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Research Article

Study of Total Hardness Present in the Groundwater around Ambarnath Area

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Abstract: Ambarnath town in Thane district of Maharashtra having industrial zone around it. For the study purpose seven ground water samples around industrial area were selected and analyzed for Total Hardness parameter. Samples were collected from Jan.2013 to June 2013 and analyzed throughout 6 months for Total Hardness parameter. Total Hardness in study area was found between 154 to 256 to mg/l. Total Hardness at all sampling Stations were found below permissible limit of BIS. At sampling station S1 (Kansai Gaon Open well) and S2 (Kansai Hand pump) Total Hardness were found more than acceptable limit by BIS i.e. above 200 mg/l indicates nature of the geological properties of the area with which water have been in contact.

Keywords: Total Hardness, Industrial zone, permissible limit, geological properties.

INTRODUCTION

Water pollution is now becoming serious threat all over the world. Different parts of India get affected by surface water pollution as well as groundwater pollution. In case of surface water pollution effect immediately detected compared to groundwater pollution. Due to manmade activities, the quality of groundwater gets degraded day-by-day. It is necessary to know the quality of water before using it for any purpose.

Within the last 2-3 decades; demand for groundwater has increased continuously. Rapid growth of population, industrialization, high rate of urbanization and expansion of irrigation activities etc. increases groundwater problem all over India. In India, 56 % of metropolitan, class-I and class-II cities are dependent on groundwater either partially or fully [1, 2].

Hardness is one of the properties of water, which prevents the lather formation with soap and increases the boiling point of water. Calcium and magnesium cations mainly cause hardness [3].

Ambarnath area is industrially developed town having number of industries; therefore study had undertaken to find out the Total Hardness level in groundwater around Ambarnath industrial area. This area is surrounded by huge residential & slum area around it.

MATERIAL AND METHODS

For study purpose seven sites around Ambarnath industrial zone were selected. Water samples were collected monthly from selected sites during Jan. 2013 to June 2013. Following sites were selected for study purpose.

Table-1: Sampling Sites

Sr. No	Sampling Area	Station No.
01	Kansai Gaon (Ganesh chauk)Open Well	S1
02	Kansai Hand Pump	S2
03	Bhimnagar Area,Open Well	S3
04	Vadavli area (Sevice centre) Bore Well	S4
05	Bhendipada area Bore Well	S5
06	Samarth Service Centre Bore Well	S6
07	Satish Service Centre Bore Well	S7

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Samples were collected in clean glass bottles. The bottles were rinsed with the groundwater to be taken for analysis. Collected samples were analyzed using EDTA method for Total Hardness.

The EDTA method was used to measure the concentration of Calcium and Magnesium ions in water samples to determine their total hardness. This method is based on the principle that EDTA and its sodium salt forms a soluble complex when added in the solution of certain cations.

M^{2+} + EDTA → M-EDTA Complex

A small amount of Eriochrome Black-T indicator is added to an aqueous solution containing calcium and magnesium ions at pH -10.0. As a result, calcium and magnesium ions get complex and the solution becomes wine red. Since EDTA has strong affinity towards calcium and magnesium ions, on the addition of sufficient amount of the reagent, a new complex of blue color is formed at the end of titration.

50 ml sample was taken in conical flask. If sample was having higher calcium, a smaller volume was taken and diluted to 50 ml. 1 ml of buffer solution was added if the sample was having higher amount of heavy metals than 1 ml of Na_2S solution was added 100-200 mg of Eriochrome black-T indicator was added, the solution turned wine red. The contents were titrated against EDTA solution. At the endpoint, the color changed from wine red to blue [3].

Calculation

$$\text{Total Hardness as } CaCO_3\text{, mg/l.} = \frac{ml\,of\,EDTA\,used\,x\,1000}{ml\,of\,sample}$$

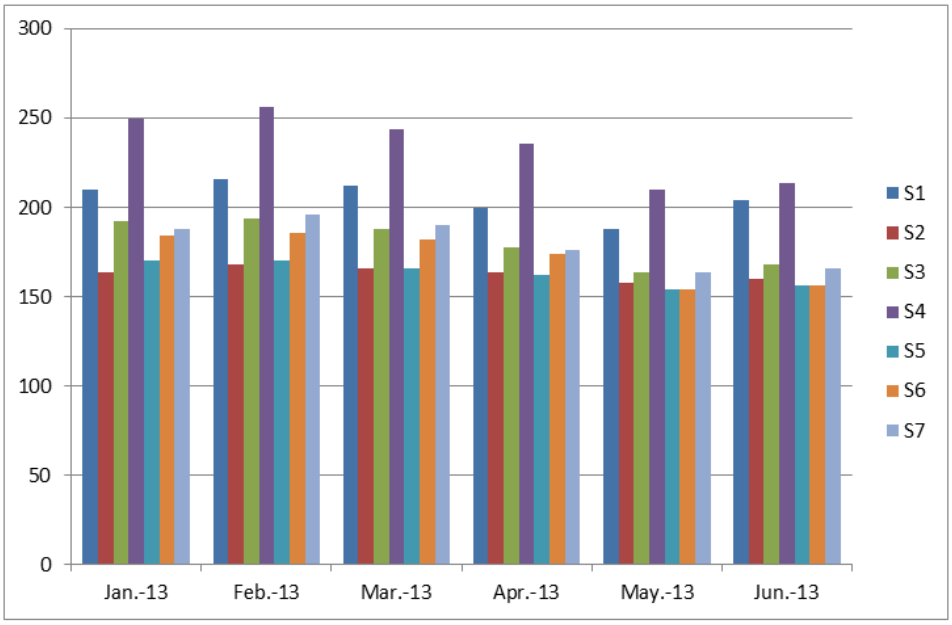
Obtained results from different sites compared with the standards (Table-3) given by BIS [4] for Total Hardness parameter.

RESULTS AND DISCUSSION

After analysis obtained results were shown in table-2.

Table-2: Obtained results of Total Hardness (mg/l) during Jan.2013 to June 2013

Sampling Site	Jan.13	Feb.13	Mar.13	Apr.13	May.13	Jun.13
S1	210	216	212	200	188	204
S2	164	168	166	164	158	160
S3	192	194	188	178	164	168
S4	250	256	244	236	210	214
S5	170	170	166	162	154	156
S6	184	186	182	174	154	156
S7	188	196	190	176	164	166



Graphical presentation – of obtained results of Total Hardness (mg/l) from sampling sites from Jan.2013 to June 2013

Table-3: Water standard for Total Hardness

Parameter	CPCB	BIS(**IS 10500 : 2012)**		WHO
		Acceptable limit	Permissible limit	
TH(mg/l)	-	200	600	-

Total Hardness varied from 256 to 154 mg/l. Standards for Total Hardness has not been set by CPCB and WHO. Total Hardness at all sampling Stations were found below permissible limit of BIS i.e.600 mg/l (IS 10500: 2012). At sampling station S1 (Kansai Gaon Open well) and S2 (Kansai Hand pump) Total Hardness were found more than acceptable limit by BIS i.e. above 200 mg/l. The high concentration of Total Hardness in water Samples may be due to dissolution of polyvalent metallic ions from sedimentary rocks, seepage and run off from the soil [5].

Highest Total Hardness recorded at Sampling station S4 (Vadavali area service centre bore well) in the month of February i.e. 256mg/l. Lowest Total Hardness recorded at sampling station S5 (Bhendipada area Bore Well) and S6 (Samarth Service Centre Bore Well) in the month of May i.e. 154 mg/l. The Hardness of water varies from place to place and it reflects the nature of the geological properties of the area, with which water have been in contact [6, 7].

Water Hardness is not useful in domestic consumption, as such water produces poor lathering with soap, which causes deterioration of cloths, scale formation, skin irritation, boiled meat and food becomes poor in quality [8, 9].

CONCLUSION

Total Hardness at all sampling Stations were found below permissible limit of BIS i.e.600 mg/l. At only two sampling sites S1 (Kansai Gaon Open well) and S2 (Kansai Hand pump) Total Hardness were found above acceptable limit i.e.200mg/l. which is an indication of geological properties of the area in which water have been in contact. Lowest Total Hardness recorded at sampling station S5 (Bhendipada area Bore Well) and S6 (Samarth Service Centre Bore Well) in the month of May and Highest Total Hardness recorded at Sampling station S4 (Vadavali area service centre bore well) in the month of February.

Hardness in water has no known adverse effects; still such water is not fit for domestic use. A hardness of more than about 200 mg/l causes scale deposits in the piping system [10, 11].

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