CODEN [USA]: IAJPBB ISSN: 2349-7750

INDO AMERICAN JOURNAL OF
PHARMACEUTICAL SCIENCES

http://doi.org/10.5281/zenodo.1307376

Available online at: http://www.iajps.com *Review Article*

REVIEW ON HEAVY METALS IN DRINKING WATER

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Abstract:

In today's world the contamination of drinking water due to various heavy metals is one of the most important concerns. Heavy metals such as copper, iron, manganese, silver, nickle, cobalt, tin, zinc, mercury, uranium have resulted in very serious and deadly diseases. They may also have adverse effects on our circulatory system, digestive system and nervous system. The levels of heavy metals in ground water vary from region to region. People taking contaminated water and suffer from various diseases such as lungs cancer, Allergies, renal stone disease and apoptosis. When the concentration of these heavy metals increases in our body they start accumulating in different organs of our body where they cause various diseases. Balochistan is one of the least developed provinces of Pakistan where basic facilities are very uncommon. Moreover, the current focus of this review paper is to provide significant insight about various heavy metals, techniques used for measuring their concentrations and the deadly diseases associated with them. This review has been written with the hope that it would be beneficial as a source of information for researchers and other common people regarding heavy metals and their adverse effects on health.

Key words: *Drinking water, heavy metals, techniques, associated diseases.*

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Please cite this article in press Muhammad Iqbal et al., ***Review on Heavy Metals in Drinking Water,*** *Indo Am. J. P. Sci, 2018; 05(07).*

INTRODUCTION:

Good human health is is associated with safe and good quality drinking water. Water provides some elements, but when polluted it may become the source of undesirable substances, dangerous to human health and cause disease such as, various cancers, adverse reproductive outcomes, teeth decay, neurological diseases and cardiovascular disease,. Toxic metals are usually present in industrial, municipal and urban runoff, which can be harmful to humans and biotic life. Increased urbanization and industrialization are to be blamed for an increased level of trace metals, especially heavy metals, in our waterways [1].Many dangerous chemical elements if released into the environment, accumulate in the soil and sediments of water bodies [2]. There are over 50 elements that can be classified as heavy metals, 17 of which are considered to be very toxic and relatively accessible[1].Characteristically, also the anions have its important role in drinking water ; results also showed affecting the human health[3] .Toxicity level depends on the type of metal, its biological role and the type of organisms that are exposed to it [1].Heavy metals have a marked effect on the aquatic flora &fauna which through biomagnification enters the food chain and ultimately affect the human beings as well [4]. The heavy metals in drinking water linked most often to human poisoning are lead, iron, cadmium copper, zinc, chromium etc .They are required by the body in small amounts , but can also be toxic in large doses. They constitute one important group of environmentally hazardous substances if present [1].

It is well known that groundwater supplies most drinking water throughout the world, which the global population is 7 billions of people [5], and whereas about 1.1 billion of them worldwide lack access to improved drinking water supplies and use unsafe surface and groundwater sources. Even people who have access to “improved” water supplies such as household connections, public standpipes, and wells may not have safe water [6] because it is well known that drinking water could be polluted with microorganisms [7], arsenic [8], polycyclic aromatic. Hydrocarbons (PAHs) [9], organic pollutants [10], nitrate and nitrite [11]**.** Up till now various review papers have been published by the researchers, this review attempts to explain general techniques used for the detrection of heavy metal along with various diseases that are associated with water containing higher amounts of heavy metals.

SIGNIFICANCE AND VARIOUS TECHNIQUES USED FOR THE DETERMINATION OF TRACE METALS:

The importance of the determination of trace metal concentration, in natural eater samples is increasing the contamination monitoring studies and to determine the main problem is the low sensitivity for trace metals at µgl-1 level. This limitation can be overcome by the use of pre-concentration procedure. On the other hand heavy metals pollution represents a serious problem for human health and for life in general the disposal of heave metals is consequences of several activities like chemical manufacturing painting and coating, mining extractive metallurgy, nuclear and other industries, those metals exert a deleterious effect on fauna and flora of lakes and streams [12]. They are one the most environmental pollutant which accumulates in living organisms. Its cause poisoning effects are serious hematological and brain damage. [13]. Heave metals in different rivers are most investigated recently [14-16]. The toxicity of heave metals has long been concerned to the health of people and ecology.

DIFFERENT TECHNIQUES USED TO DETERMINE HEAVY METALS:

Atomic absorption spectroscopy (A.A.S):

Atomic absorption spectroscopy (A.A.S) is simple and well available technique for determinations of heave metals in the natural water samples. A.A.S is the main instrument for the determination of trace heave metals ions in drinking waters in analytical chemistry laboratories. The fundamental principle of AAS is that upon irradiation of light, electrons in atoms are excited to higher energy states and during de-excitation, they emit light with frequencies characteristic of the particular atom. The sensitivity of the process derives from the fact that the width of a transition line is very small and, therefore, can be considered elemental sensitivity. To be analyzed at the atomic level, the sample needs to be atomized first. This is achieved by flame and electro-thermal atomizers, although other atomization techniques also exist. The atomized sample is then exposed to radiation and the radiation flux is measured. Prior to this, the radiation flux without the sample is also measured. The ratio of the fluxes without and with the sample, which is also known as the absorbance, can thus be calculated and used to convert into analyte concentration using the Lambert-Beer law [17, 18, 19, and 20].

Graphite furnace atomic absorption spectroscopy (G.F.A.A.S):

This technique offers high sensitivity (5×10^{-11} g selenium /g sample). But interference from the matrix can cause significant difficulties GFAAS methods rely on the fact that numerous metal compounds react with selenium compounds to form relatively

refractory metal selenidel G.F.A.A.S technique used to determining selenium levels in human urine [21].

Flame atomic absorption spectroscopy (**FAAS**):
In this electro thermal atomic absorption spectroscopy (F.A.A.S) method, nitric acid, Nickel and Platinum are added to graphite cell. E.A.A.S technique has been used to determine selenium levels in human spermatozoa [22]. For human blood plasma and serum, the detection limit of E.A.A.S method.

Capillary Electrophoresis Capillary electrophoresis (CE):
Capillary Electrophoresis Capillary electrophoresis (CE) is a combined term that refers to a family of electro-kinetic separation methods performed by means of very fine capillaries. It includes capillary zone electrophoresis (most commonly used in the context of CE), capillary gel electrophoresis, capillary isoelectric focusing, capillary isotachophoresis, and micellar electro kinetic chromatography [23]. The essential principle engaged in CE is straightforward. An external electric field is applied and depending on the ionic mobility, conductivity, and charge response to pH, different molecules move differently and therefore disconnect in a different way. By fluorescence tagging, the sample or by integrating the CE to SERS, the identity of the individual components of the sample can be determined [24].

Hydride generation atomic fluorescence spectrometry:
Hydride generation atomic fluorescence spectrometry has been used to measure selenium concentration in urine [25]. Samples have completely mineralized using focused microwave oven with mixture of nitric acid at sulfuric acid for 14 minutes.

DISEASES ASSOCITED WITH HEAVY METALS:
It has already been discussed that drinking water with high quantities of heavy metal may result in various types of deadly diseases. Different heavy metals have different effects on our body, therefore when their concentration increases in our body it results in to numerous physiological effects. Moreover, through Ingestion and dermal contact the concentration of copper and iron increase in our body and results in to cognitive dysfunction, Alzheimer type II astrocytosis, Parkinsonism and ataxia [26, 27]. When the concentration of cobalt increases in our body its starts accumulating in muscles, liver and gills. The main source of cobalt accumulation is through water ingestion [28]. In addition to it when the level of manganese rises in our body through Ingestion it causes Alzheimer type II astrocytosis, Parkinsonism, cognitive dysfunction, liver diseases, and ataxia [26] and when its levels increases through Water ingestion it has adverse Effects on central nervous functions [29]. Mercury is also one of the heavy metals and when its levels rise in our body it results in the damage of our DNA [30]. Systemic toxicity occure when the level of nickel raises in our body [31]. Tin is a post transition element of 14th group periodic table, due to the increase in the contration of this heavy metals lung cancer is caused [32]. WHO has set desired levels of heavy metals in drinking water, when its concentration increases from the prescribed values it results in to negative effects on our body. Therefore, when the concentration of zinc increases in our body it accumulates in muscle, liver and gills [28].

CONCLUSION:
Conclusively, drinking water with elevated heavy metal concentration causes various diseases. Further, this paper has focused on the various types of heavy metals and their related diseases. Based on the research of various authors, when the concentration of heavy metals rise in the drinking water they may result in different types of disease, therefore it is suggested that that the drinking water may be checked prior to use so that various risks associated with higher concentration of heavy may be prevented. It is further suggested that drinking water may be first tested and may also be passed through special treatment methods so that it may be made fit for drinking without any hazardous effects.

REFERENCES:
[1] Seema Sing1, Swati Lal1, Jeena Harjit, Sulbha Amlathe and Kataria H.C., 2011; 5:239-246.
[2] Abida Begum, Harikrishna S, Irfanullah Khan. International Journal of Chem Tech Research. CODEN(USA):IJCRGG. 2009; 2:245-249.
[3] Sardar Khana,b, Maria Shahnaz, Noor Jahana, Shafiqur Rehmana, Tahir Shahc M, Islamud Dind Journal of cleaner Production. 2012; 1- 9.
[4] Ram S, Lokhande, Pravin U, Singare, Deepali S.Pimple. Resources and Environment. 2011; 1:13-19.
5. UNFPA, United Nations Populations Founds (2011). Retrieved from http://www.unfpa.org/public/cache/offonce/home/news/pid/7204;jsessionid=6C355D2E24817C8362750 097E42535EB. (verified March 3, 2011).
6. Sobsey MD, Stauber CE, Casanova LM, Brown JM, Elliott MA. Point of use household drinking water filtration: A practical, affective solution for proving sustained access to safe drinking water

in the developing world. Environ. Sci. Technol. 2008; 42:4261-4267.
7. Lugoli F, Leopizzi MI, Bagordo F, Grassi T, Guido M, De Donno A. Widespread microbiological groundwater contamination in the South-eastern Salenco (Puglia-Italy). J. Environ. Monitor. 2011; 13:192- 200.
8. Akter A, Ali MH. Arsenic contamination in groundwater and its proposed remedial measures. Int. J. Environ. Sci. Tech. 2011; 8:433-443.
9. Bruzzoniti MC, Fungi M, Sarzanini C. Determination of EPA´s priority pollutant polycyclic aromatic hydrocarbons in drinking waters by solid phase extraction-HPLC. Anal. Methods. 2010; 2:739-745.
10. Wu B, Zhang Y, Zhang XX, Cheng SP. Health risk from exposure of organic pollutants through drinking water consumption in Nanjing, China. B. Environ. Contam. Tox. 2010; 84:46-50.
11. Manassaram DM, Backer LC, Messing R, Fleming LE, Luke B, Monteilh CP. Nitrates in drinking water and methemoglobin levels in pregnancy: a longitudinal study. Environ. Health-Glob. 2010; 9:60.
12. Sayari A, Hamoudi S and Yang Y. Application of pore-expanded malodorous silica, removal of heavy metal captions and organic pollutants from waste water, Chem. Mater. 2005; 212-216.
13. Zheng Na, Qichao wang, Zhongzhu Liang and Dongmei Zheng, Characterization of heavy metal concentration in the sediments of three freshwater river in Huludao City, Northeast China. Environmental Pollution, in press. 2008.
14. Wakida FT, D. Lara-Ruiz J. Temores-Pen a. JG. Rodriguez-Vintura. Diaz C. and Garcia-Flores E, Heavy metals in sediments of the Tecate River, Mexico. Environ Geol. 2008; 54: 637-642.
15 Li Feng, YM. Wen and PT. Zhu, Bioavailability and Toxicity of Heavy Metals in a Heavily Polluted River, in PRD, China. Bulletin of Environmental Contamination and Toxicology, in Press.2008; 90–94.
16. Mendiguchiaa Carolina, Carlos Moreno, a and Manuel Garcia-Vargasa, Evaluation of natural and anthropogenic influences on the Guadalquivir River (Spain) by dissolved heavy
[17] Dale I M., Tech. Instrum. Anal. Chem. 1982; 5: 381–394**.**
18. Vsoylak M., ELCI L., DOGAN M. Kayseri cevresindeki akarsulareda bazi katyon ve anyonlarin tayini, Marmara Universitesi Fen Bilimleri Dergisi. 1992; 9:85-89.
19. Ballinger DG. Method for chemical analysis of water and wastes, EPA. Ohio. 1989.
20. Basset J, Denney TC, Vogel's textbook of quantitative five inorganic analysis, Longman. 1983.
21. Saeed K and Thomassen Y Anal Chim Acta 130:281. 14. Anal Chim Acta. 1986; 180:373,
22. Saaranen M, Suistomaa U, Kantola M, S. Saarikoski, and Vanha T. 1987;59, 437.
[23] Duffus JH, Pure Appl. Chem. 2002; 5: 793–807
[24] Kemp G, Biotechnol. Appl. Biochem. 1998; 27 (1): 9–17
25. Sabe, Rubio R and Garcia-Beltran L, J. Trace Elem. Med. 2001.
26. Butterworth RF. Metal toxicity, liver disease and neurodegeneration. Neurotox. Res. 2010; 18:100-105.
27. Mercer JFB . The molecular basis of copper-transport diseases. Trends Mol. Med. 2001; 7:64-69.
28. Visnjic-Jeftic Z, Jaric I, Jovanovic L, Skoric S, Smederevac-Lalic M, Nikcevic M, Lenhardt M. Heavy metal and trace element accumulation in muscle, liver and gills of the Pontic shad (Alosa immaculate Bennet from the Danube River (Serbia). Microchem. J. 2010; 95:341-344.
29. Bouchard MF, Sauve S, Barbeau B, Legrand M, Brodeur ME, Bouffard T, Limoges E, Bellinger DC, Mergler D. Intellectual impairment in school-age children exposed to manganese from drinking water. Environ. Health Persp. 2011; 119:138-143.
30. Bucio L, Garcia C, Souza V, Hernández E, Gonzalez C, Betancourt M, Gutierrez-Ruiz MC (1999). Uptake, celular distribution and DNA damage produced by mercuric chloride in a human fetal hepatic cell line. Mutat Res-Fund. Mol. M. 1999; 423:65-72.
31. Duda-Chodak A, Blaszczyk U. The impact of nickel on human health. J. Element.2008; 13:685-696.
32. Jones Sr, Atkin P, Holroyd C, Lutman E, Batle JVI, Wakeford R, Walker P. Lung cancer mortality at a UK tin smelter. Occup. Med-Oxford. 2007; 57:238-245.