

Physico Chemical Assessment of Groundwater in Indore City

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ABSTRACT

The present work deals with the assessment of the ground water of some selected area of the Indore city. The investigation was carried out in the month of March and April-2012. The sites were selected to cover the Indore city including residential, commercial, industrial and agriculture area. Various parameters were studied and compared with the IS specification. Some parameters have been found undesirable in some location, mainly Kabir Khedi and Pologround area which need proper attention. Rest of the sample area has deviation within desirable and undesirable extent of tolerance.

Key words: Physico-chemical parameters, Contamination, Renewable.

INTRODUCTION

Groundwater is one of earth's most vital renewable and widely distributed resources as well as an important source of water supply, throughout the world. In India, most of the population depends on the groundwater as it is the only source of drinking water supply¹. The groundwater is believed to be comparatively much clean and free from pollution than surface water. It can become contaminated naturally or because of numerous types of human activities. Residential, municipal, commercial, industrial, and agricultural activities can all affect groundwater quality².

Groundwater can be optimally used and sustained only when the quantity and quality is properly assessed³. A large volume of chemical data on ground water from different parts of country has been generated from the point of view of its suitability for drinking purpose⁴⁻⁵.

Indore is the largest city in Madhya Pradesh State. It is situated on the Malwa plateau. Two small rivulets the Saraswati and the Khan are

flow through the city. The city is becoming centre in many aspects, such as commercial, industrial, educational etc. Ground water is being polluted due today to day the increase in the garbage, industrial waste and drainage linkages⁶⁻⁸.

The present study is related with the assessment of the quality of the ground water of some selected area of the Indore city. It is necessary to evaluate to quality of ground from the health point of view. It should be safe in this respect.

The investigations were performed on the sample collected in the month of March and April 2012. All the studies sites have been selected to cover the Indore city. The parameters studied are colour, odour, temperature, turbidity, conductivity, pH, alkalinity, total hardness, calcium hardness, magnesium hardness, TDS, chloride, iron, fluoride, nitrate, phosphate, and sulphate.

MATERIAL AND METHODS

All the chemical and reagent used were of GR or Analar grade. Stock solutions were

prepared in conductivity water. Water sample were collected in clean Jerrican bottles from different selected points. The sample collection area has been assigned as sample point S. It is from S1 to S10.

pH, Conductivity and spectrophotometer measurement have been carried out on Systronic make instruments. Other parameters have been evaluated volumetrically.

RESULT AND DISCUSSION

An attempt has been made to correlate the parameters of sample collected from different area of Indore city. Studied parameters have been summarized in the table. The results of different area have also been individually discussed. The values obtained are compared^{[9],[10]} with the desirable and permissible limit as issue by Government of India i.e. IS 10500-1991.

Sample 1, (S1)- from Vijay Nagar

Vijay Nagar is a commercial as well as residential area. One nalah flows nearby the area. Sample is slightly acidic as pH is 6.18. Colour (3 Hazen unit) shows that, there is metal ions with iron (0.7 mg/L). Other metal ions and organic compound are present, as TDS is above desirable limit. Alkalinity is above desirable limit (310mg/L) and calcium hardness is very low (40mg/L). Consumption of water for long time may cause fluorosis. Fluorosis is prevalent in areas where ground water is high in alkalinity and low in Calcium. The fluoride is just ready to cross desirable limit (0.49mg/L). Total hardness is lowest among the samples studied.

Sample 2, (S2)- from Kabit Khedi

Kabit Khedi is mixed type of industrial cluster having foundries and chemical industries. It has agriculture land and trenching plant is also there. One nalah flows nearby the area. Color of sample (3 Hazen unit) confirms the high concentration of nitrate (57.0mg/L), iron (2.7mg/L). TDS (organic and inorganic components) (829 mg/L) and Alkalinity (440mg/L) is also high. Fluoride (0.52 mg/L) just has crossed the desirable limit. This very low calcium hardness may cause osteoporosis and fluorosis. Magnesium hardness is high

(permissible) and sulphate is low. It is not harmful. High concentration of nitrates (57.0mg/L) is to be found, as fertilizers are used by farmers. Industrial effluents, animal excreta and microbes in soil are also responsible for its toxic pH (6.5), again confirms the high concentration of iron (0.74 mg/L). Turbidity is high among the sample studied (1.1NTU). This is responsible for the development of "iron bacteria", that is cause of unacceptable odour, corrosion of supply pipes etc. Observation suggested that water is not found and suitable for drinking as well as domestic use. Taste is not acceptable as TDS, Magnesium, iron, nitrates are higher.

Sample 3, (S3)-from Moti Tabela

It is residential area. Observation of data shows that sample is slightly alkaline having pH (7.28). At this pH iron is 0.74mg/L i.e. it is more in ground water hence iron(III) hydroxide may cause the formation of iron bacteria. Turbidity (1.3NTU), Colour (2 Hazen unit) is due to the iron. Again alkalinity (330mg/L) and Fluoride (0.38mg/L) are acceptable but calcium hardness is low (below desirable limit), it may cause osteoporosis.

Sample 4, (S4)- from Pologround

Pologround is a small industrial area situated in the mid of the city, having maximum units of industries including, fabrication, anodizing foundry, textile, soyabain oil factory and some drug units.

Result show that sample is a slightly acidic with pH (6.96). Soluble iron (1.01mg/L) and high nitrate (toxic) (109mg/L) reveal the (4 Hazen unit) colour of the sample. Nitrate concentration is due to industrial effluents. Alkalinity is higher (500mg/L) and calcium (64mg/L) is below desirable, with acceptable fluoride (0.57mg/L). It may be a cause for osteoporosis and fluorosis. Conductivity (3000 μ S) and alkalinity are (500mg/L) highest among the sample. Water is not potable as the total hardness (460mg/L) and magnesium (72mg/L), all this have high values. Taste is also not acceptable due to high concentration of chloride, TDS, alkalinity and nitrates

Sample 5, (S5)-0 from Gandhi Nagar

Gandhi Nagar is also residential area. All the parameters have been found within either

Table 1: Sample collection point and values of studied parameters.

Sample Collection Type of are	Commercial & Parameters	Vijay Nagar	Kabit Khedi	Moti Tabela	Polo ground	Gandhi Nagar	Sudama Nagar	Bangali Square	Rajendra Nagar	Yashwant Club	Piplapala
S.No.		S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
01	Colour(Hazen unit)	3	3	2	4	0	0	0	0	0	0
02	Temperature(°C)	31.3	31	32	30.7	31	33	31.7	31.9	32.3	30.6
03	Turbidity (NTU)	1	1.1	1.3	0.9	0.08	0.9	0.9	0.07	0.8	0.06
04	pH	6.81	6.5	7.28	6.96	6.97	7.06	7.11	7.32	7.99	7.04
05	Conductivity(µs)	1170	1644	919	3000	1378	605	866	972	1055	900
06	Alkalinity (mg/L)	310	440	330	500	450	280	320	340	330	340
07	Total Hardness (mg/L)	240	400	260	460	380	260	280	340	320	320
08	Calcium Hardness(mg/L)	40	24	32	64	96	48	6	72	48	56
09	Magnesium Hardness(mg/L)	33.6	81.6	43.2	72	33.6	43.2	24	38.4	48	43.2
10	T.D.S.(mg/L)	680	829	459	1005	687	305	432	487	526	405
11	Chloride (mg/L)	110	100	120	150	190	60	90	120	130	120
12	Iron (mg/L)	0.74	2.7	0.74	1.01	0.32	0.47	0.14	0.2	0.04	0.27
13	Fluoride(mg/L)	0.49	0.52	0.38	0.57	0.95	0.23	0.76	0.52	0.92	0.6
14	Nitrate (mg/L)	5.7	57	3.9	109	2.7	5.65	3.8	10	11.4	10.1
15	Phosphate (mg/L)	0.23	0.68	0.77	0.9	0.04	0.33	0.33	0.24	0.06	0.68
16	Sulphate (mg/L)	5	17	7	10.5	19	5	17	18	16	12

desirable of permissible limits. pH is 6.97. Iron (0.3mg/L) and nitrates (2.7mg/L) are lowest among the sample studied. It reveals zero Hazen units of colour. Value of calcium is 96mg/L and fluoride is 0.95mg/L. Nitrates, phosphate, sulphate are less soluble, it reduces the conductance but due to chloride (190mg/L) it increases to average that make water suitable for drinking.

Sample 6, (S6)- from Sudama Nagar

Sudama Nagar is also a residential area. pH (7.06) is almost neutral. TDS (305mg/L), alkalinity (280mg/L), chloride (60mg/L), fluoride (0.23mg/L) are the lowest values among studies samples. Low chloride reveals lowest value of conductance (605 μ S). It may also cause of the bacterial or viral infection. Though it is suitable for drinking.

Sample 7, (S7)- from Bangali Square

Bengali Square is residential as well as commercial area. Slightly alkaline pH (7.11), low TDS (432mg/L), iron (0.14mg/L), nitrate (3.8mg/L), chloride (90mg/L) reveal zero Hazen unit of colour. Taste is acceptable. Calcium (64mg/L) and magnesium (24mg/L) are below then desirable. Alkalinity (320mg/L) and fluoride (0.76mg/L) are within permissible shows the possibility of fluorosis after long time use. Taste is acceptable and water is suitable for drinking.

Sample 8, (S8)- from Rajendra Nagar

Rajendra Nagar is residential area situated near the railway station. Sample is slightly alkaline. All the parameters deviates slightly from standard value except chloride (120mg/L). Taste of water is acceptable and is suitable for drinking.

Sample 9, (S9) – from Yashwant Club

Yashwant club is residential area. Almost sample is alkaline, pH is (7.99). All parameters are near about the desirable limits except pH (7.99). Fluoride is within (0.92mg/L) permissible limit while calcium (48mg/L) and chloride (130mg/L) are below the desirable range. Colour and taste are acceptable.

Sample 10, (S10)- from Piplya Pala

Pipliyapala is a residential area. pH is Neutral (7.04). TDS (405mg/L), calcium (56mg/L), chloride (120mg/L) are below their desirable limit, Remaining are with permissible limit. Calcium deficiency is possible after long time consumption.

Chloride in all the studied samples is to be found below desirable range. Sulphate and turbidity are very low in all the sample.

Temperature parameter give an idea about the self purification of water body. Its variation is negligible. Conductivity of sample is accordance to pH. It also depends on the solubility of inorganic salts and hardness etc.

CONCLUSION

The assessment of ground water by physical and chemical analysis could help in understanding the extent of ground water pollution by surrounding human activities. The result and discussion exhibits that some parameters are undesirable mainly to nitrates, chlorides, calcium, magnesium, hardness and alkalinity. It has been concluded that Kabit-Khedi and Pologround area need proper attention hence regular periodical checking is required. The rest of the samples areas have deviation within desirable and undesirable to the extent of tolerance.

The findings of the work exhibits that the few parameters have values that is undesirable as nitrates, chlorides, hardness, turbidity, conductance, alkalinity, in the sample sources studied as reported in the summary of the work.

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