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ANALYSIS OF TRACE METAL STATUS IN GROUND WATER SAMPLES FROM RAHURI CITY

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ABSTRACT

The analysis of ground water samples from Rahuri City was carried out for their trace metal contamination. Bore well water from specific areas was collected and analysed to test the contamination by heavy metals like Cd, Cr, Pb, Cu, Ni and Zn. The results were compared with the standard values reported by WHO and ISI. The present study reveals that the water quality in some areas is so bad that it is not suitable for the drinking purpose, as the level of contamination is quite above the standard one.

KEYWORDS: **Ground water, Trace metals, Rahuri city, Analysis.**

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INTRODUCTION

Water is an indispensable natural resource on the earth. Two-third of the earth surface is covered by water. Water has extreme importance for survival of all living organisms. The water content in them is almost 70% of their body weight. Natural resources is the important wealth, water is one of them. Water is a wonder of the nature. *" No life without water "* is a common saying depending upon the fact that water is one of the naturally occurring important requirement of all life supporting activities[1] . Being an important constituent of many living as well as non living systems along with many organic, inorganic, soluble as well as insoluble substances, water is said to be a dynamic system. So its contents are likely to change day by day and from source to source. Any change in natural quality may affect the equilibrium and it would become useless for domestic purpose. The scarity of clean and potable drinking water is the most serious question of this century. From all available water on the earth only 1% is useful for drinking, agriculture, domestic power generation, industrial consummation, transportation and waste disposal.[2, 3, 4] In India, ground water is the major source of drinking water in both urban and rural area. Now a days it is being used by industrial as well as agricultural sector as a source of water. The quality of ground water changes with change in geological conditions of the particular area, compositions of dissolved salts depending upon source of salts, surface environment, depth of water and seasonal changes. The groundwater is considered to be comparatively much clean and free from pollution than the surface water. But the consequences of industrialization and urbanization lead to the spoiling of the water quality. It has been observed that the ground water gets contaminated due to domestic sewage, agricultural runoff, industrial effluents, and addition of various kinds of pollutants, increased human population and human activities. The use of contaminated water for drinking purpose creates health hazards due to some water borne diseases. Hence, it is up to people to provide concern over the protection and maintenance of groundwater quality.[6] Heavy metals are priority toxic pollutants that severely limit the beneficial use of water for domestic and industrial application[7]. The lakes have complex and fragile ecosystem, as they do not have self cleaning ability, pollutants accumulate readily in them[8]. Today most of the ground water gets contaminated by toxic heavy metals from the discharge of industrial wastewater and this is a worldwide environmental problem. Many industries, such as metal processing and refineries are the major sources of heavy metal emissions. Soluble heavy metals, such as copper, cadmium, lead, and chromium, are non-biodegradable and toxic even at trace levels. Heavy metals can accumulate in living organism and cause various health hazards[9-13]. Water quality data are very much important for the implementation of responsible water quality regulations for characterizing and remediating contamination and for the protection of health of human beings and the ecosystem. Therefore, it is very necessary that at regular interval of time the water quality should get checked as well as to find out the ground water pollution increasing sources. By considering the above aspects of groundwater contamination, the present study was carried out to analyse the impact of the groundwater quality of some bore well water samples of Rahuri city of Ahmednagar district. Thus, in present study an attempt has been made to check the status of the trace metals like, Cd, Cr, Pb, Cu, Ni and Zn in groundwater samples of Bore well. The studied data were compared with standard values reported by WHO[14]

METHODS AND MATERIALS

Rahuri city (Ahmednagar Distract) which is situated in the Maharashtra has its own importance because of natural resources of water around it. The wastewater of the city is being discharged into the nearby water resources. Similarly the geochemical and morphological structural changes due to weathering may also drained out some chemicals/minerals into surface and groundwater which inturn may affect the original characteristics of water that could be hazardous to human health for consumption[15-17]. The water from open well, tube well as well as municipal water is being used by the

peoples for their daily need. The literature survey reveals that no water quality management studies are made in this region so far. Hence the present study was planned and undertaken.

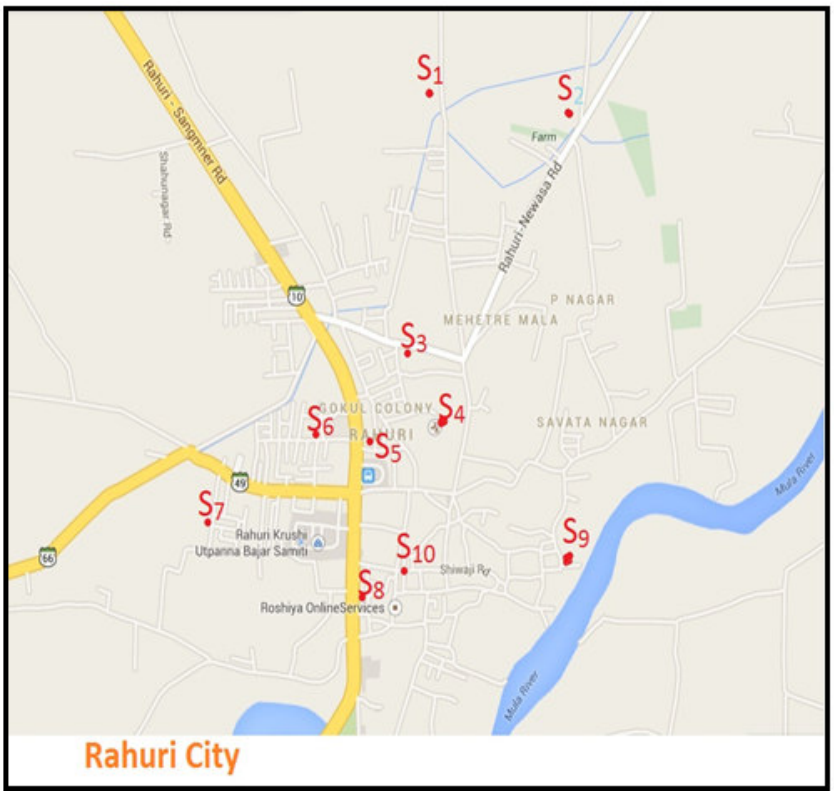


Figure 1
Map of Sampling locations of Rahuri City

Preparation of water samples

The bore well water samples were collected from ten different locations of Rahuri City (Table-1) on the basis of importance of the area. The samples were collected in plastic canes of five liters capacity without any air bubble. During sampling, special care was taken to avoid contamination for dissolved trace elements.

(i) Trace Elements analysis

All the water samples were analysed to estimate various trace elements such as Cd, Cr, Pb, Cu, Ni and Zn. The trace elements analysis was carried out by using standard methods[18-22]. For trace elements determination Atomic Absorption Spectrophotometer was used. The trace elements of the above mentioned sites of Rahuri city in ground water was calculated and described as below Water samples (50 ml) were digested with 10 ml of concentrated HNO_3 at 80 ºC till the solution turns transparent. These transparent solutions were then filtered through Whatman filter paper number 42 and diluted to 50 ml with distilled water. The concentrations of Cd, Cu, Pb, Zn, Ni and Cr in the filtrate were determined by using AAS (Atomic absorption Sperctrophotometer) method, fitted with a specific lamp of particular metal using appropriate drift blanks. All The reagents used for the analysis were AR grade and double distilled water was used for preparation of solutions.

Table 1
Sampling locations in Rahuri Cit

S. No.	Sample locations	source	Sample number
1	Pimplacha Mala	Bore Well	S_1
2	Datta Nagar	Bore Well	S_2
3	Khalwadi No. 1	Bore Well	S_3
4	Khalwadi No.2	Bore Well	S_4
5	Gokul Colony	Bore Well	S_5
6	Biroba Nagar	Bore Well	S_6
7	Karpe Estate	Bore Well	S_7
8	Balaji Temple	Bore Well	S_8
9	Ganpati Ghat	Bore Well	S_9
10	Kasar Lane	Bore Well	S_{10}

RESULTS AND DISCUSSION

The trace elements analysis of the above mention sites of Rahuri city for ground water can be described as bellow.

(i) Cadmium (Cd)
Cadmium mainly occurs in earth's crust. It enters the environment mainly through the ground surface. Cadmium is also present in manures and pesticides. Cadmium waste streams from the industries, mainly end up in soils. Due to waste combustion and burning of fossil fuels the Cadmium waste streams enters in the air. The Cadmium content in the study area was found in samples collected from S_1, S_6 and S_8 sites. Other samples are Cadmium free. Water sample S_8 has been found to have higher Cadmium contamination.

(ii) Chromium (Cr)
Through breathing, eating or drinking and through skin contact with chromium or chromium compounds people may get exposed to it. Chromium is found in many vegetables, fruits, meat, yeasts and grains in the form of Cr^{3+} (i.e. in ionic form). Diet is the main route for the intake of Chromium. Different ways of preparation of food and the way of storage of it may differ the chromium contents in the food. Chromium concentration rises when food is stored in steel tanks or cans. The Cr content in the study area was found only in the samples collected from site S_1. Remaining samples have zero Chromium concentration.

(iii)Lead (Pb)
Lead is known as a harmful environmental pollutant. It is one of the environmental threats that can directly affect health of children. It can cause damage to the brain of children. Humans are getting exposed to lead in many ways like through air, drinking water, food, contaminated soil. The lead contamination was found in water samples collected from S_6 and S_8 sites. The remaining samples were found to be lead free.

(iv) Copper (Cu)
Copper is one of the most used metals in the field of transportation, manufacturing, currency, power transmission and agriculture. Copper sources in water are extensive, and as far as natural level is concerned, copper originate from rocks weathering and atmospheric deposition. The Cu contamination in the study area was found in sample collected from site S_6. All other sites have no Cu contents.

(v) Nickel (Ni)
Although a number of cellular effects of nickel have been reported, a deficiency state in

humans has not been described yet. Nickel is nutritionally essential trace metal for least several animal species, micro-organisms and plants. Therefore either deficiency or toxicity symptoms can occur when too little or too much Ni is taken up. Nickel content is not observed in any sample under investigation.

(vi)Zinc (Zn)

Human waste which is flushed down the toilets is the largest single source of zinc from domestic activities, as it occurs naturally in many foods. The Zn contamination was found in samples collected from S_1, S_6 and S_{10} sites of the study area. Remaining samples are free from Zinc. All the analyzed data has been summarized in Table-2. Graph-1 shows graphical representation of trace metal contamination at different sampling sites in Rahuri City.

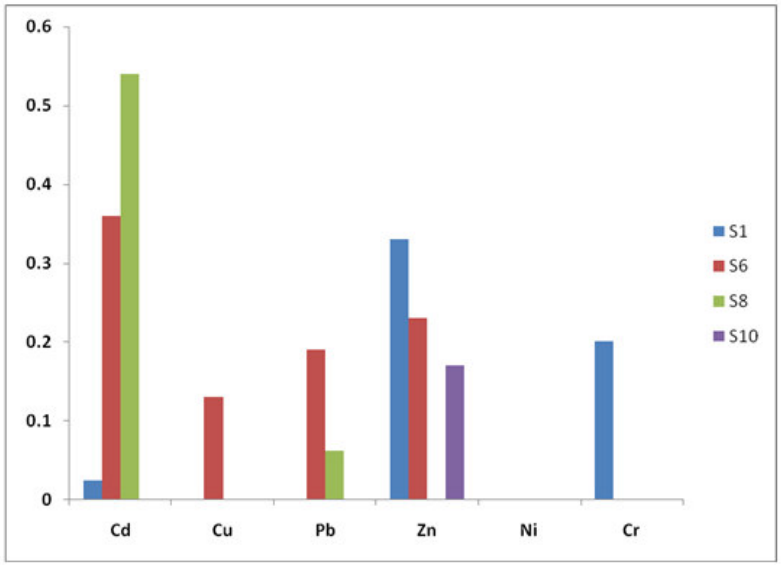
Table 2

Average results of the Trace elements of different sites from Rahuri city for Ground water

S. No.	Sampling points	Sample number	Trace elements in Rahuri City (Ground water) mg/L					
			Cd	Cu	Pb	Zn	Ni	Cr
1	Pimplacha Mala	S_1	0.023	-	-	0.330	-	0.20
2	Datta Nagar	S_2	-	-	-	-	-	-
3	Khalwadi No. 1	S_3	-	-	-	-	-	-
4	Khalwadi No. 2	S_4	-	-	-	-	-	-
5	Gokul Colony	S_5	-	-	-	-	-	-
6	Biroba Nagar	S_6	0.36	0.13	0.19	0.23	-	-
7	Karpe Estate	S_7	-	-	-	-	-	-
8	Balaji Temple	S_8	0.54	-	0.061	-	-	-
9	Ganpati Ghat	S_9	-	-	-	-	-	-
10	Kasar Lane	S_{10}	-	-	-	0.17	-	-

Graph 1

Graphical representation of Average values of the trace elements of different sites in Rahuri city



CONCLUSION

The collected water samples from Rahuri City shows some deviations in the results. The water samples collected from sites S_6 and S_8 show poor water quality as compared to other water samples. Thus the ground water from these sites is polluted and not suitable for drinking purpose. As the sampling site S_1 showed high Cu and Ni concentrations, there is need of some treatment for minimization of their concentrations. The water samples from sites S_2 and S_5 are free from trace elements content, hence the quality of ground water is good and it is fit for drinking purpose.

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