MIGRATION OF HEAVY METALS INTO WATER AND LEMON JUICE STORED IN CAST IRON CONTAINERS

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Abstract
Heavy metals residues in food can create chronic and or acute poisoning in human. The rate of transmission of these metals to food through metal containers, particularly of metals leak from container that is used to cook food is important. According to the concerns regarding the migration of metals, this research aims to study the migration of cadmium, iron, chromium, molybdenum and nickel from cast iron containers into food and liquid environments. Lemon juice and water was stored in some new and used cast-iron containers for a period of time. After the metals extraction stage of samples, the contents of heavy metals in samples were measured by inductively coupled plasma optical emission spectrometry (ICP-OES). Iron was the highest amount of metals in samples and it was measured 313.3 and 5457.8 µg/l during 72 h stored with lemon juice in new cast iron and used cast iron containers, respectively. The results showed that the using of cast iron containers for storing or cooking the food may be release some non-organic compounds especially the metals iron, chromium and nickel to more level and molybdenum and cadmium to less level. Although the iron migration can be important in terms of nutritional value if they do not have toxic risks or appropriated in more than the recommended levels. Releasing of toxic materials into food containers can be a threat for human health and it may also change in the organoleptic characteristics and the quality of food.

Keywords: heavy metals, lemon juice, cast iron container, migration, food safety, human health.

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1. INTRODUCTION

Heavy metals including the pollutants are some human environment faced with them. This particular importance from the viewpoint of environmental metals and sediments and their residues in food can create chronic and or acute poisoning, and one of the health issues of these communities are formed at the industrial countries in the world today (Satake et al., 1997). The arrival of heavy metals through the food and water may be as the first human exposure to this toxic material. Today, the rate of transmission of these metals to food through metal containers, particularly of metals leak from container that is used to cook food. Epidemiology of food poisoning with the toxic or heavy metals can be associated with one of three patterns of environmental pollution, contamination of food during processing as random and contamination through the food containers or storage in the warehouse (Moffat and Whittle, 1999). Metals such as lead, cadmium, mercury and nickel did not do biological activity in the body, but they can act as a poison and the creation of potential poisoning and effects on the nervous system of lead and cadmium pollution in connection with carcinogenicity even of this sentence (Brooks et al., 1995; Cabera et al., 1995; Tricker, 1990; Ahmed et al., 2000; Thimothy et al., 1989). Reports indicate that the main method of human exposure to heavy metals through the food and water consumption and digestive diseases. Food in qualitative control, measurement of heavy metal elements such as lead, cadmium, copper, iron and arsenic are important because this is the nature of the gradual accumulation of metals in the different organs of the body like liver, kidney, brain and muscles and they are very important in terms of establishing chronic intoxication and various health complications (Moffat and Whittle, 1999). Today, the discussion of the risks and the problems of containers that are used in cooking are of interest. Some of the containers by releasing ions and compounds are different in nature, color and glaze of them or employed, to characterize the side effect on the body. The quality of the cooking and food storage containers the size of food quality, usage is important. This is because some emerging in the preparation of the dishes have been applied to the consumer can enter into food during cooking and also in the body to follow. Therefore, nowadays, a variety of health and containers of users is the subjects of interest to many researchers. Preventive recommendations of FAO (Food and Agriculture Organization) and WHO (World Health Organization) about the use of different containers were also a subject of this verification. Migration of heavy metals to foods that in the preparation of dishes, or be kept, including the most important of these concerns. In this regard, several studies in the field of entry the risk factors from containers with various types into food and in different conditions of food are done (Palmer and Moy., 1991; Nicoleta et al., 1996; Banu et al., 1985).

One of the food containers that can be used today is cast iron pots. Cast iron is an alloy which is made from carbon and composite of magnesia and it is in the form of censorship, because of cast iron wear-resistant, corrosion and heat-resistant. Special cast iron dishes for the kitchen at almost all of these features have a fit and proper care of which many can be used for a long time. But despite all this property if not accuracy in the use of these containers like the other dishes after a while, lose their efficiency and substitution must be very early, and the use of these containers is also not recommended. Because of the structure of the metal and the possibility of escaping into the liquid contents of metals and there is need for food. It is also possible these containers also with impurities. Hence with increasing supply and kitchen utensils, especially porcelain cast iron in the shops and finally at the Iranian propaganda that home cooks are also associated with high goods, which may be followed. According to the concerns regarding the migration of metals from cast iron containers into water and food, there is few library studies taken showed that so far, the original articles in the field of migration rate of the production of metal containers into inside of water and food from cast iron container, is not described. Therefore, this research aims to study the migration of heavy metals such as Cd (cadmium), Fe (iron), Cr (chromium), Mo (molybdenum) and Ni (nickel) from cast iron containers into food and liquid environments.

2. MATERIALS AND METHODS

2.1. Preparation of the sample

To perform this study, some cast iron containers were prepared from market and transfer to the laboratory. In the laboratory, after the preparation of the desired tests they perform. At first, the containers were washed by the water/detergent and hot water and then were rinsed by deionized water. For evaluation of metals migration in acidic pH, it was 5 percent acetic as vinegar and for the composition of the neutral pH, it was used distilled water. Before the use of these materials, pH was determined by pH meters. Some acetic acid 5% was used in a new cast iron dish and a dish used cast iron (four cast iron containers purchased from only production unit in Iran that had standard symbol and the used containers was prepared through quite corrosive by wire) and a volume of distilled water is also used for a new container and a container of the same brand was originally and it was placed for welding in boil heat for 60 minutes. To determine the desired of heavy metals in 5% acetic acid and distilled water intake in prior to use and then the amount of heavy metals was determined in this solutions. After cooling and then during the time of boiling, which effect evaporation test had been eased with the use of acetic acid and compensated by distillation was made (the initial volume was a history) and finally the desired metals extraction of samples was done, and then the amount of heavy metals in samples was determined by inductively coupled plasma optical emission spectrometry (ICP-OES**)**. The difference between the amount of metals in acetic acid, and distilled water and distilled in of acetic acid and water after one hour boiling shows the amount of metals release from the container.

In the second stage, in order to study the migration of heavy metals of iron containers to food during maintenance, lemon juice samples and distilled water with clear pH was determined.

To do this, a new cast-iron container and a container used for samples of cast iron water lemon and a new container and a container of the same brand used also to distilled water, and they stored for a period of 24h, 48h and 72h at the temperature. In these times, the necessary volume of the sample of lemon juice and distilled water was harvested in each dish and the amount of desired metals was determined. To calculate the amount of migration of metals from the container, the amount of the primary metals tested water, lemon and distilled water was deducted from the amount of the metals after a time and under conditions similar to the maintenance. Parallel to the above process, the same volume of water, lemon and distilled water to each mark is marked in the pyrex containers which was cleaned perfectly with deionized water that had been entered and then under the same conditions and time was 24 times and maintenance from 24h, 48 and 72h and after that they were sampling.

Finally, the metals were tested for water samples from the lemon and distilled water inside containers for cast iron and metal water samples as well as lemon and distilled water inside containers had been specified in different times of maintenance. The metals was extracted and determined by ICP. The difference of the metals amount in the lemon water sample inside the porcelain cast iron and lime juice with the same conditions indicate the amount of metal migration from the container at the time of maintenance. This Act was done also to distilled water. Do not repeat tests and once again.

2.2. **Extraction and measurement of metals in the sample**

All of the samples after maintenance and down time or have located the desired conditions in cast iron containers immediately transferred in the washed beakers with acid. All beakers, pipettes and glass containers are required for maintenance of samples and also all plastic bottles was placed in pure nitric acid for 24h and then rinse with distilled water and finally with deionized water. The method of preparation for this event was samples after transfer to beakers using a few drops of 65%nitric acid for the prevention of the placement of deposits on the heater under the hood was put up to the act of digestion done and then to reach the volume contains 25 ml. In order to maintain the extracted liquid samples for analysis of pH, was less than 2 pH samples was measured using electrical pH meters.

Sample preparation step are relatively long and for each series of samples over the length of 10 h. Because it contains a heater temperature was moderate to prevent drying and suddenly concentration.

Then the samples was transferred into plastic leaching acid balloons till to the injection time and stored at low temperature in the refrigerator. It should be noted that in order to prevent the entry of any alloyed to the device and result in interference in the functioning and accuracy in analysis of samples, sample injection into the device before the food, liquid and extracted from membranous filter 0.45 µ were given a pass (Sheets, 1999; APHA, 2005).

2.3. Measurement of metals by ICP-OES

The amount of metals in the liquid and food samples was measured by ICP-OES method (Inductively Coupled Plasma-Optical Emission Spectroscopy), (ICP-OES: Instrument, the Model ARCOS: SPECTRO, Germany: Country, Torch Type: Flared end Torch EOP 2.5 mm, Type: CCD Detector).

At first, a solution of stocks made from the standard solution for each of the heavy metals of cadmium, chrome, iron, molybdenum and nickel at different concentrations in drawing for the calibration curve by using the device. For this purpose, the standard of the metals in the mode of a volume and concentration in sealed 50 ml and concentration of 2000 ppm was used. Then 1000 µl was picked up by micropipette and moved to the 2000 ml balloons and reach to 2000 ml volume using deionized water. 10 ml was transferred to the volume of one liter. After that, the concentrations of metals in solution were prepared for injection in ICP device (APHA, 2005). According to the standard reference method, method of heavy metal in the form of a 2005 combination of devices and their specific calibration curve plot.

2.4. Preparation of the standard curve calibration

Calibration charts obtained by using the built-in concentration (µg/l) against the height of the curve (A) for the standard solutions of Cd, Cr, Fe, Mo and Ni.

Table 1. The correlation rate of R^2, the wavelength and detection limit of metals

Metals	R^2	The passage of wavelength (nm)	Detection limit(µg/ml)
Cd	0.9994	214.438	0.1
Ni	0.9999	221.648	0.3
Fe	0.9999	259.941	0.2
Cr	0.9995	205.618	0.1
Mo	0.9999	202.095	0.2

Calibration curve is linear with the confidence coefficient of Fe, Cr, Cd, Mo and Ni was drawing. Detection limit was 0.1, 0.1, 0.2, 0.2 and 0.3 µg/l for Cd, Cr, Fe, Mo and Ni, respectively. Values are related to the correlation coefficient R^2 of different wavelengths for each of the heavy metals in Table 1.

2.5 Data statistical analysis

The results obtained using the SPSS-18 and statistical analysis tests of non-parametric Mann-Whitney and Kruskal-Wallis were used. The amount of significant data or lack of possibility of type I error is less than $p \leq 0.05$ was selected and used it. A z-test criterion of 1.96 as well as using table-level under the normal curve was used.

3. RESULTS AND DISCUSSION

In this research, the migration of heavy metals from cast iron pots inside the food models was studied. To determine the safety of metals usually associated with their release of the wall of the container, according to the US Food and Drug agency recommendations in acidic conditions (5% acetic acid) was used. This method is used for the experiment of food samples and the ability in the release and leakage of metals from the wall cast iron and metal containers to their contents of sample will be listed. At present study, the migration rate of Cd, Cr, Fe, Mo and Ni are presented on the table 2 after a time lapse of 24, 48 and 72h. The results show that the release of Cd, Mo and Ni used in production of new cast iron pots and not inside the changes, and their values were 0.1, 0.2 and 0.3 µg/l, respectively.

Release contents of chromium and iron into the water after the passage of time will increase. It also abandoned the levels of heavy metals into the water storage and in the lemon juice containers used and new cast iron at different times of maintenance. Each of the metals passes in the containers for different times of maintenance inside the cast iron to the water and lemon juice storage.

The contents of metals chromium, iron, and nickel have been measured. Among the highest amount of metals associated with iron view. With increasing amounts of maintenance time of metals used in containers and abandoned these levels are much greater than the new containers. So the iron levels was measured 313.3 and 5457.8 µg/l during 72 h in lemon juice storage in new and used cast iron containers, respectively.

There was a not change in level of molybdenum during keeping with the various times.

Table 2. Levels of heavy metals migration into the water and lemon juice from new and used cast iron containers after the passage of storage time period

Metals(µg/l)	New container				Used container			
	The passage of time (hours)				The passage of time (hours)			
	24	48	72	M±SD	24	48	72	M±SD
In stored water:								
Cd	0.1	0.1	0.1	0.1±0	0.1	0.1	0.1	0.1±0
Cr	10	11	12	11±1	10	12	26	16±8.7
Fe	19	31	33	27.7± 7.6	27	35	207	89.7±10.17
Mo	0.2	0.2	0.2	0.2± 0	0.2	0.2	0.2	0.2± 0
Ni	0.3	0.3	0.3		0.3	0.3	0.3	0.3± 0
In stored lemon juice:								
Cd	0.1	0.1	0.4	0.2 ±0.17	2	4	6	4±2
Cr	14	32	72	39.3± 29.7	70	302.4	335	214.8± 180.7
Fe	78	119.6	313.3	146.9±154.5	1350.5	3496.5	5457.8	3434.9±2054.3
Mo	0.2	0.2	0.2	0.2±0	0.2	0.2	0.2	0.2±0
Ni	2	8	28	12.7± 13.6	222	224	514	320±168

Table 3. Level of Heavy metals in boiled water and acidic fluids from new and used cast iron containers after storage time of 60 minutes

Metals(µg/l)	New container		Used container	
	Boiled water	5% acetic acid	Boiled water	5% acetic acid
Cd	0.1.1	0.1	0.1	0.1
Cr	37	0.2	105.6	0.6
Fe	1002.9	11.8	1781.3	201.6
Mo	0.2	0.2	0.2	0.2
Ni	8.6	0.3	21.4	1.2

The rate of metals migration in acidic fluids and boiling water for an hour in new and used cast iron containers is shown in the table 3. Based on this table, the levels of cadmium and molybdenum in new and used cast iron containers were equal and they were 0.1 and 0.2 µg/l respectively. Levels of chromium, iron, and nickel were variable in samples. They were in containers containing boiling water for an hour was less than containers containing 5% acetic acid. The results also show that the rate of released metals in new containers is less than used containers. Under acidic conditions, the abandonment of heavy metal has a maximum and with increasing the acidity it can be increased. In other words, the Sheet et al. (1998) showed that the use of acidic conditions more than one (nitric acid 6 normal) increase the considerable drop of lead (Sheets., 1998). Because of such a situation too for the oral material that is supposed to give a non-sufferer. Hence, the Food and Drug Administration perform the experiment, 5% acetic acid, used to position all the more real close. Because of this, the reasons for the Food and Drug Administration (FDA) method is suitable for the release of more adapted to metals and there are not examinations in other experiments with pH conditions. In this study, it was used 5% acetic acid, which is shown as abandoned metals (CFR., 1994).

In table 4, there is a statistical difference according to the storage procedures and the use of water at ambient temperature and boils at cast iron containers with the migration of any of the metals in it to help with the Mann Whitney test. Based on this table no significant difference between the release of each of the metals and methods of use and maintenance of water at ambient temperature cannot be observed ($p>0.05$; $z<1.96$). Also, the statistical difference between the data obtained with respect to the duration of the maintenance of liquid or water at ambient temperature in cast iron container in each of the other metals in it according to Mann-Whitney test. Also, based on this table no significant difference between the release of each of the metals and various time keeping water at ambient temperature was not observed ($p>0.05$; $z<1.96$).

Table 4. The differences and changes in various time keeping water at ambient temperature in cast iron containers associated with migration each of the metals in it by the Mann Whitney test

Metals	Item	z	p
Into the water stored at ambient temperature	Between different times		
Cd	24h and 48h	-0.511	0.610
	24h and 72h	-0.766	0.444
	48h and 72h	-0.422	0.673
Cr	24h and 48h	-0.843	0.399
	24h and 72h	-1.157	0.247
	48h and 72h	-0.473	0.636
Fe	24h and 48h	-0.840	0.401
	24h and 72h	-1.680	0.093
	48h and 72h	-0.945	0.345
Mo	24h and 48h	0	1
	24h and 72h	0	1
	48h and 72h	0	1
Ni	24h and 48h	-0.337	0.736
	24h and 72h	-1.194	0.232
	48h and 72h	-0.436	0.663
Into the water stored at ambient temperature and boil			
Cd	-	-0.742	0.458
Cr	-	-1.194	0.232
Fe	-	-0.436	0.663
Mo	-	0	1
Ni	-	-0.179	0.858

Table 5 shows the changes in difference and relationship between the kind of fluid or food and water storage conditions, acetic acid and lemon juice in cast iron with the migration of any of the metals with Mann Whitney test. Based on this table, there is significant differences between to stored water and acetic acid medium ($p<0.05$; $z>1.96$), water and lemon juice ($p<0.05$; $z>1.96$) and migration of metals as cadmium, chromium, iron, and nickel in cast iron container showed. But there was not observed a significant difference between the release of Mo metal and storage water, acetic acid and lemon juice ($p>0.05$; $z<1.96$). Also, there was not shown significant differences between the storage of water and acetic acid, lemon drop with this metal from cast iron containers ($p>0.05$; $z<1.96$).

In a study, Quintaes et al. evaluated the migration of iron, magnesium, manganese, chromium, nickel, calcium, zinc, lead, cadmium and mercury from cast iron containers using lactic acid and acetic acid as a food simulation. Migration patterns were studied during five maintenance cycle at 22ºC. The data showed that the ion of Fe and Mn in cast iron pan has increased. The releasing of heavy metals lead, cadmium or mercury did not determine in none of them. The rate of migration of Fe in five cast iron container containing acetic acid (0.88 M) for a term of up to 20 minutes reported from 243 to 502 mg/l. Also, based on this study, the rate of migration of Fe and Ni metals from cast iron containers containing acid acetic for 24 hours at 22°C reported 304.2 to 3117.4 and 0.02 to 0.059 mg/l (Quintaes et al., 2004).

In the present study, after the passage of time 24, 48 and 72 hours, the release of cadmium, molybdenum and nickel from new and used cast iron containers containing water did not change and their levels were 0.1, 0.2 and 0.3 µg/l.

But lemon juice maintenance in cast iron containers in different times was remarkable and more values of metals chromium, iron, and nickel have been measured.

In among metals, the highest value corresponds to the iron. With increasing the maintenance time, the releasing of metals into the lemon juice was more and these values are much higher in used containers than new dishes. So, the level of metals in new and used cast iron containers after keeping lemon juice for 72h were measured 313.3 and 5457.8 µg/l, respectively. But the level of Mo metal has not changed with different times of maintenance.

Table 5.The changes of differences and relationship into water or lemon juice with migration of the metals due to storage conditions by using Mann Whitney test

Metals	Items	z	p
Cd			
	Water and acetic acid	-3.475	0.001
	Water and lemon juice	-3.864	<0.001
	Acetic acid and lemon juice	-1.050	0.294
Cr			
	Water and acetic acid	-2.688	0.007
	Water and lemon juice	-4.548	<0.001
	Acetic acid and lemon juice	-0.749	0.454
Fe			
	Water and acetic acid	-3.267	0.001
	Water and lemon juice	-4.276	<0.001
	Acetic acid and lemon juice	-0.094	0.925
Mo			
	Water and acetic acid	0	1
	Water and lemon juice	0	1
	Acetic acid and lemon juice	0	1
Ni			
	Water and acetic acid	-3.812	<0.001
	Water and lemon juice	-4.866	<0.001
	Acetic acid and lemon juice	-0.094	0.925

Exposure to large amounts of molybdenum causes liver complications, stomach ulcers, diarrhea, convulsions, blindness, bone disease, Osteoporosis and finally to be heart failure. Studies have shown that daily consumption of more than 10 mg/kg molybdenum is harmful for human health. But it takes up to 1.5 mg/day no observed effect, except for copper excretion in the urine. The amount of free risk taking 0.15 to 0.5 mg molybdenum has been determined (WHO, 2011). In another study, Quintaes et al. (2007) evaluated the immigration of iron and manganese from cast iron containers and the effects of food preparation methods on iron status in vegetarian people studied. They entered rice and tomato sauce in a cast iron pan for cooking. Then the content of Fe and Mn was measured by using ICP-OES. Vegetarians used these containers for 12 weeks. Tomato sauce prepared in cast iron containers had more iron and manganese than copper. The results showed that the transfer of minerals increases with the cooking stage. Iron deficiency anemia in people from 32.1% to 5.3% decreased while the normal incidence of blood in people increased from 41% to 67.8%. This study showed that iron migration from cooking utensils has been done and it has improved the nutritional status of iron's vegetarians (Quintaes et al., 2007)).

Also, another study by Quintaes et al. (2005) has been done associated with the concentration of iron and acceptance of prepared yogurt in casting iron pots. The aim of this study was to evaluate yogurt iron along with sugar and gelatin and in glass and casting iron containers. The sensory test for acceptance of people and that which would carry the product has done. Yogurt prepared in cast iron and glass containers with the use of milk and dry milk. Half of the sugar and gelatin with a taste of strawberry was added to product after fermentation and Iron levels in the samples were determined using ICP-OES. The results showed that 0.018 and 0.882 mg of iron in natural yogurt 100g to glass dish and cast iron dish has been added respectively. Yogurt gelatin-containing in glass containers and cast iron had 0.037 and 1.302 mg iron in 100g.

After the sensory evaluation, the individuals prefer the yogurt inside the cast iron containers was 29.5 that with the strawberry gelatin containing add to yogurt it reaches about 51.5%. Yogurt prepared in cast iron containers an easy to be prepared in homes and a significant amount of iron can be added to it. Arguably the add gelatin and sugar can taste it goodness for consumer (Quintaes et al., 2005).
Usually the iron deficiency causes anemia and it is the most common deficiency of nutrients. On the use of iron-bearing sources have said that using procedures such as cooking utensils and pots of dimension can be many levels of cooking equipment of iron enters the contents inside these containers (Adish et al., 1999). Use cast iron, steel, and galvanized tubes in transmission and distribution of water can enter the water values of iron. Usually the maximum concentration of iron in drinking water should not exceed 2.5 mg/l. As well as iron, through the consumption of food in the event of encountering the original source can be from 10 to 14 mg/day (WHO., 2003[a]). In a research by Kuligowski and Halperin (1992) referred to examine the domestic cooking utensils of iron, nickel and chromium by atomic absorption spectroscopy. So on this research different dish such as stainless steel and cast iron, medium and light steel, aluminum and glazed steel have been tested. These containers exposed to moderate acidic conditions in with the face of a boiling temperature. Nickel, chromium and iron distinguished in them. Nickel is a main corrosive product in stainless steel containers. These researchers have recommended that patients have sensitivity towards the Ni, it is better to use non-stainless steel containers (Kuligowski and Halperin, 1992). In the present study were also entering the metals cadmium, chromium, nickel and iron from cast iron containers enter to food and water in these containers are kept or cooking inside and iron can release more than other metals into water and food inside. The US Food and Drug Administration from 1972 have monitored the production of food containers and food grade container imported to this country inspects in terms of the existence of the cadmium. Now the maximum permitted concentration of released cadmium from food containers is 0.25 to 0.5 µg/l. The US Food and Drug administration in 1994 reported that almost15 % of all containers of food imported to the US which have been tested; they are not in accordance with the provisions of cadmium metal in terms of US Food and Drug Administration. Also California state express to some concerns in associated with the US Food and Drug Administration regulations that does not apply enough protection due to citizens and recommendations expected to do more research on this (CFR,1994).
Food is usually can have some chromium with concentrations from 10 to 1300 µg. The highest rate of Ni through food intake occurs when uses the metal containers containing chromium in the preparation of food. The average intake of chromium from water and food can be up to 52 to 943 µg/day. Chromium enters the body through air, water and food and it is the main source of food for the arrival of chrome into human body and in this connection the maximum level of chromium in drinking water is 0.05 mg/l (WHO, 2003[b]). Studies have shown that contact and maintenance of drinking water within the lead plates containing chromium nickel-based for one full night can be have nickel concentrations of 490 µg/l in water. There are nickel leakage and release through the pipes of nickel-chrome stainless steel into the drinking water which its content usually reduces after a few weeks. The cause of this can be enabled to browse the non-nickel ions from the surface of the pipes that will be abandoned. The concentration of nickel in water in stainless steel tubes that recently uses for transfer of drinking water can reach up to µg/l. As well as the concentration of nickel in water boiled in an electric kettle may be and its value depends on the thermal element that the amount of nickel in the water could rise significantly. In particular, it is important in cases where the use of a new kettle or skillet inside the sediment to be relieved. The maximum level corresponds to the elements of the nickel pages. However, the rate of nickel release into the water is reduced over time. In

this connection, the concentration in the range of 100 to 400 µg/l and even in quantities greater than 1000 µg/l can exist that more than maximum limit. Usually the maximum concentration of nickel in drinking water is 0.1 mg/l (WHO, 2005; Flint and Packirisamy., 1995; Haudrechy et al., 1994). Humans can be infected with the pollution sources in the form of nickel sensitivity and have in some cases sensitive person may suffer dyspnea. Long-term and continuous contamination with nickel led to increased incidence of cancer. The International Agency for Research on Cancer (IARC) has introduced nickel and a particular composition of Ni as possible carcinogenic factors (IARC, 1990). Long-term use and is also being used to cast iron pots can be created as been concerns how to use the containers for storage, preparation or serving up food can be important. In this regard the use of acidic foods in these containers can release of metals which affect the transition of metals. Also, the condition of cooking food and to being acidic conditions and in terms of being used cast iron containers can be found on the release of metals during the entry time to use and maintenance contents inside it the effect of the transition. In this case, that would be better to prevent long term food storage and the use of acidic foods in these containers. It also should be carefully kept and the uses of these containers. Because of the lack of accuracy in the use and maintenance of cast iron containers can cause several amounts of toxic metals being abandoned into food.

4. CONCLUSIONS

This study shows that the cooking of food in cast iron containers may release some non-organic compounds especially the metals iron and chromium and nickel to more level and molybdenum and cadmium to less level. Although the ion migration can be important in terms of nutritional value if they do not have toxic risks or appropriated in more than the recommended levels. Releasing of toxic material into containers and food can be also threat the human health and they also can cause to change in the organoleptic characteristics in food or cause non-notable acceptance of changes in food or in the nature of the material and the quality. Considering the effects of toxic metals can use and maintenance out of cast iron containers are imported into the food, it is better extra care for using of these containers.

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