

Study of Physico-Chemical Parameters of Groundwater Quality along the Periphery of Sanjivani Sugar Factory Kopargaon, Maharashtra

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Abstract- Water is the prime natural resource. Water is important for life on earth, and the largest source of fresh water lies under the earth's surface, hence it is need to check the groundwater quality. The physico-chemical parameters of groundwater along the area of Sanjivani sugar factory, Kopargaon, Maharashtra state were studied. The various parameters are selected for the assessment of ground water quality and that parameters are temperature, pH, alkalinity, dissolved oxygen, total dissolved solids, total hardness, calcium, magnesium, chloride, fluoride etc. Comparative studies of groundwater samples in different seasons (pre-monsoon and post monsoon) were experimented and in which found that alkalinity, TDS, calcium are in higher concentration than the permissible limit with reference to the standard limits given by BIS.

Keywords- Ground water, Physico-chemical parameters, Drinking water quality, BIS.

I. INTRODUCTION

The part of the earth's surface covered with water in various forms such as rivers, lakes, ponds, reservoirs and oceans etc. are described as water bodies. Water is one of the basic needs on the globe. Water is probably the only natural resource to touch all aspects of human civilization from agricultural and industrial development to cultural and religious values embedded in society. The total water amount on the earth is about 1.35 billion cubic kilometers. About 97.1 % has been locked into oceans as salt water. Ice sheets and glaciers have arrested 2.1 %. Only 0.2 % is the fresh water present on the earth, which is used by human for various of purposes. Remaining 0.6 % is in underground form. But unfortunately it has been getting polluted day by day due to different anthropogenic activities. So it is burning need, to conserve the water and prevent it from various type of pollution. There should be proper water quality investigation and management. This could be possible by continuous Water Quality Monitoring.

Ground water has been the primary source of water supply for domestic, agricultural and industrial uses in

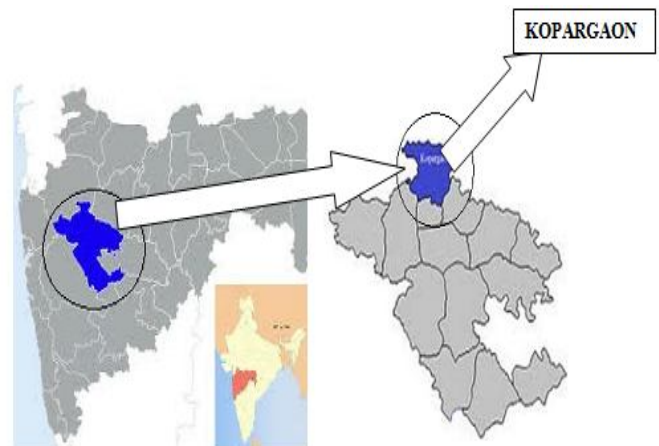
Maharashtra. It is the single higher and most readily available resource of irrigation and more than 55% of the total area under irrigation depends on ground water sources. About 70% of rural water supplies are depend on ground water source. Thus ground water plays a very important role in the state's economy and therefore necessity to be monitored scientifically both in terms of quality and quantity, for sustainable development and management.

II. MATERIAL AND METHODS

For the present study the samples for analyze groundwater parameter are collected along the periphery of Sanjivani sugar factory, Kopargaon. Groundwater samples are collected from dug well, tube well, hand pump etc. during the pre-monsoon and post monsoon period i.e.(March 2014 and Sept.2015). The above collected ground water samples were check for various water quality parameters by using physio-chemical analysis [2] viz. Temperature, pH, Alkalinity, Dissolved oxygen, TDS, Total Hardness, Calcium, Magnesium, Chloride, Fluoride, Nitrate etc.

For physical and chemical analysis of the samples a number of sophisticated instruments were used and standard methods were followed [12].

Fig. 1 : Location map of Kopargaon Taluka



1.1 Location map of Kopargaon Taluka

2.1 Selection of water quality parameters:

The occurrence of the ion and impurities in the ground water is mainly depends upon the geologic formation at the particular area. The Deccan trap basalt forms the main water bearing formation in the Kopergaon taluka. Some basic impurities are found in all types of geological

formation. However the ion and impurities associated with the basaltic formations are high Alkalinity, Total hardness, Cl, Ca, Mg, TDS, Fluoride and Iron. The hydrogeology of the Kopergaon Taluka forms the basis of selection of the water quality parameters such as Alkalinity, Total hardness,, Cl, Ca, Mg, TDS, Fluoride and Nitrate.

Fig.2 : Over view of Sampling Locations. (12 Nos.)



Over view of Sampling Locations. (12 Nos.)

Table 1 : LATITUDES AND LONGITUDES OF SAMPLING LOCATIONS

SR. NO.	LOCATION	LATITUDE (N)	LONGITUDE (E)	SOURCE
1	S 1	19°54'16.1" N	74°29'49.9" E	Dug Well
2	S2	19°54'19.8" N	74°29'46.4" E	Dug Well
3	S3	19°54'24.1" N	74°29'53.0" E	Dug Well
4	S4	19°54'25.5" N	74°29'56.4" E	Dug Well
5	S5	19°54'14.8" N	74°30'20.5" E	Hand Pump
6	S6	19°54'16.2" N	74°30'24.9" E	Dug Well
7	S7	19°53'40.1" N	74°30'12.0" E	Hand Pump
8	S8	19°53'46.6" N	74°30'12.4" E	Dug Well
9	S9	19°53'46.6" N	74°29'59.5" E	Tube Well
10	S10	19°53'43.4" N	74°29'51.3" E	Dug Well
11	S11	19°53'52.4" N	74°29'45.5" E	Tube Well
12	S12	19°53'58" N	74°29'41.8" E	Tube Well

III. RESULTS AND DISCUSSION

This section presents the results of physico-chemical parameters as determined in samples collected from along the periphery of Sanjivani (Takli) Sahakari Sakhar Karkhana Ltd. Kopergaon. The results of analysis obtained are summarized in Table 2.

3.1 Physico-chemical analysis of ground water quality parameters during Pre-Monsoon:

Ground water samples were collected from periphery of Sanjivani (Takli) Sahakari Sakhar Karkhana Ltd. Kopergaon. These samples were collected during summer season .The results of analysis are tabulated below.

Table 2: Physico-chemical analysis of ground water quality parameters during pre-monsoon season:

Parameter	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12
Temperature 0C	25.2	24.3	23.8	24.6	25.1	24.7	25.2	24.9	24.8	25.1	25.3	24.8
Ph	8.10	7.42	7.80	7.32	8.12	7.64	7.48	7.82	7.46	7.60	7.86	7.65
Alkalinity	265.54	225.38	285.10	313.48	252.25	620.24	605.16	546.84	610.8	394.56	236.00	295.5
DO	6.35	6.24	6.84	5.92	6.15	5.86	6.10	6.21	6.14	5.98	6.14	6.18
TDS	748	845.4	585.8	854	1360	1250.4	1925	2045.2	2016.5	2120	985.4	896.20
Total hardness	545.4	510	595.8	564.25	625.4	704.62	865.4	712.8	716.4	784.5	576	554.4
Calcium	78.35	94.3	135.25	146.85	185.2	174.4	165.75	198.5	210.15	208.45	87.50	86.54
Magnesium	44.25	73.25	58.45	46.30	46.85	93.4	112.50	122.35	118.3	103.8	57.6	64.25
Chloride	354.25	230.554	195.73	246.62	354.2	295.84	458.62	410.42	305.52	268.56	246.58	315.26
Fluoride	0.48	0.58	0.42	0.41	0.43	0.49	0.43	0.44	0.46	0.57	0.36	0.38
Nitrate	25.4	37.8	30.2	24.5	30.16	48.26	54.24	46.6	49.82	45.84	34.5	24.8

Note: All units are in mg/l except Temperature & pH

1. Temperature:

Cool water is generally more suitable than warm water. High water temperature raises the growth of microorganisms and may increase taste, odour and corrosion problems. The temperature for above samples was found in range between 23.8⁰C to 25.3⁰C. The higher values of temperature parameter are found especially for pre-monsoon assessment.

2. pH:

Low pH is one of the common problem of ground water. The reason of low pH is due to the addition of acidic rain water. Other ions found in ground water such as nitrates and sulfates may reduces pH value. The ill effects of acidic water are many. The pH value becomes important in corrosion control, since lower pH values may cause turburculation and corrosion of pipes and water tanks etc. A lower pH value below 4.0 may produce sour taste and higher value above 8.5 give it a bitter taste. Higher pH values (alkaline water) may produce incrustation, sediment deposit, difficulty in chlorinating, besides producing certain psychological effects on human system, if such alkaline waters are consumed. It is clear from the table 2 that the pH value of water samples were varying from 7.32 to 8.12 and these values are within the permissible limits prescribed by BIS.

3. Alkalinity:

The acceptable limit at presence of alkalinity like hydroxides, carbonates and bicarbonates should be between 200 to 600 mg/l. The alkalinity values were found in the range of 225.38 to 620.24 mg/l, which is higher than acceptable limit.

4. Dissolved Oxygen (D.O.)

The dissolved oxygen level is changes due to physical, chemical and biological activities in the water. It is up to 4 mg/l for survival of aquatic life. Higher temperature, biological impurities, ammonia, nitrates, ferrous iron, chemicals such as hydrogen sulphide and organic matter reduce DO values. From Table 2 the concentration of D.O. is 5.86 to 6.84 mg/l.

5. Total Dissolved Solids (TDS)

Total dissolved solids is defined as the concentration of all dissolved minerals in the water. High concentration of TDS could be due to heavy residential area and intensive irrigation. Sources for TDS include agricultural run-off, urban run-off, industrial effluent, municipal wastewater, and natural sources such as leaves, silt, plankton and rocks. The high concentration of TDS (levels above 2,000 mg/L) may cause

corrosion of pipes and plumbing systems. In the present investigation the TDS level was found 585.8 to 2045.2 mg/l which is higher values than permissible limit. As per standard TDS greater than 2000 mg/l unacceptable for drinking purpose.

6. Total Hardness:

Hardness is defined as a characteristics of water that represent the total concentration of calcium and magnesium ions expressed as calcium carbonate.. Hardness is one of the important property of groundwater from utility point of view for different purposes. For potable water the total hardness should be limited up to 200 mg/l & maximum permissible value is 600 mg/l. Table 2 indicates the concentration range of total hardness found is 510 to 865.4 mg/l which has indicated higher values in groundwater.

7. Calcium:

Calcium is an important nutrient required for organism. Calcium values observed in range 78.35- 210.15 mg/l for pre monsoon season are higher than permissible limits.

8. Magnesium:

Concentration of magnesium values observed in the range of 44.25- 122.35 mg/l in different samples, For pre monsoon season the concentration of magnesium are higher sides.

9. Chloride

Chlorides occur in all natural water in varying conditions. The desirable value of Chloride content is 250 mg/l. Above taken samples were found concentration of chloride vary from 195.73-458.62 mg/l. Obtained range which is slightly higher than acceptable limits. The high chloride content may harm metallic pipes and structure.

10. Fluoride:

Fluoride concentration is significantly low in all the samples. Fluorides in a drinking water have a dual significance, if the fluoride concentration in drinking water is less than 0.8 mg/l, it causes dental carries in growing children. If it is more than 1.5 mg/l, it causes mottling of enamel, brittleness of bones. The fluoride content in the groundwater shows a range of 0.36 to 0.57 mg/l (Table2). In all samples fluoride content found within permissible limit as compared to BIS standards.

11. Nitrate:

Nitrate content in drinking water is considered important for its adverse health effects. The occurrence of high levels of nitrate in ground water is a prominent problem in many parts of the country. The nitrate content in the study area varies from 24.5 to 54.24 mg/l during pre-monsoon season. Nitrate is effective plant nutrient and moderately toxic. A limit of 45 mg/l has been prescribed by BIS (2012) for drinking water supplies. Nitrate concentration above 45 mg/l may prove harmful to human health. Excessive nitrate in the water could be due to the large use of fertilizers or improper operation and maintenance of septic systems. Nitrates are especially toxic to children less than six months of age. Children who ingest nitrate may not have developed an immune system that can ward off the compound. The condition known as "blue-baby syndrome" may occur.

3.2 Physico-chemical analysis of ground water quality parameters during Post-Monsoon

Ground water samples were collected from periphery of Sanjivani (Takli) Sahakari Sakhar Karkhana Ltd. Kopargoan. These samples were collected during post monsoon season .The results of analysis are tabulated below:

Table 3 : Physico-chemical analysis of ground water quality parameters during post-monsoon season:

Parameter	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12
Temperature 0C	18.5	19.3	19.2	19.7	20.1	18.8	19.4	19.7	18.8	19.2	19.2	19.9
Ph	7.86	7.65	7.1	6.94	6.86	6.68	6.84	6.67	6.54	7.2	6.95	6.21
Alkalinity	248.5	246.48	316.24	214.6	342	390.4	374	365	398	324	224	210.8
DO	6.45	6.34	6.21	5.98	6.76	6.95	5.87	5.78	6.3	5.64	6.52	6.8
TDS	445.5	464.75	482.5	454	452.3	548.4	536	585.43	654.4	562	358.5	368.7
Totalhardness	355.45	480.14	325	445.8	438.2	518	654.6	618.3	610.4	485.7	285.4	314.5
Calcium	45.5	65.25	85.32	82.15	92.2	85.62	102.84	125.65	135.46	110.94	75	68.4
Magnesium	32.5	50.4	42.36	54.45	38.6	55.6	68.50	78.43	65.4	76.88	38.8	35.6
Chlonide	135.4	110	224.85	165.46	176.2	214.46	248.65	265.4	288.5	286.46	187	164
Fluoride	0.36	0.38	0.41	0.42	0.42	0.49	0.43	0.44	0.46	0.47	0.36	0.38
Nitrate	20.14	23.8	23.5	18.4	26.46	38.2	46.4	36.6	45.82	45.84	24.5	19.58

Note: All units are in mg/l except Temperature & pH

1. Temperature:

The temperature for above ground water samples were found in range between 18.5°C to 19.5 °C. The lower values of temperature are noticed especially for post-monsoon measurements.

2. pH:

It is clear from the table 3 that the pH value of water samples were varying from 6.21 to 7.86 and these values are within the limits prescribed by BIS.

3. Alkalinity:

The acceptable limit at presence of alkalinity like hydroxides, carbonates and bicarbonates should be between 200 to 600 mg/l .The alkalinity values were found between 210.8 to 398 (S5) mg/l , which is slightly in higher side.

4. Dissolved Oxygen :

It is up to 4 mg/l for survival of aquatic life ,From Table 3. Samples were found D.O 5.64 to 6.95 mg/l.

5. Total Dissolved Solids:

The concentration of TDS level was found in between to 358.5 to 654.4 mg/l which is not within permissible limit. As per BIS standard TDS greater than 600 mg/l unacceptable for drinking purpose.

6. Total Hardness :

For potable water the TH should be limited upto 300 gm/l & maximum permissible value is 600 mg/l. Table 3 indicates that all samples are above permissible limits i.e. range in between 285.4 to 654.6 mg/l which has indicated higher hardness in groundwater.

7. Calcium:

Calcium is an important nutrient required for organism. Calcium values observed for post monsoon season are in between 45.5 to 135.46 mg/l. which has indicated higher calcium in groundwater than acceptable limit.

8. Magnesium:

Concentration of magnesium values observed for post monsoon season are in between 32.5 to 78.43 mg/l where desirable limit is 30 mg/l.

9. Chloride (Cl-):

The desirable value of Chloride content is 250 mg/l. Above taken samples were found concentration of chloride vary from 110 to 288.5 mg/l which shows higher than desirable limits. High concentrations of chloride give a salty taste to water.

10. Fluoride:

The fluoride content in the ground water shows a range of 0.36 to 0.49 mg/l which is within permissible limit. According to recommendation of BIS maximum permissible level of fluoride concentration should be below 1.5mg/l .

11. Nitrate:

The nitrate content in the study area varies from 18.4 to 46.4 mg/L during post-monsoon season which is within the permissible limit as compared to BIS standards.

IV.CONCLUSION

In the present study water quality has been calculated to assess the suitability of groundwater for drinking purpose along the periphery of Sanjivani sugar factory, Kopergaon, Maharashtra, India. Better water quality was found in the post monsoon season than that of pre-monsoon season because of water recharging due to rain water. The results shows that the concentration of alkalinity, total hardness, Nitrate, TDS, Ca, Mg, Cl at most of the sampling stations having higher values than the permissible limit prescribed by the Indian standards. The analysis shows that the groundwater of the study area need some treatment before it consumption. It is recommended that water analysis should be carried out from time to time to monitor the rate and kinds of contamination.

REFERENCE

- [1] N.J. Pawar, G.M.Pondhe and S.F.Patil, (1998), "Groundwater pollution due to sugar-mill effluent, at Sonai, Maharashtra, India", Environmental Geology journal Springer-Verlag 34 (3/2), pp.150-158,
- [2] Hemant Pathak,S. N. Limaye (2012) " Assessment of Physico- Chemical Quality of Groundwater in rural area nearby Sagar city, MP, India" Pelagia Research Library Advances in Applied Science Research, 2012, pp.555-562.
- [3] Agale M.C., Patel N.G. and Patil A.G., (2013), " Impact of sugar industry effluents on the quality of ground water from Dahiwad Village, Dist-Dhule (M.S.)", Archivas of applied science research., 5(2), pp.58-60,
- [4] Ganapathi Subramanian.R, Subramanian.V, (2011), "Pre and Post Monsoon variation in Physico chemical characteristics in Groundwater quality of parts of Tirunelveli District, Tamil Nadu, India", International journal of Geomatics and Geosciences, vol.2, pp.1.
- [5] K.K. Deshmukh, (2014), "Environmental Impact of Sugar mill Effluent on the Quality of Groundwater from Sangamner, Ahmednagar, Maharashtra, India", Research Journal of Recent Sciences , ISSN 2277-2502, Vol. 3(ISC-2013), pp.385-392 .
- [6] V.T. Patil & P. R. Patil, (2010), "Physicochemical Analysis of Selected Groundwater Samples of Amalner Town in Jalgaon District, Maharashtra, India", EJournal of Chemistry, pp.111-116.
- [7] Sunita R. Dandwate, (2012), "Study of Physicochemical Parameters of Groundwater Quality of Kopergaon area, Maharashtra State, India during Pre-monsoon and Post monsoon Seasons", E-Journal of Chemistry, pp. 15-20.
- [8] Ground Water Information Ahmednagar District Maharashtra, (2010), "Government of India, Ministry of Water Resources", Central ground Water Board, pp 1-27.
- [9] Thomas Harter, (2003), "Groundwater quality and groundwater pollution", University of California, pp. 90-104.
- [10] BIS (Bureau of Indian Standards)-Drinking water quality 10500 (2012), Indian Standard Drinking Water Specification, Second revision, pp. 1-8.
- [11] WHO (World Health Organization). Guidelines for drinking-water quality, 2nd ed, 1993, Vol 1, pp 188.
- [12] Manual on Water and Waste water Analysis: National Environmental Engineering Research Institute, Aug 1983
- [13] Patil. P.N, Sawant. D.V, Deshmukh. R.N," Physico-chemical parameters for testing of water–A review", International Journal Of Environmental sciences,Vol.3,' No.3(2012), pp.1194-1227.