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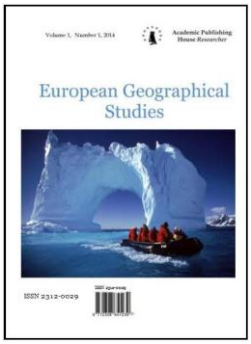

UDC 551

Determınatıon of the Amount of Heavy Metal on Peaches Grown ın Umurbey, West Anatolıa

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Abstract

This study is conducted to determine the amount of heavy metal in peaches which are grown in Umurbey lowland, Çanakkale. Samples, taken from the peaches which grow in different regions of Umurbey, are analysed in the Laboratory of Provincial Directorate of Food, Agriculture and Livestock of Çanakkale (Çanakkale İl Gıda Tarım ve Hayvancılık Genel Müdürlüğü Labaratuvarı) with method of wet decomposition by using Unicam 929 Atomic Absorption Spectrometer. As a result of the analyse, amount of six heavy metal, cadmium, aluminium, lead, zinc, copper, iron, manganese, and nickel in the peaches are determined. Depending on the findings, recommendations were made in sugestions.

Keywords: Peach, Canakkale Umurbey Plain, Heavy metal, Human health

Introduction

Heavy metal is an element required for an organism to grow healthily and its weight is less than % 0,01 of the organism. Another definition is that elements whose specific gravity is greater than 5 g/cm^3 and whose atomic number is from 22 to 92 are described as heavy metals (Çınar, 2008). Metals, which have numerous area of usage, are biologically split into tree groups (Clark, 1992). Effects of heavy metals; limits, all kinds of metal shows toxic effect on human health (Sonsuz, 2011). The effects usually cause nervous system communication disorders, trouble in blood synthesis, brain damage, respiratory tract diseases, kidney damage and skin disorders (Sonsuz, 2011). Heavy metals are also effective on the humans and animals through mixing industrial wastewaters with drinking water or through pollination of particles contaminated with heavy metals (Kahvecioğlu and all. 2003). Effects of heavy metals on human and environment; have an important role in human health. Along with the elements constituting the main structures of the living; plant, animal and us-humans, there are also 20 other elements in the structure of the living which have a great effect on the organism despite their little amounts (Duran, 2006). Heavy metals are usually found in the waters on the surface of the ocean and rising, they are moved to atmosphere. High levels of heavy metals take place on the surface of river waters and by the seaside. On the areas close to down-town, pollution is combined with sewer system (Wickfors and Ukeles, 1982; Rebhun and Amotz, 1984) but their level rise up around industrial areas (Cotté-Krief and Assocs. 2000; Bu-Olayan and Assocs. 2001; Eser and Volpe, 2002). Heavy metals, having toxic effects in every respect, have been diffused around from several sources and create one of the important reasons of environmental pollution (Goyer, 1991). In some systems, mechanism of

actions of heavy metals changes depending upon the concentration. In this type of organisms, concentration of the metals should be taken into consideration (Bakar and oths, 2009). For example, cadmium could have severe toxic effects for aquatic organisms when it is found in the water in excessive amounts even on low concentrations (Kruger, 2002). Lead, in acute intoxication, could cause stomach-ache, brain damage in children. It could cause trembling, loss of weight and appetite (Şahin, 2006). Allowed copper level for the food by WHO and FAO is 4 mg/kg (www.inchem.org). In case of exceeding the limit, long term exposure to copper powder could irritate nose, eyes and mouth and could cause headache, dizziness and nausea (Çetin, 2006). It has been concluded that 2-3 mg of daily manganese intake daily will be sufficient (www.inchem.org). More than that causes respiration and neurotic disorders and infertility in humans (Tuncay, 2007). However, when elemental aluminium is taken excessively, symptoms such as hypo kinesis, disorder in muscle functions (weakening), having difficulty in writing are monitored (Haghiri, 1973).

Table 1: Amount of trace elements approximately taken into human body with foodstuff on a daily basis

Copper	2100
Manga	3300
Nickel	460
Lead	138
Zinc	16900

Human is in need of minerals, vitamins and proteins to be able to sustain a healthy life. Vegetables have a place in human nutrition in terms of minerals such as vitamin, calcium, iron and other contents (Thompson and Kelly, 1990). With the increasing growth in agribusiness, initially in irrigation water, it is recently discussed that heavy metals are encountered in plants (Anonymous, 1998). Heavy metals, with their toxic effects and accumulation features, constitute a considerable extent of pollution for the environment (Omgbu and Kokogbo, 1993).

Some heavy metals such as chromium, iron, aluminium, copper, manganese and zinc are essential micro-nutrients for plants and animals (Somers, 1984). However, these are easily digested and accumulated. Heavy metals being constantly taken, even if at the low levels, with the foodstuff by the people and animals causes several harmful effects due to the difficulty of being eliminated from the body. Also, heavy metals demonstrate the characteristic of accumulation in the body. Plants obtain the heavy metals from the soil and their leaves which are exposed to polluted air (Zurerave and Assocs, 1989). In recent years, interest in pollution with heavy metals relatively increased. On certain concentrations most of the heavy metals indicate detrimental effects to organisms and causes eco-destruction. It is known by all that some substances have become current issues by being stored in various organisms that we use as nutrition and even by causing humans, the last member of the food chain, to be poisoned (Demir, 1998). Considering the lithologic character of Umurbey catchment basin, high density of heavy metal and minerals found as melt in the irrigation water cause agricultural products in the region to contain heavy metals.

Material and method

In this study, experimental procedure, one of the quantitative research methods, is used. Umurbey is established on a place starting from the edge of Çanakkale-Bursa highway to the end of Umurbey Lowland which ranges to south. The place is Samutlar hill which is 6 km away from the Dardanelles. It is 25 km away from Çanakkale and 15 km from Lapseki. Its catchment basin is quite large. Ranging from the north of the city to the coast in east-west direction, whole Umurbey Lowland, 8000 decare, is an entirely irrigable area.

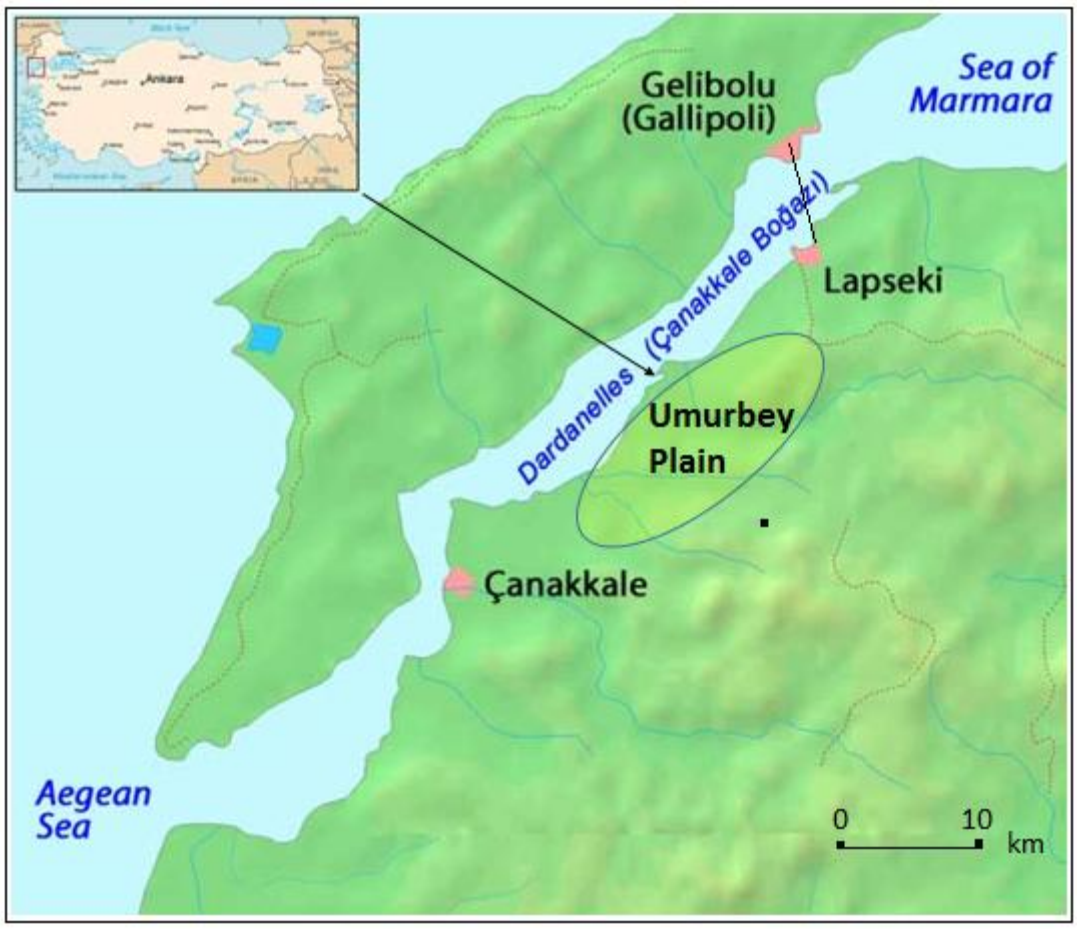

Figure 1. Study area, Umurbey peaches farming area

The study area is limited with the peaches of Umurbey Lowland in Lapseki town of Çanakkale. Peach samples taken from Umurbey city in Lapseki, Çanakkale is given to the Laboratory of Çanakkale Directorate of Provincial Food, Agriculture and Livestock to be analysed; in order to be cleaned of the dust, the dirt and the parasites on them, firstly, they are washed with tap water and then with deionized water. In peaches being analysed, method of wet decomposition is used. 2-4 g or mL (supposed to be arranged according to the amount of the mineral searched for in the sample being analysed) of the homogenised sample is inserted into Kjeldahl tube. Adding on 21 mL of aqua fortis (HNO_3), 3 mL of sulphuric acid (H_2SO_4), 3 mL of perchloric acid ($HClO_4$), it is attached to the burning unit.

Unicam 929 Atomic Absorption Spectrometer is used in the study to determine the metal contents. Hollow cathode lamps used in the study are UNICAM copper, manganese, lead, zinc and CATHODEON nickel lams. Weighing is done via Avery Berkel scale with 0,0001 precision. Polarographic and voltametric studies are fulfilled via Metrohm 757 Computrace Voltametric Analyser. With the polarographic and voltametric analyser, many research, development and analyses are executed. This study is performed using square wave stripping voltammetry. pH measurements are done via Jenway 3040 pH meter. pH measurements are constantly monitored and when the equilibrium position is reached, prepared solutions are used.

Agriculture of Peach in Umurbey

Çanakkale is among one of the most important cities in our country in peach and nectarine production. High quality of the fruits produced provides great advantages in both domestic and foreign markets. In 2009, the most important peach producers in the world are China, Italy, USA, Spain, Greece, Turkey and France. China fulfils 47% of the total world production. Turkey is ranked as the 6th with %3 (FAO, 2009). According to 2009 data, number of peach tree in our country is 16.664.000 while the production is 547.213 tons. Although peach farming is done in many parts of Turkey, some provinces have been gained much more importance (TÜİK, 2010). Çanakkale has an

important position in our country in terms of fruit farming. After Bursa, Mersin and İzmir, the biggest peach farming is fulfilled in Çanakkale. Turkey provides 11% of its total peach production from Çanakkale. Fruits and vegetables produced in the region draws attention with their high quality feature. A great number of peach and nectarine types are raised in Çanakkale and get high credits in domestic and foreign markets (Schorr-Galiondo, 2006; Şeker, 2011).

Table 2: Peach Fields in Çanakkale in 2012 (Çanakkale Directorate of Provincial Food, Agriculture and Livestock)

Provincial	Public orchards			**The number of scattered trees**		**Total number of fruit trees**	The average yield per tree (kg)	Production (tons)
	Footprint (hectare)	Number of trees		Fructiferous **Ages**	Fruitless **Ages**			
		Fructiferous **Ages**	Fruitless **Ages**					
Center	11.632	344.360	146.340	17.300	110	361.660	66	23.869
AYVACIK	106	2.200	2.40	4.480	262	6.680	50	334
BAYRAMİÇ	1.200	40.400	3.600	2.850	300	43.250	50	2.162
BİGA	205	9.900	0	9.250	0	19.150	50	957
B.ADA	0	0	0	350	50	350	34	12
ÇAN	20	0	800	5.500	850	5.500	33	182
ECEABAT	161	4.840	40	550	500	5.390	60	323
EZİNE	145	2.140	1.820	2.670	70	4.810	48	231
GELİBOLU	1.050	32.700	9.300	4.200	700	36.900	46	1.697
G.ADA	40	3.750	0	2.050	200	5.800	50	290
LAPSEKİ	26.630	820.000	246.200	9.600	1.50	829.600	61	50.606
YENİCE	20	600	0	800	0	1.400	65	91
Total Province	41.209	1.260.890	410.140	59.600	4.092	1.320.490	61	80.754

As it is seen in the table above prepared by Çanakkale Directorate of Provincial Food, Agriculture and Livestock, peach production in Çanakkale province is done in a 41.209-decare field. Total amount of peaches obtained from the field is 80.754 tons. In general production of the province, Lapseki Town is placed on the top with 50.606 tons of peach obtained from 26.630-decare-field.

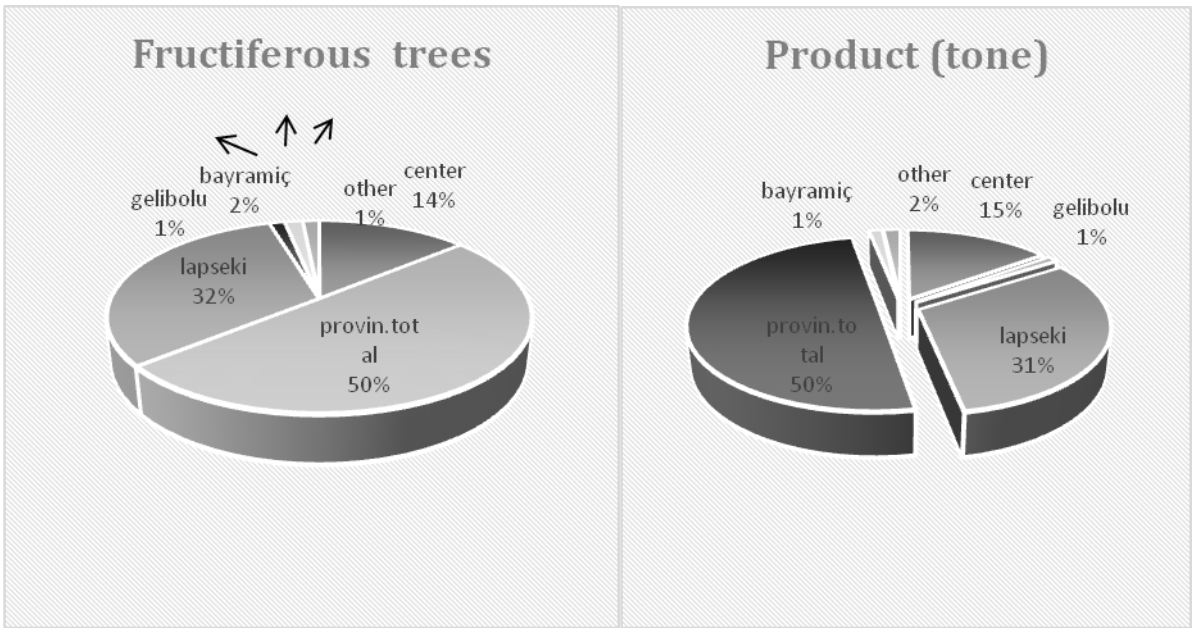

Figure 2: Percentage distribution of the number of peach trees and production rates in Çanakkale according to towns

As in figure 1, of the trees bearing fruit, whole province comprises 50%, Lapseki town (Umurbey) comprises 32%, city centre comprises 14%, Bayramiç comprises %2, Gelibolu comprises %1 and other towns comprise the remaining 1%. On the basis of the tables and diagrams above, when we look at the production rates obtained from the peach trees in Çanakkale, whole province provides 50%, Lapseki town (Umurbey) provides 31%, city centre provides 15%, Bayramiç provides 1%, Gelibolu provides 1% and the other towns provides the remaining 2% of the total production. As a result, while a major part of Çanakkale does peach farming, taking place on the top, Lapseki (Umurbey) has an important part in the farming. As it can be seen in the table above prepared by Çanakkale Directorate of Provincial Food, Agriculture and Livestock according to 2012 data, total nectarine production in Çanakkale has been fulfilled as 21.041 tons in an 11.386-decare field. 13.617 tons of the production belongs to Lapseki Town.

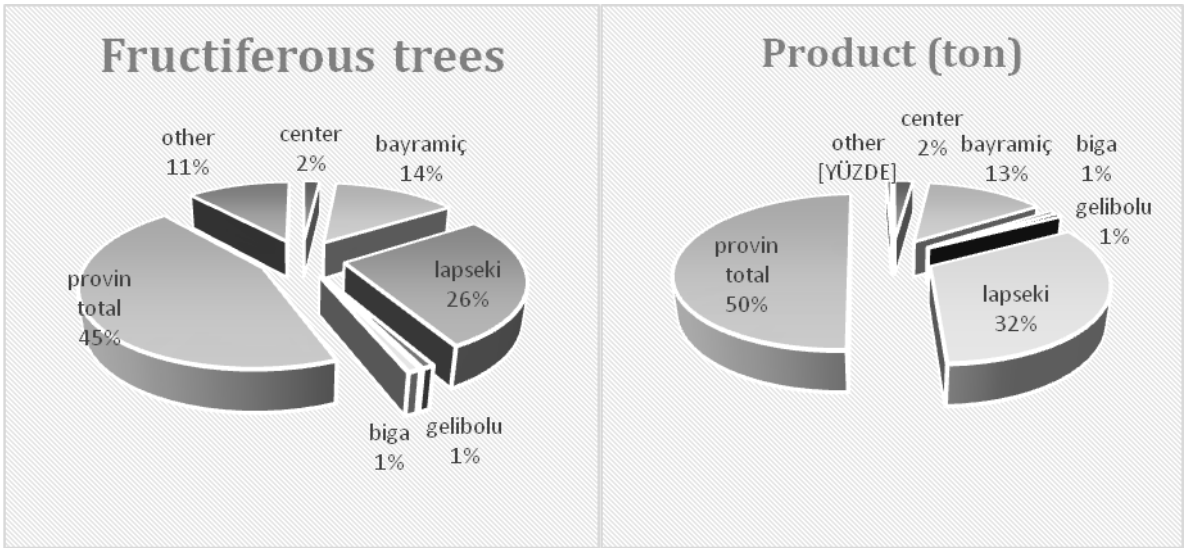

Figure 3: Percentage distribution of the number of nectarine trees and production rates in Çanakkale according to towns

When we look at the nectarine field rates in Çanakkale, as it can be in figure 2, of the trees bearing fruit, whole province comprises 45%, Lapseki town (Umurbey) comprises 26%, city centre comprises 2%, Bayramiç comprises 13%, Gelibolu comprises 1%, Biga comprises 1% and other towns comprise the remaining 1%. On the basis of the tables and diagrams above, when we look at the production rates obtained from the peach trees in Çanakkale, whole province provides 50%, Lapseki town (Umurbey) provides 32%, City Centre provides 15%, Bayramiç provides 1%, Gelibolu provides 1% and the other towns provides the remaining 2% of the total production. Consequently, Lapseki (Umurbey), a town of Çanakkale, is placed on the top and has an important part in nectarine production.

Results

Peach samples which have been taken and analysed under this study is evaluated according to metal limit standard levels acceptable for vegetables and fruits in Table 3.

Table 3: Metal Limit Standard Levels Acceptable for Vegetables and Fruits (Türkdoğan, M.K.)

Element	Standart (ppm)
Pb	6-9
Cu	2-20
Ni	1-10
Mn	10-20
Zn	5-100
Cd	0,1

When examined the results that are obtained after the different peach samples taken from Umurbey analysed in laboratory environment via wet decomposition method; Pb value for the first peach sample is 0,07758 ppm. For Cu, it is 0,8072 ppm. When we examine the value for Ni in the first peach sample, it is 0,08792 ppm. When we examine for Zn, the result is 1,518 ppm. The result for Cd is 0,02904 ppm.

Table 4: Sample of first peaches samples

Heavy metals	Wavelength (analyte)	Average results (ppm)
Cadmium (Cd)	214.440	0.02904
Lead (Pb)	220.353	0.07758
Aluminum (Al)	396.153	1.451
Copper (Cu)	327.393	0.7293
Iron (Fe)	238.204	2.593
Manga (Mn)	257.610	0.1937
Nickel (Ni)	231.604	0.08792
Zinc (Zn)	213.857	1.518

When we compare the result with the values in Table 5, it is seen that results correspond to standard acceptable values.

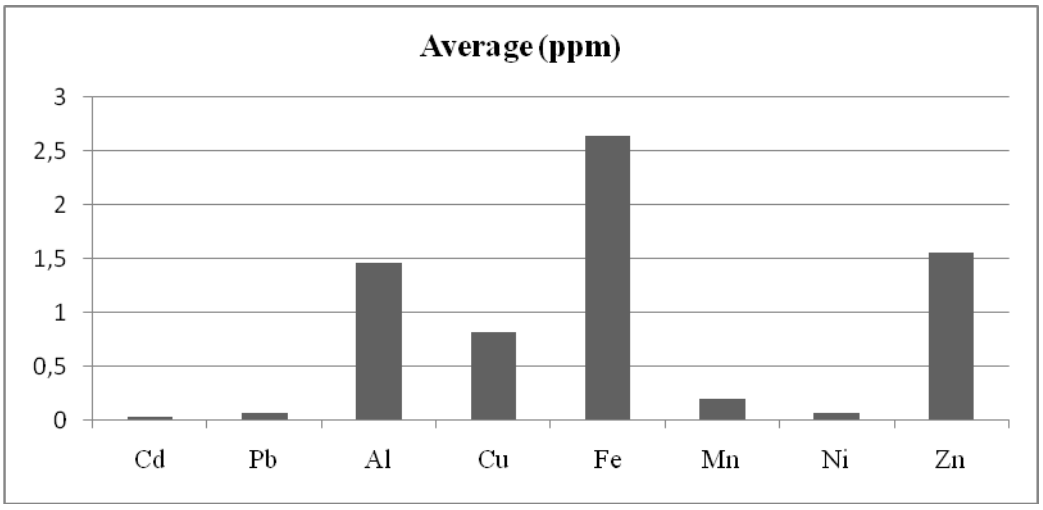

Figure 4: Average results of heavy metals analysed in first peaches samples

When we examine the Pb values in the second peach sample whose heavy metal levels has been analysed, the result acquired is 0,06076 ppm. For Cu in the second sample, the result 0,8072 ppm is obtained. When result for Ni in the second sample is 0,05515 ppm. The result for Zn is 0,05515 ppm; for Cd, it is 0,0286 ppm.

Table 5**:** Sample of second peaches samples

Heavy metals	**Wavelength (analyte)**	**Average results (ppm)**
Cadmium (Cd)	214.440	0,0286
Lead (Pb)	220.353	0,06076
Aluminum (Al)	396.153	1,464
Copper (Cu)	327.393	0,8072
Iron (Fe)	238.204	2,644
Manga (Mn)	231.604	0,1956
Nickel (Ni)	231.604	0,05515
Zinc (Zn)	213.857	1,55

Consequently, when we compare the second peach sample with the acceptable values in Table 8, it can be seen that the second sample is also in accordance with the standard values.

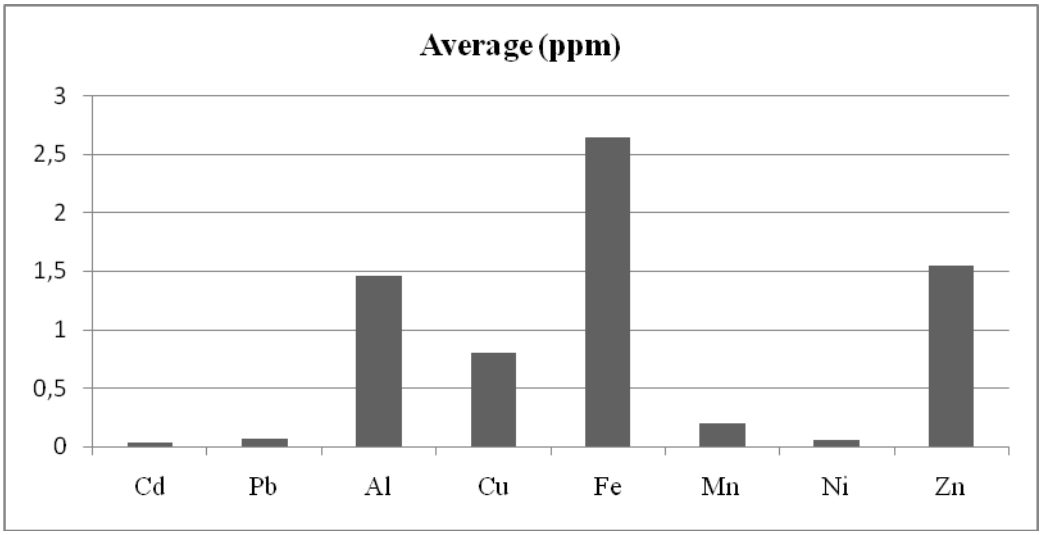

Figure 5: Results of heavy metals analysed in second peach sample

Conclusion

We observe that the highest rate of heavy metals in both samples of peaches taken from Umurbey Lowland in Çanakkale is iron, zinc and aluminium; respectively. When examined the results that are obtained after the different peach samples taken from Umurbey analysed in laboratory environment via wet decomposition method; Pb value in the first peach sample is 0,07758 ppm, 0,06076 ppm in the second one. When compared with the Table 4, we can conclude that in both samples, heavy metals do not exceed the acceptable limit values. For Cu, the value in both samples is 0,8072 ppm, which also suits with the values in Table 5. When we examine the Ni, we obtain the values that it is 0,08792 ppm and 0,05515 ppm respectively in the first and second samples. These results also show pertinence with the standard acceptable values in the Table 5.

As for Zn, the result in the first sample is 1,518 ppm. And in the second one, it is 0,05515 ppm. When these results are compared with the values in Table 5, it can be concluded that the results suits with standard acceptable values. Lastly, for Cd, when we compare both results, 0,02904 ppm in the first sample and 0,0286 ppm in the second. We can indicate that results correspond to standard acceptable values.

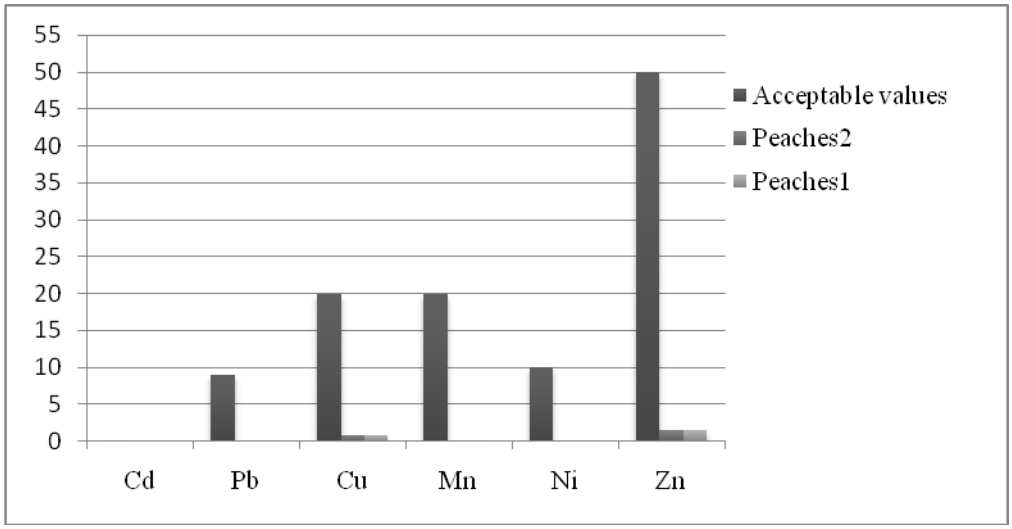

Figure 6: Comparison of metal limit standard levels acceptable for vegetables and fruits and peach samples that were analysed

When the results obtained are compared with standard limit values, it is concluded that the heavy metal contents of peaches having been analysed do not exceed the limit values; therefore, they does not pose a danger on human health. However, in both samples that has been examined, it is determined that cadmium rate is close to standard limit level.

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