Assessment of Nickel Concentration in Surface and Ground Water of the Kowsar Dam Basin

Fardin Boustani, M Hojati , S Ebrahimzadeh

***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 Ni concentration using standard procedures. The results were compared with other national and international standards. Among the analyzed samples, as the maximum value of Nickel (0.01 mg/L) was observed on the station 2 at the autumn 2010, all the samples analyzed were within the maximum admissible limits by the United States Environmental Protection Agency, EU, WHO and the Iranian. In general results of the present study have shown that a Ni mean value of station No. 2 with 0.006 mg/L is higher than the other stations. Ni level of all samples and stations have had normal values 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, Nickel, Maximum admissible limit, World health organization

I. INTRODUCTION

HEAVY metals 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 [1,2].. Well known examples of heavy metals include: Iron, Lead and Copper. Others include: Arsenic, Mercury, Cadmium, Chromium, Nickel, Zinc, Cobalt and Vanadium [1,3,4].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.

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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[5].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[5]. Besides the shortage, drinking water may be contaminated by different contaminants which have an impact on the health and economic status of the consumers [6]. 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 [7].Nickel is a metal of widespread distribution in the environment: there are almost 100 minerals of which it is an essential constituent and which have many industrial and commercial uses. Nickel and nickel compounds belong to the classic noxious agents encountered in industry but are also known to affect non-occupationally exposed individuals. The general population may be exposed to nickel in the air, water and food. Inhalation is an important route of occupational exposure to nickel in relation to health risks. Most nickel in the human body originates from drinking water and food; however, the gastrointestinal route is of lesser importance, due to its limited intestinal absorption. The toxicity and carcinogenicity of some nickel compounds (in the nasal cavity, larynx and lungs) in experimental animals, as well as in the occupationally exposed population, are well documented[8].

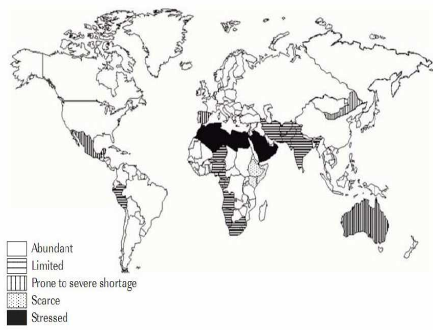

Fig. 1 Water availability in different region of the world [5]

II. MATERIALS AND METHODS

The main goal of this paper is to determine the levels/concentration of the Ni as a heavy metal in water in different parts of the Kowsar dams watershed (Table 1) to compare the values with the national and international organization (like WHO) recommended drinking water standards (Table.2) [9,10,11,12]. 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.7. 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 .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.

Fig. 2 Location of the study area

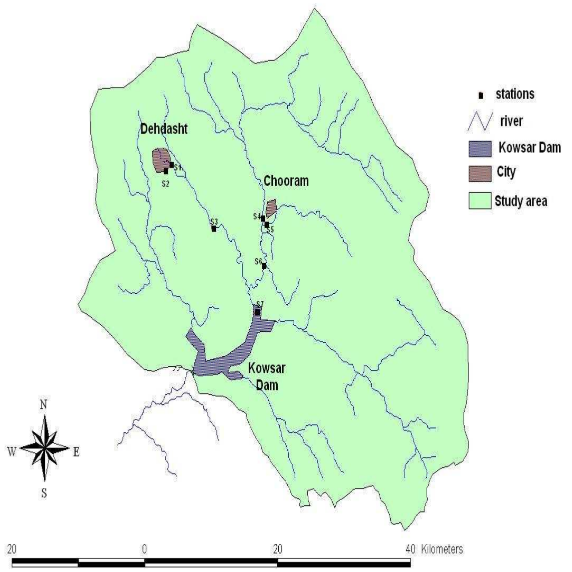

Fig. 3 Location of the sampling station on the streams and the Kowsar dam reservoir

TABLE I
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

Nickel has been determined by atomic absorption spectroscopy using either direct aspiration into a flame or a furnace spectrometric technique. The detection limit is 5 mg/liter with the flame method and 0.1 mg/liter with the furnace procedure [13]. The situation of stations No. 1, 2 and 4 in the watershed of the Kowsar dam was showed in figures 4 to 6.

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

Standards	Ni (mg/L)
USEPA 2008	0.02
EU,1998	0.02
WHO,2008	0.02
Iranian,1997	0.02

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 The oil pipe line is located on the upstream of Kowsadam basin next to Choram , station 4

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 and Kurtosis, were determined. The values of Nickel concentration and their statistical parameters of the water samples are illustrated in Table 3. Based on measured value of all stations an seasons ,maximum Nickel concentration(0.01 mg/L) was recorded in station 2 from a groundwater well near Dehdasht at autumn 2010 ,and station 6 has had minimum value (0.0002 mg/L) at autumn 2010. Comparisons of mean values were illustrated in figure 8. As this chart shows, mean values of Nickel concentration during 4 seasons in station 2 has had higher level related to other stations. Nickel level in station 2 was increase because of rising in human activity such as agricultural wastes and infiltration of waste water to the ground water aquifer and near the mentioned station.

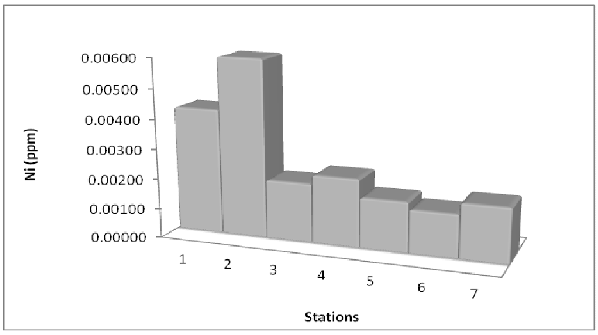

Fig. 8 Mean value of Nickel levels on all Stations (mg/L)

TABLE III
NICKEL CONCENTRATION IN STATIONS OF STUDY AREA

Season	Ni (µg/L) in Stations						
	1	2	3	4	5	6	7
Winter 2009	0.00105	0.00543	0.00204	0.00172	0.00140	0.00167	0.00115
Spring 2010	0.00191	0.00308	0.00308	0.00576	0.00223	0.00293	0.00205
Summer 2010	0.00470	0.00417	0.00158	0.00125	0.00086	0.00089	0.00176
Autumn 2010	0.00917	0.01118	0.00116	0.00035	0.00220	0.00025	0.00230
MAX	0.00917	0.01118	0.00308	0.00576	0.00223	0.00293	0.00230
MIN	0.00105	0.00308	0.00116	0.00035	0.00086	0.00025	0.00115
AVR	0.00421	0.00597	0.00197	0.00227	0.00167	0.00144	0.00181

IV. Conclusion

The study was done to evaluate the status of Nickel 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 Nickel (0.01 mg/L) was observed on the station 2 at the autumn 2010, all the samples analyzed were within the maximum admissible limits by the United States Environmental Protection Agency 2008(0.02 mg/L) ,the EU 1998(0.02 mg/L) ,the WHO 2008(0.02 mg/L) and the Iranian,1996 (0.02 mg/L) . In general results of this present research have shown that a Ni mean value of station No. 2 with 0.01 mg/L is higher than the other stations. Although Ni 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 spatially agricultural land and waste water of towns in the areas(station 1) , which can effect on ground water and human health implications in future. Subsequently, the concentration of Nickel in ground water of study area is higher than the surface water and it can indicate with human and industrial activity such as oil pipe line which is located in this area. This research, therefore, recommends the government and other responsible authorities to take suitable improving measures in the Kowsar dam watersheds.

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