Short Communication

Zahedan Journal of Research in Medical Sciences

Journal homepage: www.zjrms.ir

Heavy Metals Concentrations in Mashhad Drinking Water Network

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Article information

Article history:
Received: 22 Jan 2013
Accepted: 18 Mar 2013
Available online: 19 May 2013
ZJRMS 2013; 15(9): 74-76

Keywords:
Drinking water
Heavy metals
Chromium
Cadmium
Lead

Abstract

***Background*:** Existence of heavy metals, may have adverse effects on consumers. This study was carried out to determine some heavy metals concentrations (cadmium, chromium and lead) in Mashhad drinking water network.
***Materials and Methods*:** In this cross study, samples were collected from different points of urban drinking water network according to the standard methods, and tested by atomic absorption spectrophotometeric method.
***Results*:** Cadmium and chromium concentrations did not exceed national and international standards, only lead concentrations were slightly higher than standard rate in some areas and its mean difference spring and summer was significant (p=0.03).
***Conclusion*:** It is necessary to do needful measures by responsible company because of the metals importance.

Introduction

Necessity of access to safe drinking water for the health of consumers is an undeniable issue, with increasing population growth and industrial water demand is on the rise. Microbial contamination as well as chemical pollution, which are of importance in water quality, result from the use of chemicals in industries [1, 2]. In the last decades existence of natural and antropogenic high concentrations of heavy metals in water, according to their properties is known as one of the major health problems [3-5]. Heavy metals like silver (Ag), cadmium (Cd), mercury (Hg), tin (Sn) have a strong affinity for amine and sulfhydryl groups thus due to combination of enzymes containing these groups will lead to their collapse. Poisoning by lead, copper, cadmium and zinc are very dangerous and have severe effects on the nervous system, kidneys and blood. Lead (Pb) is involved in reducing IQ, delaying learning, physical and mental growth of children and adults [6]. Chromium (VI) can cause to gastrointestinal tract and lungs cancers [3]. There are various factories around Mashhad that most of them do not have wastewater treatment system on the other hand wastewater collection network does not cover entire the city, therefore it is possible to enter different coumponds such as heavy metals to water resoursce. This study was carried out to determine cadmium, chromium (VI) and lead concentrations (according to literatures their existence probability was high) in Mashhad drinking water network.

Materials and Methods

This cross study was conducted in spring and summer 2011. Sampling stations were selected so that cover entire the city, monthly samplings was done on a day, during the last 10 days of every month. Sampling points have been marked on Mashhad map (Fig. 1).

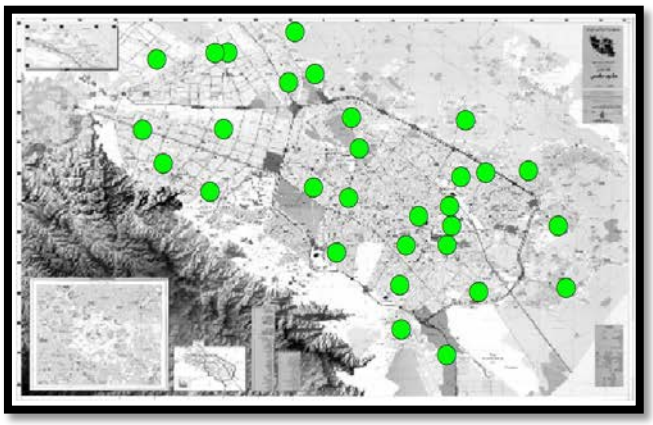

Figure 1. Sampling points position on Mashhad map

Sampling and preservation of samples were performed according to the standard methods and measured by atomic absorption spectrophotometeric [7]. Data were analysed by SPSS-16 and One-way ANOVA, paired t-test and One sample t-test on the significant level p<0.05. Resullts and compare to national standard and international standards (EPA, WHO) [8, 9].

Results

Data analysis showed that cadmium concentration was 0.97±0.78 and 0.95±0.52 µg/L in spring and summer respectively which this mean difference was not

significant in any seasons. Chromium (VI) concentration was 10.29±10.26 and 10.41±10.49 µg/L in spring and summer respectively that just concentrations difference among areas was significant (p=0.014). Lead concentration was 10.16±4.7 and 14.06±9.66 µg/L in spring and summer respectively without any significant difference between seasons. Chromium (VI) and lead concentration in summer were higher than spring concentration. According to the p-values, just lead difference was significant (p=0.03) in spring and summer. Whereas there was correlation among metals concentrations in both seasons, this correlation for spring and summer lead and cadmium concentrations was stronger and more significant (p<0.001). Metals (Cd, Cr) concentrations in all samples were lower than WHO (World Health Organization) guideline and Iran standard (Cd=3, Cr=50 µg/L) and EPA standard (Environment Protection Agency) (Cd=5, Cr=100 µg/L). Lead concentration just in March was lower than mentioned standards and EPA standard (maximum contaminant level=15 µg/L) but exceeded Iran standard and WHO guideline (10 µg/L) and EPA standard (maximum contaminant level goal=0 µg/L) in other months (Fig. 2). There was no significant correlation among sampling sites. Three types of water (surface, ground water and combination of them) distributes to the network, significant correlation was not found between metals concentrations and water types.

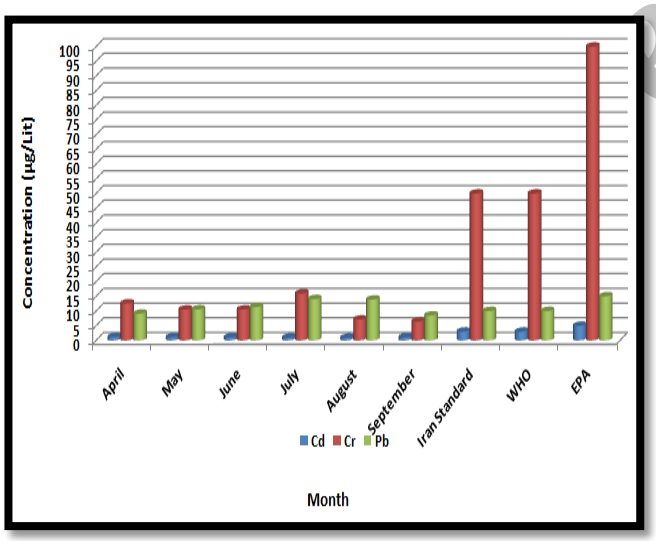

Figure 2. Monthly mean concentrations of metals in comparison with different standards

Discussion

Whereas Pb concentration was slightly higher than WHO guideline and Iran standard, it was equal to EPA standard. Both Cr and Pb concentrations were increased in summer, it sounds logical because in summer water volume in distribution system is low due to higher consumption of stationary and variable (pilgrims) population, on the other hand leakage potential of pollutant sources -which major of them can be network pipes- is constant; these conditions result in more metals concentrations, moreover one of Cr penetration probable sources can be its presence in soil, Savari et al. stated that Ahvaz water network had metals leakage and corrosion potential [10].

The results in this paper similar to Nouri et al. study in the water wells close to Zanjan zinc and lead smelting plant because Pb concentration was higher than Iran standard (50 µg/L), by considering new standards Pb (59%) and Cd (53%) of samples have been WHO guideline and EPA standard [11], although sampling sites in these study have been different (well and tap), it could be concluded, in addition of leakage pipe Pb has leakage potential from soil texture. Rajaee et al. examined heavy metals health risk of groundwater in Aliabad Katoul plain, there were no significant correlation between metals concentrations and standards. spring metals (Pb, Cd, Cr) concentrations are lower than them in this study that it is acceptable because Rajaee's study was done in rural region [6]. Cd and Cr amounts were fewer than standards in all month which correspond Miranzade et al. paper [5].

Kavcar et al. explored health risk assessment for exposure to trace metals via drinking water ingestion pathway, Cr, Cu, Mn, Ni and Zn in 50% of samples were detected, Ni (more than 20% of samples) and As (58% of samples) concentrarions were equal to standards [12]. Bhuiyan et al. surveyed hazardous metal pollution in irrigation and drinking water systems in the vicinity of a coal mine area of northwestern Bangladesh, results demonstrated more than 50% of samples were polluted [13]. Therefore Mashhad drinking water have no problem with measured heavy metals but the findings recommended the need to control Pb concentration, necessary measures like decayed pipes changing, using Lead free pipes and water blending. Due to metals importance it is suggested that heavy metals concentrations monitoring in water and food supply must be done according to guidelines in order to prevent chronic disease.

Acknowledgements

This work was supported by vice-chancellor for research of Mashhad University of Medical Sciences (Code: 89789), We would like to thank Environmental and Occupational Health Engineering Department of vice-chancellor of Health for executive support

Authors' Contributions

All authors had equal role in design, work, statistical analysis and manuscript writing.

Conflict of Interest

The authors declare no conflict of interest.

Funding/Support

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Please cite this article as: Peiravi R, Alidadi H, Dehghan A, Vahedian M. Heavy metals concentrations in Mashhad drinking water network. Zahedan J Res Med Sci (ZJRMS) 2013; 15(9): 74-76.