ARSENIC CONCENTRATION IN RIVER TRIBUTARIES OF THE CHORAM-DEHDASHT AREA

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Abstract- 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 As concentration using standard procedures. The results were compared with other national and international standards. Among the analyzed samples, as the maximum value of Arsenic 0.005 (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 , Japan , Canada and Iranian, standards. In general results of the present study have shown that As mean

Keywords- Kowsar Dam, Drinking Water Quality, Arsenic, 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.

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 in Bangladesh where natural levels of arsenic in groundwater were found to be causing harmful effects on the population [4]. Every metal are inorganic elements essential for plant growth in traces or very minute quantities. They are toxic and poisonous in relatively higher concentrations.

Two factors contribute to the deleterious effects of heavy metals as environmental pollutants. Firstly, they cannot be destroyed through biological degradation as in the case of most organic pollutants. Secondly, they are easily assimilated and can be bioaccumulated in the protoplasm of aquatic organisms [5]. Well known examples of heavy metals include: Iron, Lead and Copper. Others include: Arsenic, Mercury, Cadmium, Chromium, Arsenic, Zinc, Cobalt and Vanadium [6]. Water contamination occurs when man-made products such as gasoline, oil, road salts and chemicals get into the water and cause it to become unsafe and unfit for human use.

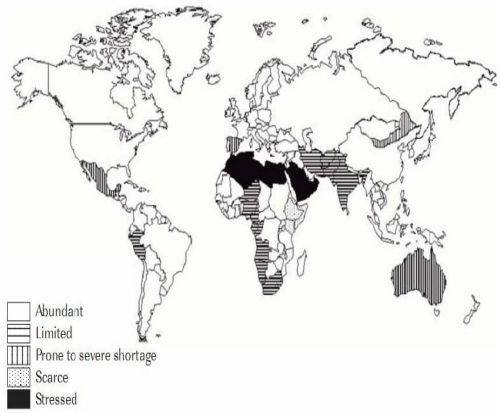


Fig. 1 Water availability in different region of the world [1].

Arsenic occurs naturally in the environment as an element of the earth's crust. Arsenic is combined with other elements such as oxygen, chlorine, and sulfur to form inorganic arsenic compounds. Exposure to higher-than-average levels of arsenic occurs mainly in workplaces, near or in hazardous waste sites, and areas with high levels naturally occurring in soil, rocks, and water. Exposure to high levels of arsenic can cause death. Exposure to arsenic at low levels for extended periods of time can cause a discoloration of the skin and the appearance of small corns or warts. Arsenic exposures are addressed in specific standards for the general industry, shipyard employment, and the construction industry [7].

Arsenic is a trace element of particular interest from the perspective of water quality assessment. Arsenic occurs in nature: primarily, it is present in rocks, soils, and waters. In turn, nearby biota are exposed to arsenic, and certain arsenic compounds tend to accumulate in plant and animal tissue. The introduction of arsenic into water, soil and biologic media results from both geologic and anthropogenic sources. Geologically, this trace element is found in the Earth's crust and is incorporated into streams through the processes of weathering, erosion, and deposition. Human activities such as mining and smelting, industrial processes, wood preservation, and agricultural practices can expose the environment to arsenic as well. Arsenic is a known carcinogen. Lung, skin, and liver cancer can result from inhalation and ingestion of arsenic. The metal has been shown to be detrimental to the human vascular system and is associated with the development of diabetes. Fortunately, the Environmental Protection Agency's (EPA) Safe Drinking Water Act set standards for water-quality based on Maximum Contaminant Levels (MCLs). The EPA's Maximum Contaminant Level Goal (MCLG) for any known carcinogen, such as arsenic, is zero. However, the enforceable MCL for drinking water is 10 ppb, recently revised from the previous MCL of 50 ppb [8].

II. MATERIALS AND METHODS

The main goal of this paper is to determine the levels/concentration of the As 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 have been shown in figure 3. Information about sampling stations is shown in table 1.



Fig. 2 Location of the study area References

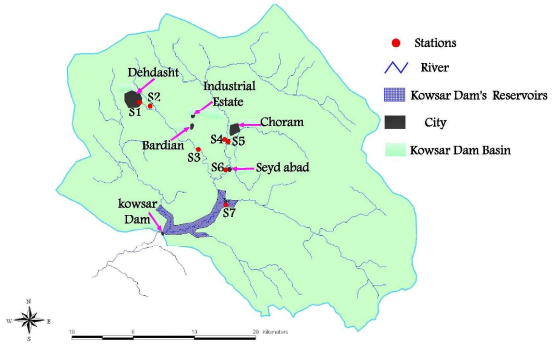


Fig. 3 Location of the sampling station on the streams and the Kowsar damreservoir (Google map 2011).

TABLE I
DRINKING WATER CONTAMINANTS AND MAXIMUM ADMISSIBLE LIMIT SET BY DIFFERENT NATIONAL AND INTERNATIONAL ORGANIZATION

Standards	As
	mg/L
USEPA 2008	0.05
EU,1998	0.05
WHO,2008	0.01
Canadian	0.025
Japan	0.01
Iranian,1997	0.05

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, seasonably. 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.

TABLE I I
INFORMATION ABOUT OF THE SAMPLING STATIONS

No.	Stations	UTM		elevation
		X	Y	
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.

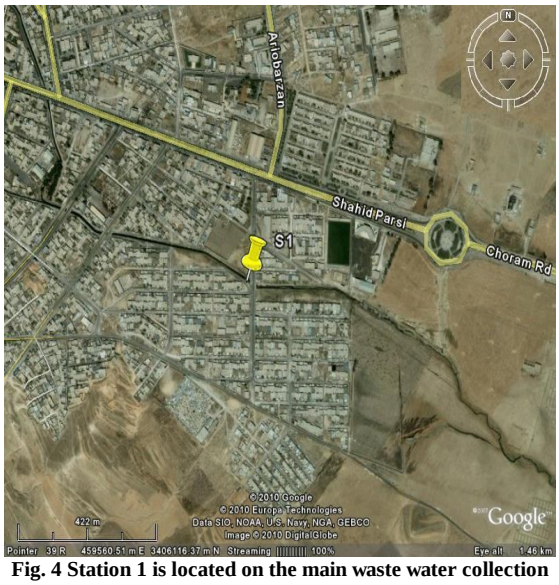


Fig. 4 Station 1 is located on the main waste water collection canal in Dehdasht.



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



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



Fig. 7 The part of Kowsar dam reservoir.

III. RESULTS AND DISASSSION

First statistical parameters of values such as mean maximum, minimum, standard deviation, skewness, Kurtosis, were determined. The values of Arsenic concentration and their statistical parameters of the water samples are illustrated in Table 2. Based on measured value of all stations an seasons, maximum Arsenic concentration (0.005 mg/L) was recorded in station 1 at spring 2010, and station 7 has had minimum value (0.00012 mg/L) at spring 2010. Comparisons of mean values were illustrated in figure 8. As this chart shows, mean values of Arsenic 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. Arsenic level in station 1 was increase because of rising in human activity near the mentioned station.

TABLE I I I
ARSENIC CONCENTRATION IN STATIONS OF STUDY AREA

Season	As (mg/L) in Stations						
	1	2	3	4	5	6	7
Winter2009	0.0006	0.00036	0.00069	0.00097	0.00032	0.00035	0.0004
Spring 2010	0.00535	0.00185	0.00185	0.00043	0.00036	0.00025	0.00012
Summer 2010	0.00077	0.00071	0.0005	0.00046	0.00065	0.00065	0.00098
Autumn 2010	0.00089	0.00065	0.00198	0.00098	0.0004	0.00035	0.00015
MAX	0.00535	0.00185	0.00198	0.00098	0.00065	0.00065	0.00098
MIN	0.00060	0.00036	0.00050	0.00043	0.00032	0.00025	0.00012
AVR	0.00190	0.00089	0.00126	0.00071	0.00043	0.00040	0.00041

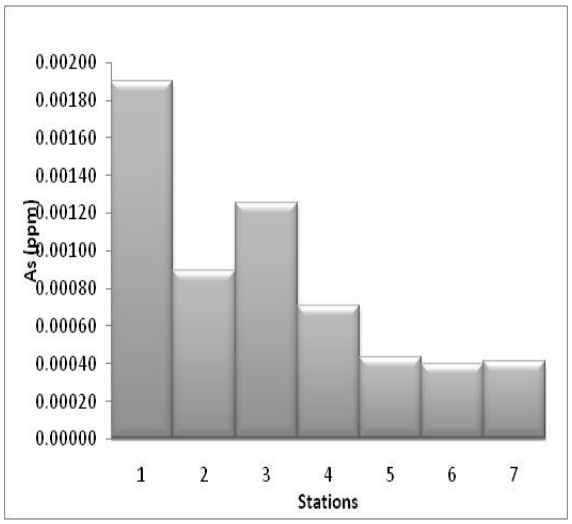


Fig. 8 Mean value of Hg levels on all Stations (mg/L)

CONCLUSION

The study was done to evaluate the status of Arsenic 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 Arsenic (0.005 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 2008(0.05 mg/L), the EU 1998(0.05 mg/L), the WHO 2008(0.01 mg/L) Japan (0.01 mg/L), Canadian (0.025) and the Iranian,1996 (0.05 mg/L).

In general results of this present research have shown that a As mean value of station No. 1 with 0.005 mg/L is higher than the other stations.

Although As level of all samples and stations have had normal values currently but 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.

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