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Short Communication

Iron Contents in Ground Water of Maihar Region, Satna, India

Tripathi I.P.[1], Mishra S.N.[2], Pandey Shailesh[1] and Dwivedi Arvind Prasad[1]
[1]Dept. of Physical Sci., Faculty of Sci. and Enviro., Mahatma Gandhi Chitrakoot Gromodaya Vishwavidyalaya, Chitrakoot, Satna, MP, INDIA
[2]Atal Bhari Bajpei Hindi University, Bhopal, MP, INDIA

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Abstract

Historically, Maihar is an important place in the Central India. Millions of people from all over the country visit for Darshan of Goddess Sharda-Mata. This town is also an important place with well developed cement industries and a number of lime companies. In the present work we have carried out estimation of Iron contents of water samples collected from different parts of Maihar region. The concentration of Iron in water from hand pumps, bore wells and river water ranges between 0.01 to 1.0 mg/l. Water samples of hand pumps of Itchol School, Tighara, Palahpur, Geetnagar, Bhatanbara and bore well no.-3 having the higher concentration of Iron than the WHO permissible limit.

Keywords: Maihar, cement industries, lime companies, iron, permissible limit.

Introduction

Water is one of the indispensable natural resources on our environment. The fresh water present on the earth is only 2.8% out of the all the water on the earth and 20% of the fresh eater constitutes the ground water[1]. Iron is an essential element in human nutrition. It is a vital component of haemoglobin, myoglobin and some other enzyme system. Haemoglobin transport oxygen to the various tissue of the body[2]. Myoglobin stores some oxygen for immediate use by the cell[3]. The total iron content of the normal adult man is estimated to be 4-5gm Maximum part of iron in the body is present as haemoglobin[4]. The rest of iron in body is present as a reserved store in liver, kidney, spleen and other organs[5]. Daily requirements for an adult man and woman is 24 mg and 32 mg respectively[6].

Iron deficiency anaemia is one of the words leading health problem. Anaemia occurs most commonly in growing children, menstruating and pregnant and other suffering from parasitic disease such as hookworms and malaria[7]. In iron deficiency anaemia RBCs are Pale and small and oxygen carrying power of the blood is reduced due to low haemoglobin content (5-9 mg./ 100 ml blood).

Several types of disorders are known due to overload of iron in the body[8-9]. One of these disorders called siderosis describes the presence of excess of iron in the body. Another disorder, Haechromatosis, results from the prolonged consumption of acid food stuffs cooked in iron kitchen ware[10]. This disorder has been observed among Bantus in South Africa, who intake as high as 100 mg are more daily. Iron salts in large doses are very toxic. Ingestion of large quantities of iron tablets[11] within an hour causes nausia, vomiting and diarrhea. In severe cases this is followed by gastrointestinal bleeding and circulatory collapse, by liver necrosis which are often fatal[12].

The iron present in natural waters can be attributed to the dissolution of rocks and minerals, acid mine drainage, landfill leachates or iron related industries[13]. Iron occurs in ground water of places having shale, sand stone and other cocky geological formations. The concentration of iron in well aerated water is seldom high but under reducing conditions, which may exist in some ground water, lakes or reservoirs and in absence of sulphide and carbonate, high concentrations of soluble ferrous iron may be found.

The permissible/ excessive limit of iron as suggested by various agencies is given in table -1. Ministry of Health, Govt. of India has suggested the limit of iron 0.3 mg/l permissive and 1.0 mg/l excessive on the basis of aesthetic and taste considerations.

Table-1
Permissible Iron Limit for Drinking Water

Standards Agency	Limit	
	Permissive	Excessive
International Standard of Drinking Water	0.3	1.0
ICMR New Delhi 1975	0.1	1.0
European Standards for Drinking Water 1970	0.1	–
Indian Standard Specification for Drinking NEERI-IS 10500- 1983	0.3	1.0
WHO Guideline Value for Drinking Water 1984	0.3	-

There are two sources of iron for hand pump water. Firstly, iron may come through geological strata; secondly, it may come form corrosion of iron pipe used. The geological formation in

area of limestone type, having soluble iron (Fe^{3+}). In the under ground water resolurce and leaching of iron from rocks in the main cause for presence of iron in under ground water[14]. Generally, iron bearing water is capable of dissolving iron both form iron pipes and soil/ rocks rich in iron[15]. It is the fourth most abundant by mass in the earth crust in occurs mainly in the ferrousand ferric state.iron in surface and under ground water generally present in ferric state. It is an essential and non conservative trace element found in the significant concentration in drinking water because of its aboundence in the earths crust. Usually iron occurring in ground water in the form of ferric hydroxide, in concentration less than 0.5mg/l[16].

Maihar is an important place famous for its temple of Goddess Sharda, Sanad state in central India, under the political agent in Baghelkhand, with an area of about 407 square miles. It was bonded on the north by state of Nagod and the south by the Jabalpore, east by Nagod and Rewah and west by Ajaigarh. Maihar town was the capital of the state of the same Satna District of Rewa division in the state of Madhya Pradesh.

In the present work we have carried out estimation of iron content of the drinking water sources i.e. Tons river, hand pumps and bore wells, located several parts of Maihar region.

Material and Methods

Water samples were collected in three different seasons of the year and were analyzed for their iron content. Collection was done by Grab Sampling Method in polyethylene bottles. Samples were acidified and refrigerated. Iron analysis was done on Atomic Absorption Spectrophotometer by direct aspiration method. Operating parameters were chosen as below:

Element	Flame	Wave length (nm)	Slit width (nm)	Lamp current (mA)	Sensitivity (mg/l)
Fe	Oxidizing	348.3	0.2	30	0.10

The standards used in the present analysis were prepared as described in standard method[15.]

Results and Discussion

Water from River: The raw water for Maihar water collected from Tons river. The iron concentration varies from 0.1- 0.8 mg/l. The iron content of water is highest in rainy season and lowest in summer. Hasan and cow workers[17] have also observed high amount of iron during rainy season. Sengupta et al.[18] studied the Ganga river at West Bangal and reported that iron content is 0.1-1.0 mg/l. H. C. Katariya et al.[19] studied the trace element detaction of river parbati in narsingh garh area of Madhya Pradesh and reported that irin content is 0.08-1.33 mg/l. Nguyen and Bhargava[20] reported that the concentration of iron in Saigon river at Hochi Minch city of Vietnam is within permissible limit. Magarde et al.[21] carried out the assessment of water quality of Bhopal lake and reported that the iron content is 0.31 to 0.88 µg/l. Tale et al.[22] carried out evaluation of iron level from manar dam and reported that the iron content is 0.61 to 1.98 mg/l.

On the contrary various salts of iron are also sometimes used as coagulating agents. In that case treatment should result into increase of iron level. It is the finished water from the treatment plant that is actually used for human consumption.

Water from Hand Pumps: The concentration of iron content in hand pumps ranges from 0.01- 1.0 mg/l as shown in table- 2. The concentrations of iron in water of hand pump are within the excessive limit during all seasons. Phirke et al.[23] studied the quality of hand pump water in Delhi and found that concentration are within permissive limit 0.03- 1.3 mg/l. Pandey et al.[24] studied water quality of Nagpur and reported 0.0- 0.250 mg/l. Sunita et al.[25] studied water quality in and around patna town and reported 0.1-0.8 mg/l.25 Pandey et al.[26] studied the water quality of Rewa City and reported 0.16- 19.9 mg/l iron in ground water.

Table-2
Concentration of Iron mg/l in Hand Pumps of Maihar Region

S. N.	Location of Hand Pumps	Seasons		
		Rainy	Winter	Summer
1.	Itchol School	1.00	0.80	0.20
2.	Tighara	1.00	0.50	0.10
3.	Palahpur	0.85	0.70	0.20
4.	Naibasti	0.64	0.20	0.20
5.	Babupur	0.41	0.10	0.30
6.	Barkhura Naibasti	0.51	0.20	0.11
7.	Tiloura	0.95	0.60	0.45
8.	Geetnagar	0.84	0.50	0.23
9.	Barhiya	0.016	0.01	0.02
10.	Badanpur	0.018	0.10	0.02
11.	Sonwari	0.016	0.01	0.01
12.	Bedra	0.022	0.02	0.01
13.	Paundi	0.02	0.01	0.01
14.	Katiya	0.028	0.02	0.025
15.	Etama	0.036	0.02	0.022
16.	Amdra	0.03	0.02	0.01

Water from Bore Wells: The water collected from bore wells. The iron concentration ranges 0.10-0.27 mg/l during all seasons as shown in table-3. Some worker determined iron content of ground water (wells and bore wells) in and around Jaipur and found that iron concentration is below permissive level. Sharma et al.[27] studied the iron concentration in bore well water of district Koraput of Orissa and Bhandra of Maharashtra and found that water is corrosive in nature and capable of dissolving iron form soil strata as well as from pipes and reported concentration is as high as 32.4 mg/l and water is yellowish turbid. Pranab Sabhapndit et al.[28] studied the ground water and surface water in gheopur sub–division of sonitpur district,assam and reported the iron concentration of bore well water is 0.34-5.6 mg/l.28.

Table -3
Concentration of Iron mg/l in Bore Wells of Maihar Region

S N	Location of Bore Wells	SEASONS		
		Rainy	Winter	Summer
1.	1	0.20	0.10	0.10
2.	2	0.10	0.10	0.11
3.	3	0.50	0.20	0.30
4.	4	0.10	0.10	0.15
5.	5	0.20	0.15	0.10
6.	6	0.20	0.10	0.10
7.	7	0.27	0.20	0.10
8.	8	0.25	0.10	0.15
9.	9	0.25	0.15	0.15
10.	10	0.20	0.12	0.15

Conclusion

The concentration of Iron in water from hand pumps, bore-well and river water ranges between 0.01- 1.0 mg/l. Water samples of hand pumps of Itchol School (1.0), Tighara (1.0), Tiloura (0.95), Palahpur (0.85), Geetnagar (0.84), Bhatanwara (0.64) mg/l having the higher concentration of Iron than the permissible limit of WHO guide lines and Hand Pump of Itchol School and Tighara having the concentrations of Iron equivalent to excessive limit of WHO guide lines. In the water from Bore Wells No. 3, Iron concentration is above the WHO permissible limit and all the Bore Wells (1-10) iron concentration is above the permissible limit of ICMR New Delhi. However, it is below the permissible limit of WHO guide lines and NEERI standards, accept those of Bore Well No 3. It is obvious that this water must be treated for the removal of excessive amount of Iron before it is used for drinking purpose.

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