006), also for (Cu), the results showed that samples are free from (Cu) as a pollutant where (Cu) values are ranged among (1.30- 11.33) ppm also all located within allowed limits of (Cu) which fixed as (20) ppm, according to (David person., 2004). While (Zn) results showed the samples are free of contamination, (Zn) concentration values are ranged among (2.38-37) ppm and all located within the allowable limits the (99.40) ppm, according to the (WHO 2006) and Food Agriculture organization (FAO 2006). While the final results are calculated for each of elements (Cd), (As), (Sb) with expression to the results in part per billion (PPb) as shown in Table (2)

Table (2) the concentrations of elements in vegetables and fruits samples calculated part per billion (ppb)

Allowed limits according to WHO	Sb	As	Cd	Origin	samples	No.
Cd=100	218.06	UDL*	51.55	Jordan	Peach Musky	1
	140.41	UDL	68.33	Syria	Green apple	2
	185.26	UDL	53.50	Syria	Red apple	3
	324.2	UDL	41.86	Jordan	Peach Sophie	4
	168.84	UDL	16.47	Africa	Orange	5
As=70	47.71	UDL	50.92	Turkey	Yellow lemon	6
	71.02	UDL	87.04	Iran	Cucumber	7
	77.62	UDL	142.60	Iran	Tomato	8
	UDL	UDL	UDL	Ecuador	Bananas	9
	UDL	109.03	25.06	Turkey	Yellow grape	10
	UDL	UDL	36.20	Egypt	Pomegranate	11
Sb=100	UDL	UDL	41.38	Egypt	Grape fruit	12
	UDL	UDL	7.35	Turkey	Pear	13
	65.70	UDL	UDL	Turkey	Tangerine	14
	UDL	UDL	UDL	Egypt	Orange	15
	UDL	UDL	14.10	China	Apple/Hajiang	16
	60.08	UDL	81.14	Syria	Potato	17
UDL	UDL	171.18	Iran	Onion	18	

* UDL: Under detection limits

For determination of (Cd), two sample out of (18) samples are contaminated with (Cd), they are, (tomato and onion) which imported from Iran where they reached to (142.60- 171.18) respectively, according to (WHO, 2006) and Food and Drug Administration (FDA, 2006), allowed limits are fixed globally in (100) ppb due to highly toxicity of (Cd) which is very dangerous to human health, also accumulate in human body, this accumulation in organs of human body can cause tumors, fetal malformations and multiple cancers (Manoguerra AS, et.al 2005). While the results showed in the determination of (As), all sample is not contaminated with this toxic element except imported (yellow grape) from Turkey as it contained a concentration of (109.03) ppb, this result is higher than allowed limits which is (70) ppb, according to (WHO / FAO.2006), (As) is toxic element that impact a skeleton of humans also impact brain directly and can cause a bone cancer also explosion of the brain at high concentration of (As), this is what constitutes a high risk to human health (McLaughlin et al., 2000). For (Sb) determination results showed a contamination of (5) samples of Peach Musky, Green Apple, Red Apple, Peach Sophie and Orange) out of (18) samples, results reached to highest concentration (324.2) ppb, this value is higher than allowed limits which fixed as (100) ppb, according to the (WHO and FAO., 2006). The presence of (As) in such samples are impact a human health in general, especially children, in particular, (As) can cause an inhibition of brain development in children with reducing mental development at initial stages of mental growth, so it can give a negative impact of human health (D,Mello, 2003).

Conclusions and recommendations

An obtained Results in this study, showed there are a contamination with high concentrations of heavy metals in several types of imported fruits and vegetables and non-compliance to the standard specifications of food, which could pose a risk to the human health due to the accumulation of these elements in the internal sensitive organs such as liver, kidney and brain. So in this case we recommend tightening control over the health of imported and domestic fruits and vegetables products, also determine the extent of its safety and suitability for human consumption through examination and analysis by the competent and responsible of safety for the citizen entities.

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