Research Journal of Chemical and Environmental Sciences
Res J. Chem. Environ. Sci. Vol 4 [2] April 2016: 60-64
Online ISSN 2321-1040
CODEN: RJCEA2 [USA]

Website: www.aelsindia.com/rjces.htm

RJCES

ORIGINAL ARTICLE

Studying the Concentration of Heavy Metals in Drinking Water Sources and Reservoirs of Kermanshah

Seyyed Alireza Mousavi[1,2] , Mahid Faraji[1], Asadola Sadeghi[3]
1-Department of Environmental Health, Kermanshah University of Medical Sciences, Kermanshah, Iran
2-Research Center for Environmental Determinants of Health (RCEDH), Kermanshah University of Medical Sciences, Kermanshah, Iran
3-Water and Sewage Company, Kermanshah, Iran

ABSTRACT
One of the major health problems in drinking water sources is being different concentration and higher than standard of heavy metals which can be considered as a potential and effective factor in suffering various diseases including cancers. Heavy metals go into the groundwater from different sources; these sources include using chemical fertilizers in agriculture, domestic sewages, industrial sewages and waste emulsion. The aim of this study is monitoring the qualification of drinking water sources in terms of heavy metals which is necessary as a periodical indicator. The supplier sources and reservoirs of drinking water in Kermanshah were sampled in standard conditions and in two periods of time (2009 and 2010). The samples were analyzed according to standard methods and by atomic absorption spectrometry in the laboratory of Water and Wastewater Company in Kermanshah to determine the concentration of heavy metals. The results show that the concentrations of 17 studied metals are lower than national standards. The range of measured concentration for 5 heavy metals, Cd, Ni, Pb, Cr and Fe, in drinking water wells in Kermanshah and in 2010 were respectively 52±75, 2±4, 5±6, 2±1 and 0.2±0.2 µg/Land the concentration of these metals in the water reservoirs in Kermanshah and in 1390 was respectively 69±130, 2±4, 4±5, 5±2 and 0.5±0.1 µg/L. Comparing the results of heavy metals concentration in this study with drinking water standards shows that the concentration of studied heavy metals are lower than the rated levels that were declared by the World Health Organization and the National Standards Organization of Iran.
Keywords: *water sources, heavy metals, drinking water, Kermanshah.*

Received 19.01.2016 Accepted 20.03.2016

INTRODUCTION

Accessibility to safe drinking water is one of the basic and major needs in society and is considered as an important vital source and is important in human life. Today supplying required drinking water and providing water services to people is a serious problem in many cities and villages [1, 2]. Removing living pathogenic elements, harmful chemicals, color and odor in a way that to have pleasant flavor, performing preventative actions and also proper refinement are necessary to provide safe water [3].

The importance of providing safe and adequate drinking water has been frequently emphasized in international organizations like the World Health Organization. So that this organization called the 1980s as the decade of safe drinking water [2]. According to the statistics of the World Health Organization, more than one billion people don't have access to safe drinking water around the world, thus each year more than 1500000 people in the world die because of intestinal diseases due to the lack of safe drinking water, and 19% of this population are children whom are younger than 5 years old [4].

Iran is a developing country and is located in the dry zone of the Middle East. The average rate of rainfall in Iran is 250 mm per year and according to its specific continental conditions, it has diverse climates. Each year in Iran the population increases and the storage sources decreases, and on the other hand by developing urbanization, industrialization and agriculture, the water sources will be exposed to different chemical and microbial pollutions [4, 5]. Heavy metals are one of these pollutants which enter the water sources from different sources separately or with other pollutants. Therefore comprehensive and systematic planning for annual monitoring of water resources is necessary to control them and reduce the adverse effects of these pollutants on human and environment [7, 8].

Today due to the lack of inherent soil fertility and the tendency of farmers to increase the utilization of phosphate and potassium fertilizers to increase the efficiency of harvests, the concentration of heavy metals in the soil such as Cd, Cu, and Hg increase [6, 9, 10, and 11]. There are lots of concerns in industrialized countries because there are heavy metals in slimes of urban sewages and they are used as fertilizers [2]. Staving off the municipal and industrial wastes, vehicle fumes, the mining activities, the mineral extraction operations, improper agriculture methods are some effective factors in accumulation of heavy metals in soils [7, 12].

The heavy metals have bidirectional role in body and physical activities, so some of the heavy elements have a nutritional and actuator role for some of the enzymes and oppositely some of these metals disorder the body's metabolism operations. These metals are condensed by the food chain, and they will be a significant threat for human by accumulating in human body and the upper organisms of food chain [7, 8, 9 and 13].

Kermanshah city is the capital of Kermanshah province and is located in the 34 degrees and 19 minutes of the northern latitude ad 47 degrees and 7 minutes of the northern longitude to the Greenwich meridian and also it is located in the middle of the western side of Iran. The average annual rate of rainfall in this city is 444.7 mm. These favorable conditions for soil and climate improve agriculture in this region, and therefore the result will be the indiscriminate use of agriculture fertilizers and unrefined sewages on farm lands. Since the drinking water sources scattered throughout the city and suburbs (the farm lands in DehPahn and MianDarband), the probability of pervading heavy metals into these sources increases. Therefore according to these specific conditions, the drinking water sources and reservoirs in Kermanshah were sampled during a two-year period to determine the level of pollution caused by heavy metals.

METHODS

All of the sources and reservoirs of Kermanshah and its suburbs were sampled based on the principles of the Standard Methods book. The samples were collected in a polyethylene flask that was washed respectively with twice distilled aquapura, one molar nitric acid and again with twice distilled aquapura. Three samples were chosen from each source. The samples were stabilized according to the type of metals and standard procedures. All of the samples were kept at the temperature less than 4^{C} and they were tested in the shortest time (to reduce the physical changes of the samples). The atomic absorption spectrometry SpectrAA Varian Fs 220was used to determine the concentration of heavy metals in the samples. According to the manufacturer's instructions, the device was calibrated using standard solutions and then the concentration of real samples was determined.

RESULT AND DISCUSSION

Tables 1to 3 show the results of Ni, Pb, Fe, Cd and Cr in drinking water wells and storage tanks in Kermanshah. These metals have higher concentration among 17 studied metals. Comparing the results of concentration of heavy metals in tables 1 to 3 in this study with the standards of drinking water shows that the concentration of the studied metals in drinking water sources in Kermanshah are lower than the extent permitted which is specified by the World Health Organization and the National Standards Organization of Iran. Therefore according to the results, the sources and reservoirs of drinking water in Kermanshah don't have any problems in terms of heavy metals and they can be used safely. However the field studies show that the target geographical zone is not industrial and the drainages and sewages systems collect the runoffs and municipal sewages and then transfer them out of the city. So the risk of being heavy metals in water sources which are available in the city decreases. But there are lots of wells in rich farm lands of suburbs (like DehPahn and MianDarband) that are cultivated several times in a year. These wells are probably exposed to be contaminated by heavy metals and it is due to immethodical use of chemical fertilizers.

The results of this study and other studies which were conducted in different parts of Iran show that some provinces don't face with the risk of polluting drinking water by heavy metals and it has been proven in previous studies. Alighadr *et al* (2004-2005) show that the concentration of heavy metals in drinking water in Ardabil was lower than the standard level and it matches with current study [14]. Moslehiand Nahid (2007) expressed that the concentration of metallic elements such as Cu, Zn, Cd, Ni and Cr were lower than the standard level in different areas of Tehran [15]. Hadizadeh *et al* (2007) examined the doses of heavy metals in available water sources in the upper Triassic slate – fylti that is located in west of Mashhad (TorghabehShandiz). They realized that the concentrationof these metals are lower than the authorized levels in Standards of the World Health Organization (16). Shahriari *et al* realized that in Birjand the average dose of Cr in the studied sources (sources of drinking water and drainages) was respectively 0.09146 and 0.05146 mg/L. But sometimes the concentrations that are higher than the

standard level have also been reported: It was declared that the studied samples of drinking water sources in the city don't have a desirable dose of Cr which is because of geographical problems. But the dose of Cu in the samples of water sources and drainages doesn't make any problems [17]. Hassanzade *et al* evaluate the groundwater in Kerman and stated that the maximum concentration of tested heavy metals such as Cd (12 µg/L), Cr (280 µg/L), Cu (150 µg/L), Mn (132 µg/L), Pb (120 µg/L) and Zn (173 µg/L) were higher than the maximum level of the World Health Organization. Lack of correlation between the concentration of heavy metals such as Cu, Zn, Cr and partly Pb with the studied major ions (nitrate, Ca, etc.) indicates that these metals enter groundwater by anthropogenic pollutions [18].
Abedini*et al* study the sources of drinking water in Bardaskan city in Khorasan (aqueducts, wells, etc.) and indicate that the maximum concentration of metals like Cr, Cd, Cu, Zn and Fe are respectively 0.04, 0.012, 0.099, 0.107 and 0.509 mg/L, and according to the standards, the concentration of studied metals in groundwater sources are less than the critical level (19). In 2009Mirazadeh *et al* studied the drainages of Kashan. They expressed that the average concentration of metals are Cr (3.66), Cu (76.5), Zn (167.7), Pb (2.87), Ag (1.37), Co (3.74), Ni (5.1) and Cd (0.45) µg/Land they were not higher than the national and international standards and they don't make any risk for consumers [20]. In 1992Karimpour and Shariat studied the sources of drinking water in Hamadan (Ekbatan dam and 20 wells in Dasht e Bahar), they showed that the doses of Pb, Cd and Cr were respectively 0.514, 0.118 and 0.107 mg/L and they were higher than the standard level [21]. Some researches, findings and other studies of other researchers about different parts of the country were conducted on different environments such as groundwater, surface water, bottled water, dams, mineral springs, rivers, lagoons, farm lands, soil, mud and dust. It has been shown that in some parts of the country, the doses of some heavy metals are higher than the standard level and it is because of using chemical fertilizers and pesticides to increase the farmland products and transferring pollutants of unprincipled staving off the industrial sewages and insanitary staving off the domestic sewages.

Table 1: The concentration of heavy metals in drinking water storage reservoirs in Kermanshah city in 2009 and 2010

Heavy metals	**Fe**		**Cr**		**Pb**		**Ni**		**Cd**	
reservoirs	**89**	**90**	**89**	**90**	**89**	**90**	**89**	**90**	**89**	**90**
standard	**300**		**50**		**10**		**70**		**30**	
Republic	125.77	127.57	3.5	2.47	4.62	5.41	2.69	1.42	0.38	0.29
OlfatiNia	36.78	48.69	2.91	4.22	4.16	6.79	3.63	3.19	0.28	0.49
ZamZam	51.01	31.48	3.32	11.88	3.54	5.72	5.93	4.45	0.26	0.23
Ferdousi	14.96	25.59	4.03	4.09	4.36	5.27	3.44	3.48	0.24	0.16
Chaman	27.12	61.23	8.05	7.92	3.47	3.13	2.58	2.33	0.28	0.21
kousar	58.36	36.7	3	4.45	3.76	3.94	3.2	3.79	0.19	0.62
Moalem (new)	37.3	8.2	7.9	9.91	1.08	4.43	4.24	1.32	0.53	0.21
Moalem (old)	25.77	158.77	6.14	10.57	1.4	8.55	4.13	3.28	0.38	0.25
Zafar	11.58	20.03	3.36	2.82	1.01	3.68	2.62	1.72	0.34	0.23
Zeynabiyeh	30.59	24.96	5.48	5.17	4.1	4.57	2.67	2.29	0.23	0.22
Mosalla	66.79	39.42	2.53	4.45	3.5	4.6	1.57	3.92	0.61	0.22

The concentration of metals are based on ppb.

Table 2: The concentration of heavy metals in drinking water wells in Kermanshah in 2009

Heavy metals	**Fe**	**Cr**	**Pb**	**Ni**	**Cd**
standard	**300**	**50**	**10**	**70**	**30**
Number 1 Boulevard	44.63	5.78	4.72	9.07	0.21
Number 2 Boulevard	24.45	3.63	4.05	5.43	0.19
Number 3 Boulevard	25.03	2.11	3.11	4.49	0.15
Number 4 Boulevard	31.92	4.2	3.69	7.97	0.17
Number 5 Boulevard	42.74	3.12	2	11.19	0.14
Number 6 Boulevard	32.94	2.82	4.38	13.44	0.21
Number 2 ZamZam	22.77	3.47	3.37	3.37	0.24
Number 11 ZamZam	27.66	4.43	2.93	24.73	0.22
Number 3 Dolat Abad	43.21	3.31	5.42	4.25	0.65
Nokan	41.02	9.08	4.24	3.46	0.51
The airport	9.51	4.64	3.78	2.56	0.32
Number 1 Moalem	33.31	5.01	1.48	6.88	0.93
Number 2 Moalem	22.72	10.56	0.99	4.32	0.59
Number 3 Moalem	25.15	9.98	1.18	4.58	0.4

Number 4 Moalem	10.99	8.22	1.27	5.33	0.73
Number 1 Karmandan	30.95	5.58	1.13	5.5	0.97
Number 2 Karmandan	11.26	4.81	1.09	3.48	1.06
Taavon	15.95	5.64	1.16	3.81	0.91
Parvaz	13.75	3.62	1.14	3.21	0.71

The modules of metals are based on ppb.

Table 3: The concentration of heavy metals in drinking water wells in Kermanshah in 1390

Heavy metals	**Fe**	**Cr**	**Pb**	**Ni**	**Cd**
standard	**300**	**50**	**10**	**70**	**30**
Highway Number 1	22.14	5.69	7.99	5.57	0.52
Highway Number 2	25.59	3.03	5.47	5.32	0.64
Highway Number 3	15.77	5.42	5.35	4.48	0.62
Highway Number 4	22.56	9.59	3.44	3.06	0.55
Cheghamirza Phase 2	24.23	6.91	4.98	5.53	0.51
Elahiyeh	17.14	6.73	5.34	5.49	0.57
ChaleChale Number 2	213.71	1.9	3.97	6.89	0.33
Water Affairs	61.86	4.33	4.93	5.24	0.38
GhalehKohneh	56.13	8.92	4.13	5.29	0.33
Sajadiyeh Number 2	14.61	5.93	7.35	7.75	0.34
ZamZam Number 2	33.17	8.88	5.44	4.72	0.36
DehPahn Number 12	59.34	3.68	3.88	6.31	0.11
DehPahn Number 13	93.56	2.57	3.7	6.85	0.67
DehPahn Number 14	109.59	6.01	3.61	3.91	0.58
DehPahn Number 20	33.62	7.05	3.9	4.25	0.67
ZamZam Company	275.59	0.07	5.75	5.29	1.08

The concentration of metals is based on ppb.

CONCLUSION

According to the results of performed experiments about measuring the doses of 5 heavy metals, Ni, Pb, Cr, Fe and Cd in wells and water drainages, the concentration of heavy metals in this study are lower than the standards of drinking water that are specified by the World Health Organization and the National Standard Organization of Iran.

ACKNOWLEDGEMENTS

Hereby we appreciate the Kermanshah Province Water and Wastewater Company and also the Kermanshah University of medical science that helped us a lot.

REFERENCES

1. Urban Water Supply. Monzavi, Mohammad Taghi. (1993).Tehran University publication.
2. Zouli, Mohammad Ali. Bazrafshan, Edris.. (1998).Comprehensive text book of water and wastewater technology.
3. Almasi, Ali. (1990). Public Health. Chapter 4. Second part. Samat publication
4. Lee, SH .Levy, DA. Craun, GF. Beach. Mj. Calderon, Rl" surveillance for waterborne disease outbreaks - united states, 1999-2000"
5. Shariat Panahi, Mohammad. (1995). The principles of quality and refining water and wastewater. Tehran University publication.
6. T.H.Y. T Boot. 2001.Translation: Daneshvar, Nezamoddin. The principles of controlling the quality of water. Tabriz University publication, fifth edition, p 81.
7. Environmental Engineering. Volume 1. Water and Wastewater. Translation: Torkian, Ayoub. Kankash publication. 1374.
8. The quality of drinking water. Oodi, Ghasem. Mihaghegh publication. 1373.
9. Environmental health engineering in tropics. Translation: mahvi, Amir Hossein. Isalou, Mansour. Jahaddaneshgahi of Tehran publication.
10. Pacheco J, Marin L, Cabrera A, SteinichB,Escolero O. (2001).Nitrate temporal and spatial patterns in 12 water-supply wells, Yucatan,Mexico. Environ Geol. 40(6): 708-715
11. Jiao Y, Grant CA, Bailey LD. (2004).Effects of phosphorus and zinc fertilizer on cadmium uptake and distribution in lax and durum wheat. J Sci Food Agr; 84(8): 777-785.
12. Atafar Z, Mesdaghinia A, Nouri J, Homaee M, Yunesian M, Ahmadimoghaddam M, teal. (2010).Effect of fertilizer application on soil heavy metal concentration. Environ Monit Assess ; 160(1): 83-89.

13. WHO guidline values for drinking water quality 2ed Geneva: 1993.
14. Alighadr, Morteza. Hazrati, Sadegh. Ghanbari, Mohsen. (1996). "Measuring the concentration of heavy metals in drinking water sources of Ardabil in 1384 -1385". The tenth national conference of environmental health, Hamadan. 8th to 10th of Aban..
15. Nahid, Parvin. Moslehi Moslehabadi, Parivash. (1997)."Examining and analyzing heavy metals in the areas of drinking water and the methods for removing these metals". Food science and technology journal. Vol 5. 78-90.
16. HadizadeKhader, Hossein. Jafarzade, Fatemeh. Bakhshi, Abdoulah. Amel Besharati, Jafar. (1994). Evaluating the quality of groundwater in phyllites in west of Mashhad to measure the hydro geochemical parameters and the doses of heavy metals in them". Fifteenth conference of the geological society of Iran. Tarbiat Moalem University..
17. Shahriari, Taher. Moasheri, Bibinarges. Khodadadi, Maryam. Azizi, Mohammad. (2000)."Examining the doses of heavy metals including Cr ad Cu in drinking water sources and drainages in Birjand". The journal of Medical Science in Birjand University. Vol 18. Num 1. 34-38.
18. Hassanzadeh, Reza, Abbasnejad, Ahmad. Hamzeh, Mohammad Ali. (1999). "Evaluating the pollution of ground waters around Kerman". Journal of ecology. 36th year.
19. Abedini, Ali. Khodaparast, SeyedJojat. Babaee, Hadi. Abedini, Hamed. (2001). "Determining the concentration of heavy metals in ground water of Bardaskan, Khorasan". Forth conference on engineering geology and the environment of Iran. TarbiatModaress University.
20. Miranzade, Mohammad Bagher. Mahmoudizade, Abbas Ali. Hassanzade, Mojtaba. Bigdeli, Mahmoud. (2000). Evaluating the concentration of heavy metals in the drainages of Kasha in 1389". The journal of Health and Hygiene. Vol II. Num 3. Pp 58 – 68.
21. Karimpour, Moslem. Shariat, Mahmoud.(1999). Evaluating the doses of heavy metals in drainages of Hamadan". The scientific journal of Hamadan medical science university. 7th year. Num 2.78-89

CITE THIS ARTICLE

S A Mousavi , M Faraji, A Sadeghi. Studying the Concentration of Heavy Metals in Drinking Water Sources and Reservoirs of Kermanshah. Res. J. Chem. Env. Sci. Vol 4 [2] April 2016. 60-64