ISSN: 2181-1067 Journal homepage: www.summusjournals.uz


International scientific and technical journal
**INNOVATION TECHNICAL AND TECHNOLOGY**
Vol.1, №.3. 2020.

# SIGNIFICANCE AND HARMFUL EFFECTS OF SOME HEAVY METALS PRESENT IN FOOD FOR THE METABOLIC PROCESS.

Yulchiyeva S.T.[1]
*Tashkent state technical university, Tashkent, Uzbekistan*

**Abstract:** Heavy metal is used to refer to metals and semi-metals with a density of more than 5 gr/cm3. The rapid developments of the new technologies in numerous projects and soil contamination by heavy metals, make the soil structure poisonous for plant growth and development, and they all damage the soil biodiversity. Water is also essential for the survival of all living organisms, but unfortunately sources of water used in industries are suffering from all kinds of pollution. The aim of this study is to review the level of food contamination with toxic heavy metals in world. This study was a descriptive overview with entry criteria, relevant information and the keywords of the research. Heavy metals such as Zn, Pb, Fe, Ni, Co and Cu are abundant in the environment and contribute greatly to the stability and balance of ecosystem processes. However, the fact that they are in excess pollutes the food chain and then becomes a source of poisoning for humans and the entire ecological function. This is an important problem in the study of ecology and geochemistry.

**Key words:** Zinc, copper, heavy metal, lead, nickel, manganese, selenium, process, phytoplankton, bacteria.

## Introduction

"Heavy metals" are natural elements characterized by their rather high atomic mass and their high density. Although typically occurring in rather low concentration, they can be found all through the crust of our planet. Commonly, a density of at least 5 g $cm^{-3}$ is used to define a heavy metal and to differentiate it from other, "light" metals. Other, broader definitions for "heavy metals" require an atomic mass higher than 23 or an atomic number exceeding 20; these definitions are highly error prone and confusing. [1]

For a long time, the role of metal ions in the systematic functioning of biological functions has been considered important. Some metals are essential, while others are harmful to metabolic processes. For example, the element zinc, which is very common in nature, plays a key role in the formation of enzymes in the body. Iron also plays an important role in the whole life process. Heavy metals are also harmful to the body at concentrations above critical levels, but some of them are necessary for biological function at low concentrations of elements such as iron (Fe), manganese (Mn), copper (Cu), zinc (Zn) and selenium (Se). [1]

## Methods and materials

In water, heavy metals (Cu, Fe, Zn, Se, Mn, Pb, Cd, Co, Ni, As ..) are first absorbed by phytoplankton, bacteria, fungi and other small organisms, and then consumed by large species, and as a result enter the human body. Presence of metals as natural ingredients in food.

Consumption of foods exposed to heavy metals through polluted products, as well as during technological processes [2] has tragic consequences, and high concentrations of toxic heavy metals have a negative impact on human health. They are common foods such as salt, bread, meat and water. can also pass from food to a living organism. [3].

Toxic metals. Among the heavy metals that can be stored for a long time in food are toxic metals such as arsenic, lead, mercury and cadmium. Such heavy metals are extremely harmful to human health, and these toxic metals pass easily through the food chain to the human body, but they are not essential for metabolic processes. Children are more prone to accumulate heavy metals in the body than adults.

However, the accumulation of these metals causes serious complications, especially in children with impaired mental development, impaired renal function, cardiovascular and auditory systems. There are many studies around the world on heavy metals as toxic substances in food [3,4, 5]

Nickel (Ni) is a dangerous metal for humans, causing diseases such as fibrosis, chronic bronchitis, impaired lung function, and emphysema [9]. Allergic dermatitis is the most common effect of nickel toxicity in the general population [6] However, it is thought to be an important element for some plants and animals [10]. According to scientists such as Plent, Zornton [11] and Carla [12], Ni deficiency leads to a decrease in plasma cholesterol, an increase in liver cholesterol, as well as serious changes in the liver and hair, decreased fertility and poor progeny growth.

Zinc (Zn). Zinc is an important element, and its limit value in surface and groundwater typically does not exceed 0.01 and 0.05 μg / l, respectively [13]. However, an increase in the concentration of zinc was observed as a result of the melting of the ice water in the pipes. It should be noted that drinking water with a zinc content higher than 3 μg / l may not be acceptable for consumers [14].

Cobalt (Co) Cobalt is a trace element necessary for humans in the form of vitamin B12 in a complex way that passes through food for humans [7, 13]. Co deficiency leads to noxious anemia syndrome, excessive addition of Co to the foam stabilizer in beer has led to severe cardiomyopathy, hematological, neurological, and thyroid abnormalities in humans [7, 15].

Copper (Cu) This is a very important element, but when consumed in excess, they cause poisoning [16, 17]. Copper deficiency leads to permanent hair syndrome in humans and abnormal hair in animals, while excessive Cu intake leads to hepatolenticular degeneration [8]. It also helps in the exchange of essential, noradrenaline and adrenaline and in the production of pigment. Zinc-copper interactions lead to ischemic heart disease, which means that excessive consumption of zinc-copper can cause serious damage to heart function in both animals and humans.

Chrome (Cr) Chromium helps maintain blood glucose levels, but its toxicity can lead to allergic dermatitis such as eczema [18].

Cadmium(Cd) is a toxic metal that is dangerous to human health. According to the International Agency for Research on Cancer (IARC), acute exposure to cadmium causes inflammation in the respiratory system, followed by cough, dryness and irritation of the nose and throat, headaches, pneumonitis and lung tumors. [20.21] .The high concentration of cadmium ions in living cells leads to the breakdown of enzymes and proteins, resulting in damage to the mitochondria. This disruptive effect increases the oxidizing property of the cell. It can also lead to disruption of cell function, i.e. cell death. [22] Cadmium is also rapidly and easily adsorbed on organic substances such as fulvic acids, so high concentrations of local Cd source can be observed in organic-rich waters [7, 12]. Chronic exposure to the metal can lead to kidney disease, anemia, emphysema, anosmia (loss of sensation and smell), cardiovascular disease, kidney problems,



* Corresponding author: sevara.tojimatovna@gmail.com

and hypertension [11]. Itai-itai disease is caused by the severe effects of Cd, which is very painful and leads to fractures and fragmentation of the bones [6].Cadmium is obtained as a by-product from sulfide deposits, mainly lead, zinc and copper. The level of cadmium in the human body increases with age, between the ages of 40-50 it reaches an average of 30mg and then decreases slightly. [23]

Cadmium - directly harms people in several ways. It is naturally found regularly with other heavy metals such as zinc, copper, and lead. Occurs in compound form as a by-product of soil erosion, volcanic eruption, and industrial processes. Industrially, its use is one of the most desirable metals in the production of electroplating and nickel-cadmium batteries. [24]

Lead (Pb) is an element with atomic number 32 and after iron, is the most commonly used metal. Lead has entered agricultural products due to the use of chemical fertilizers, herbicides, sewage treatment and contamination of soil by sewage. This metal is significantly toxic and accumulates in the body which results in acute poisoning in humans [2]

Moreover, if the water has acidic pH, it will cause poisoning and absorbs lead while it passes through the water pipes. Mercury is a metal with atomic number 80 and it could be absorbed by inhalation, ingestion and through the skin. Mercury vapor tends to affect central nervous system, kidneys and liver [25].

## Results and discussing

Bread provides more than 50-90% percent of the protein and calories needed by the body. Heavy metals can enter crops and eventually bread and cereal. Flour manufacturers can also be contaminated with heavy metals when the water used during the preparation of dough is contaminated with heavy metals. In addition, bakeries' fuel type influences the deposition of heavy metals in bread. Bakeries locations in the city and those close to the industrial centers are also of importance [9].

Oils and fats, like other food products always contain some different metal residues that might have been contaminated through natural ways (soil, water, fertilizers and pesticides) or during the transportation, processing and storage. Regardless of the source, the presence of metal residues in oil even in very small amounts is considered undesirable and negatively affects the quality levels. Metals such as lead and arsenic in oil have high intoxicating effect and it is important to precisely control the amounts[26]

Vegetables are important components of a healthy diet and based on scientific evidence the consumption of vegetables can reduce the risks of heart diseases and some cancers, especially gastro-intestinal cancer. Vegetables that are irrigated by contaminated water such as industrial and urban sewage, increase the possibility of the presence of heavy metals in farmed vegetables [6]

Meat is one essential and basic nutrient, rich in minerals. Subsequently, it is an important factor in food chain. The increase of foodborne diseases has attracted a lot of attention from the health authorities. One reason is the toxicity of heavy metals in animal products [19]

## Conclusion

Excess of all toxic elements is dangerous for living organisms, where its effects on various organisms have been studied. Toxic heavy metals have the property of adversely affecting many biological activities in humans, animals, and various other organisms. In particular, the harmful effects of cadmium in humans are not limited to the kidneys and bones, but it damages almost all organs and tissues, which necessitates health measures to reduce their effects. There are many ways to reduce the activity of these heavy metals, which serves to reduce their toxicity. One of today's urgent tasks is to implement preventive measures in high-risk patients and implement measures based on prophylactic strategies for the population, such as supporting cadmium safety



* Corresponding author: sevara.tojimatovna@gmail.com

standards, reviewing food safety policies and limiting industrial emissions of toxic metals, helping to prevent heavy metal toxicity. is to create an environment that gives.

And also to study the mechanisms of using of waste from the food industry and agricultural wastes as bio-absorbs to determine the best option of using, what would improve it. To achieve the goal, the work has been studied and analyzed all attainable sources of agro based low-cost reasonable adsorbents for their feasibility in the removal of heavy metals from food stuff.

## References


1. Ikem, A.; Egiebor, N. O., Assessment of trace elements in canned fishes (mackerel, tuna, salmon, sardines and herrings) marketed in Georgia and Alabama (United States of America). Journal of food composition and analysis 2005, 18 (8), 771-787.
2. Sadeghi, A.; Hashemi, M.; Jamali-Behnam, F.; Zohani, A.; Esmaily, H.; Dehghan, A., Determination of Chromium, Lead and Cadmium Levels in Edible Organs of Marketed Chickens in Mashhad, Iran. Journal of food quality and hazards control 2015, 2 (4), 134-138.
3. Schilt, A. A.; Taylor, R., Infra-red spectra of 1: 10-phenanthroline metal complexes in the rock salt region below 2000 cm− 1. Journal of Inorganic and Nuclear Chemistry 1959, 9 (3-4), 211-221. [5]. Rahimi, E., Lead and cadmium concentrations in goat, cow, sheep, and buffalo milks from different regions of Iran. Food chemistry 2013, 136 (2), 389-391.
4. Abbasi, N., Aspergillus spp. germ tubes induce stronger cytokine responses in human bronchial epithelial cells in comparison with spores. Current Medical Mycology 2015, 1, 37-93.
5. Naseri, M.; Vazirzadeh, A.; Kazemi, R.; Zaheri, F., Concentration of some heavy metals in rice types available in Shiraz market and human health risk assessment. Food chemistry 2015, 175, 243-248.
6. World Health Organization (WHO), *Guidelines for Drinking-Water Quality, First Addendum to Geneva*, World Health Organization, Geneva, Switzerland, 3rd edition, 2006.
7. J. Plant, D. Smith, B. Smith, and L. Williams, "Environmental geochemistry at the global scale," *Journal of the Geological Society*, vol. 157, no. 4, pp. 837–849, 2000.View at: Publisher Site | Google Scholar
8. 8.World Health Organization (WHO), *Guidelines on Drinking-Water Quality*, World Health Organization, Geneva, Switzerland, 3rd edition, 2004.
9. J.A.Plant and I. Thornton, "Geochemistry applied to agriculture," in *Applied Environ mental Geochemistry*, I. Thornton, Ed., pp. 231–266, Academic Press, London, UK, 1st edition, 1983.View at: Google Scholar
10. W. M. Carla, *Environmental Geology*, WMC. Brown Publishers, Dubugue, IA, USA, 5th edition, 2002.
11. A. Ismail, M. Riaz, S. Akhtar, J. E. Goodwill, and J. Sun, "Heavy metals in milk: global prevalence and health risk assessment," *Toxin Reviews*, vol. 38, no. 1, pp. 1–12, 2019.View at: Publisher Site | Google Scholar
12. W. M. Carla, *Environmental Geology*, WMC. Brown Publishers, Dubugue, IA, USA, 5th edition, 2002.
13. H.Ali and E. Khan, "Trophic transfer, bioaccumulation, and biomagnification of non-essential hazardous heavy metals and metalloids in food chains/webs-concepts and implications for wildlife and human health," *Human and Ecological Risk Assessment: An International Journal*, vol. 25, no. 6, pp. 1353–1376, 2019.View at: Publisher Site | Google Scholar




* Corresponding author: sevara.tojimatovna@gmail.com

14. C.Li, K.Zhou, W.Qin et al., “A review on heavy metals contamination in soil: effects, sources, and remediation techniques,” *Soil and Sediment Contamination: An International Journal*, vol. 28, no. 4, pp. 380–394, 2019.View at: Publisher Site | Google Scholar
15. B.E. Davies, C. Bowman, T. C. Davies, and O. Selinus, “Medical geology: perspectives and prospects,” in *Essentials of Medical Geology*, pp. 1–13, Springer, Dordrecht, Netherlands, 2013.View at: Google Scholar
16. L.R. McDowell, *Minerals in Animal and Human Nutrition*, Elsevier Publishers, Alpharetta, GA, USA, 2nd edition, 2003.
17. R.W. McDowell, M. D. Taylor, and B. A. Stevenson, “Natural background and anthropogenic contributions of cadmium to New Zealand soils,” *Agriculture, Ecosystems & Environment*, vol. 165, pp. 80–87, 2013.View at: Publisher Site | Google Scholar
18. C.L. Broadhurst and P. Domenico, “Clinical studies on chromium picolinate supplementation in diabetes mellitus-a review,” *Diabetes Technology & Therapeutics*, vol. 8, no. 6, pp. 677–687, 2006.View at: Publisher Site | Google Scholar
19. Binns, J.; Maconachie, R.; Tanko, A., Water, land and health in urban and peri-urban food production: the case of Kano, Nigeria. Land Degradation & Development 2003, 14 (5), 431-444.
20. Meeting of the IARC working group on beryllium, cadmium, mercury and exposures in the glass manufacturing industry Scand J Work Environ Health. 1993; 19(5):360–3.
21. Roy SS, Mahapatra R, Rath S, Bajpai A, Singh V, Nair N, et al. Improved neonatal survival after participatory learning and action with women's groups: a prospective study in rural eastern India. Bull World Health Organ. 2013; 91(6):426–33B.
22. Pan YX,Luo Z,Zhuo MQ,Wei CC,Chen GH,Song YF, Oxidative stress and mitochondrial dysfunction mediated Cd-induced hepatic lipid accumulation in zebrafish Danio rerio. Aquatic toxicology (Amsterdam, Netherlands). 2018 Jun [PubMed PMID: 29604498]
23. P. K. Rai, S. S. Lee, M. Zhang, Y. F. Tsang, and K.-H. Kim, “Heavy metals in food crops: health risks, fate, mechanisms, and management,” *Environment International*, vol. 125, pp. 365–385, 2019.View at: Publisher Site | Google Scholar
24. 24. Godt J,Scheidig F,Grosse-Siestrup C,Esche V,Brandenburg P,Reich A,Groneberg DA, The toxicity of cadmium and resulting hazards for human health. Journal of occupational medicine and toxicology (London, England). 2006 Sep 10 [PubMed PMID: 16961932]
25. Hematopoietic system, nervous system and Hashemi M et al /J. Pharm. Sci. & Res. Vol. 9(10), 2017, 1692-16971692 renal system are the three main body systems sensitive to this metal.
26. Hirsch, J. (2018). Metals in Baby Food: What You Need to Know. Consumer Reports Aug https://www.consumerreports.org/food-safety/heavy-metals-in-baby-food/Heavy



* Corresponding author: sevara.tojimatovna@gmail.com