ASSESSMENT OF LEAD (PB) LEVEL IN WATER FROM WATERSHED OF THE KOWSAR DAM

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Abstract- Natural water quality varies markedly and is affected by the geology, biology, and hydro climatic characteristics of an area. The availability of water and its physical, chemical, and biological composition affect the ability of aquatic environments to sustain healthy ecosystems: as water quality and quantity are eroded, organisms suffer and ecosystem services may be lost The Kowsar dam supply water for different usages such as drinking, industrial, agricultural and aquaculture farms usages and located next to the city of Dehdashat in Kohgiluye and Boyerahmad province in southern Iran. There are some towns and villages on the Kowsar dam watersheds, which Dehdasht and Choram are the most important and populated cities in this area. The study was undertaken to assess the status of water quality in the urban areas of the Kowsar dam. A total of 28 water samples were collected from 6 stations on surface water and 1 station from groundwater on the watershed of the Kowsar dam. All the samples were analyzed for Pb concentration using standard procedures. The results were compared with other national and international standards. Among the analyzed samples, as the maximum value of lead (0.04 mg/L) was observed on the station 1 at the spring 2010, all the samples analyzed were within the maximum admissible limits by the United States Environmental Protection Agency, EU, WHO, Iranian and the Indian standards. In general results of the present study have shown that a Pb mean value of station No. 1 with 0.016 mg/L is higher than the other stations. Pb level of all samples and stations are far from drinking water standards and this is an indication of pollution potential and hazards because of human activity and waste water of towns in the areas, which can effect on human health implications in future. This research, therefore, recommends the government and other responsible authorities to take suitable improving measures in the Kowsar dam watersheds.

Keywords- Kowsar Dam, Drinking Water Quality, Lead, Maximum Admissible Limit, World Health Organization,

I. INTRODUCTION

We know less than 0.007 percent of all water on Earth is available to drink and less than 1 percent of all fresh water is readily accessible for human use. So pollution control and protection of water resources systems are necessary and water quality has an important role on the human health and aquatic ecosystems. As we need development for better living, and some of development plant have some disadvantages on environment and water systems, the development plant have to sustainable for decreasing the human activity on water pollution. Of the 6 billion people on earth, more than one billion lack accesses to safe drinking water and, about 2.5 billion do not have access to adequate sanitation services (TWAS, 2002) [1]. In addition to these shortcomings, various types of waterborne diseases kill on an average more than 6 million children each year i.e. about 20,000 children a day [1]. Besides the shortage, drinking water may be contaminated by different contaminants which have an impact on the health and economic status of the consumers [2]. Contaminants such as bacteria, viruses, heavy metals, nitrates and salt have found their way into water supplies due to inadequate treatment and disposal of waste (human and livestock), industrial discharges, and over-use of limited water resources [3]. Even if no sources of anthropogenic contamination exist, natural sources are also equally potential to contribute higher levels of metals and other chemicals that can harm human health. This is highlighted recently where natural levels of lead in groundwater were found to be causing harmful effects on the population.

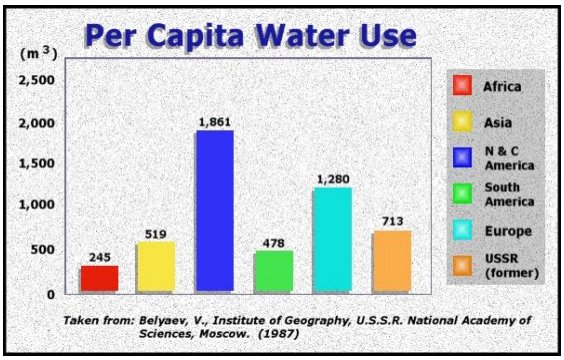

Fig 1. Water availability in different region of the world [1].

Heavy metals are very toxic to humans and other organisms. Their distribution in the environment is often used as an indicator of overall human impacts to the environment. It is important to sample for these chemicals in aquifers where they may occur at high concentrations, since their drinking standards are very low and there are a variety of anthropogenic sources. Lead is the most significant of all the heavy metals because it is both very toxic and very common. It gets into water from the corrosion of plumbing materials, where lead has been used freely

since Roman times. In addition, lead can be found in the solder used to join copper pipes, and in fittings and faucets made from brass [10].

Lead is used principally in the production of lead-acid batteries, solder and alloys. The organolead compounds tetraethyl and tetramethyl lead have also been used extensively as antiknock and lubricating agents in petrol, although their use for these purposes in many countries has largely been phased out. Owing to the decreasing use of lead- containing additives in petrol and of lead-containing solder in the food processing industry, concentrations in air and food are declining; in most countries, lead levels in blood are also declining unless there are specific sources, such as dust from leaded paint or household recycling of lead-containing materials. Lead is rarely present in tap water as a result of its dissolution from natural sources; rather, its presence is primarily from corrosive water effects on household plumbing systems containing lead in pipes, solder, fittings or the service connections to homes. The amount of lead dissolved from the plumbing system depends on several factors, including pH, temperature, water hardness and standing time of the water, with soft, acidic water being the most plumb solvent. Free chlorine residuals in drinking-water tend to form more insoluble lead-containing sediments, whereas chloramines residuals may form more soluble sediments in lead pipe [14]. Concentrations of lead in rocks are approximately 5.0 mg/kg (parts per million). This chemical is not very soluble and natural concentrations in ground water will be less than 0.5 mg/L (parts per billion).Lead has many anthropogenic sources and it was once commonly used in automobile fuels, paint and plumbing. Although these uses have decreased, lead is still used in batteries and alloys, and it is found in wastes and in fossil fuel combustion products. Health-based drinking water criteria have not been established for lead. No level of lead is considered safe in drinking water; although an action level of 15 mg/L at the tap can be used to identify highly impacted water. An additional concern with these chemicals, particularly mercury and lead, is that they accumulate in the environment. Consequently, there is food chain. Surficial aquifers have been impacted by anthropogenic sources of lead. Lead is persistent in environment and these impacts will probable continue for some time. It is unclear whether these anthropogenic inputs represent a health concern to humans [4].

II. MATERIALS AND METHODS

The main goal of this paper is to determine the levels/concentration of the Pb as a heavy metal in water in different parts of the Kowsar dams watershed to compare the values with the national and international organization (like WHO) recommended drinking water standards (Table.1). The dam will supply water to the Persian Gulf littoral cities and ports for nearly 20 years. It will offer water to 2.4 million habitants in south of Iran. Kowsar Dam will flow 70 million cubic meters of water to farmlands in Lishter, Boneh and Zeidoun deserts. The dam can hold 684 million cubic meters of water per annum. In order to evaluation of water quality of the Kowsar dam water sampling were done with seasonally duration on the Kowsar dam reservoir and its watersheds as have been shown in figure no.3. A total of 28 water samples were collected from 6 stations on surface water and 1 station from groundwater on the watershed of the Kowsar dam (Table 2). A standard method was used for sampling. Water was collected in polyethylene bottles 0.5 m below the surface. All glass and plastic ware used for sampling and analyses were rinsed with milli-Q water. Lead has been determined by atomic absorption spectroscopy using either direct aspiration into a flame or a furnace spectrometric technique. The detection limit is 5 µg/litre with the flame method and 0.1 µg/litre with the furnace procedure [11,12,13,14].



Fig. 2. Location of the study area

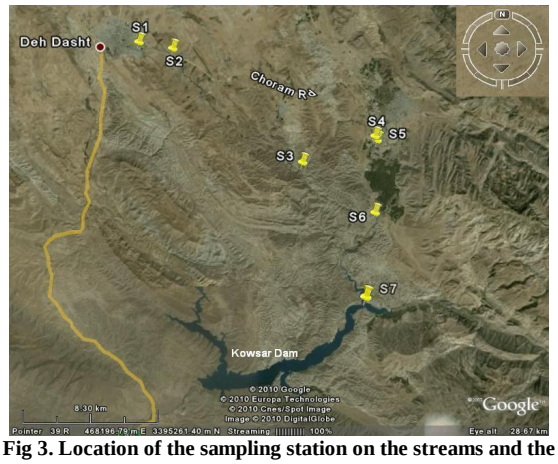

Fig 3. Location of the sampling station on the streams and the Kowsar damreservoir (Google map 2011).

Table I. Drinking water contaminants and maximum admissible limit set by different national and international organization.

Standards	Pb
	mg/L
USEPA 2008	0
EU,1998	0.01
WHO,2008	0.01
Iranian,1997	0.01
Indian,2005	0.1

Table I1. Information about the sampling stations

No.	Stations	UTM. X	UTM. Y	elevation
S1	Dehdasht	459458	3406145	1631
S2	Dezhkam well	461525	3405728	1630
S3	Barm- Morghabi	469329	3398564	1534
S4	Toughar river	473853	3400147	1524
S5	Kam-Lisho river	473962	3399945	1524
S6	seyd-Abad	473899	3395254	1489
S7	Kousar Dam	473794	3389578	1454

The situation of stations No. 1, 2 and 4 in the watershed of the Kowsar dam was showed in figures 4 to 6.



Fig 4. Station 1 is located on the main waste water collection canal in Dehdasht.



Fig 5. Location of station 2 (a groundwater well)



Fig 6. Station 4 is located on the upstream of Kowsar dam basin next to Choram.

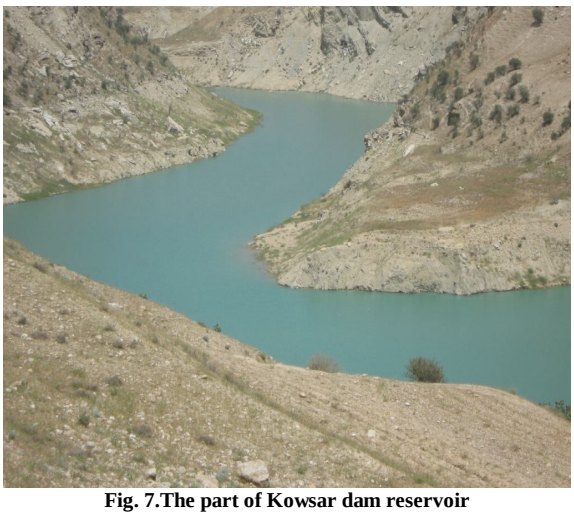

Fig. 7.The part of Kowsar dam reservoir

III. RESULTS AND DISCUSSION

First statistical parameters of values such as mean, maximum, minimum, standard deviation, skewness, Kurtosis, were determined. The values of Lead concentration and their statistical parameters of the water samples are illustrated in Table 2.

Based on measured value of all stations an seasons, maximum lead concentration (0.046 mg/L) was recorded in station 1 which is located on the main waste water collecting canal of Dehdasht at spring 2010 ,and station 5 has had minimum value (0.0004 mg/L) at summer 2010. Comparisons of mean values were illustrated in figure 8. As this chart shows, mean values of Lead concentration during 4 seasons in station 1 has had higher level related to other stations. Station 1 is located on the main waste water collecting canal of Dehdasht. Lead level in station 1 was increase because of rising in human activity near the mentioned station, agricultural activity around the Dehdasht city and Dehdasht industrial zoon where located near this station.

Table II. Lead Concentration in stations of study area.

Season	Pb (mg/L) in Stations						
	1	2	3	4	5	6	7
Winter2009	0.00621	0.01574	0.01475	0.00503	0.01915	0.00942	0.00329
Spring 2010	0.04666	0.01574	0.01574	0.0203	0.00203	0.01619	0.01352
Sumer 2010	0.00187	0.00178	0.00062	0.00054	0.0004	0.00045	0.00118
Autumn 2010	0.00985	0.002339	0.00119	0.001671	0.002217	0.00055	0.004478
MAX	0.0467	0.0157	0.0157	0.0203	0.0192	0.0162	0.0135
MIN	0.0019	0.0018	0.0006	0.0005	0.0004	0.0005	0.0012
AVR	0.0161	0.0089	0.0081	0.0069	0.0059	0.0067	0.0056
STD	0.0206	0.0079	0.0083	0.0091	0.0088	0.0076	0.0054
Skew	1.8501	-0.0043	0.0082	1.7529	1.9479	0.6364	1.6219
Kurt	3.5180	-5.9750	-5.9054	3.0703	3.8414	-2.4447	2.9125

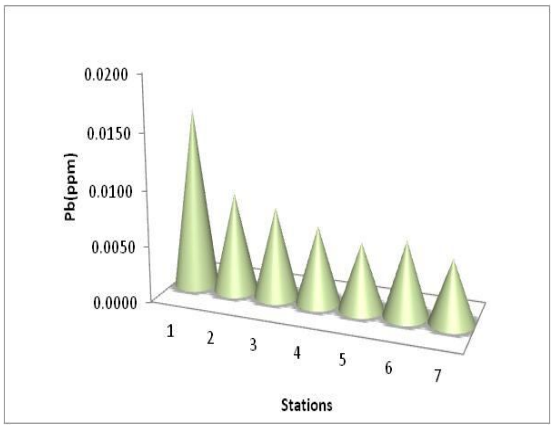

Fig. 8. Mean value of Lead levels on all Stations (mg/L)



Fig 9. Pollution in station 1, from Dehdasht city

CONCLUSION

The study was done to evaluate the status of Lead concentration in the upstream watershed of the Kowsar dam. A total of 28 water samples were collected from 6 stations on surface water and 1 station from groundwater on the watershed of the Kowsar dam. The results were compared with other national and international standards. Among the analyzed samples, as the maximum value of lead (0.04 mg/L) was observed on the station 1 at the spring 2010, the samples analyzed were not within the maximum admissible limits by the United States Environmental Protection Agency 2008(0 mg/L) ,the EU 1998(0.01 mg/L) ,the WHO 2008(0.01 mg/L) and the Iranian,1996 (0.01 mg/L). In general results of this present research have shown that a Pb mean value of station No. 1 with 0.016 mg/L is higher than the other stations. Pb level of all samples and stations are higher than all international acceptable standards expect Indian standards and this is an indication of pollution and hazards because of human activity and waste water of towns in the areas (fig 9), which can effect on human health implications in future. Subsequently, the concentration of lead in study area is far from the drinking water and it's not suitable for domestic purposes. This research, therefore, recommends the government and other responsible authorities to take suitable improving measures in the Kowsar dam watersheds.

ACKNOWLEDGMENT

The authors wish to thank the research committee of Kohkiluye and Boyer Ahmad regional water authority, Islamic Azad University, North Tehranbranch, Fars Science and Resarch branch, and Marvdasht branch for funding this research. Further, we thank all whose names are not mentioned here for their valuable contribution to the success of this research.

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