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Studies on Physicochemical Properties of Drinking Water of Akola City

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Abstract
The physico-chemical status of water samples from ten major part of locality in Akot city was assessed. The sampling points were selected on the basis of their importance. The physicochemical parameter like, temperature, pH, electrical conductivity (EC), total dissolved solids (TDS), turbidity, dissolved oxygen (DO), total alkalinity (TA), total hardness (TH), calcium (Ca++) magnesium (Mg++), sodium (Na+), potassium (K+), chloride (Cl-), fluoride (F-), nitrate (NO- 3) sulphate (SO2- 4) and phosphate (PO3- 4) of Open Well and Bore well was determined. The results were compared with standards prescribed by WHO (1973) and ISI (10500-91). It was found that the ground water was contaminated at few sampling sites namely Mothi Umri, While the sampling sites Hanuman Nagar, Jatharpeth, Shudhir Colony and Rautwadi showed physicochemical parameters within the water quality standards and the quality of water is good and it is fit for drinking purpose.
Keywords: Groundwater, physicochemical parameter, open well and borewell, Akola city.

INTRODUCTION

Water is a valuable commodity for the survival of all life forms in the ecosystem. It is essential for growing crops, plants, household uses such as drinking, cooking, sanitation and in industries for various physical, chemical and biological processes. Quality drinking water is of basic importance to human physiology and man's continued existence depends very much on its availability. Provision of quality water to rural and urban population is necessary in order to prevent health hazards. The combination of unsafe drinking water and inadequate sanitation facilities constitute one of the major causes of death and disability as a result of water borne diseases, which is often on epidemic scale among the poor in developing countries. Water has to comply with certain physical, chemical and microbiological standards, which are designed to ensure that the water is potable and safe for drinking before it can be described as being of good quality. Quality water is defined as water that is free from disease - producing microorganisms and chemical substances deleterious to health. Despite the abundance of water, large percentage of the world population does not have enough to drink and meet their essential needs, as the provision of quality water remains a major problem. Water from most sources is therefore unfit for immediate consumption without some sort of treatment. The original source of most drinking water is rich in aquatic microbes, some of which could be pathogenic if they enter the human body. Conformation with microbiological standard is therefore of special interest because of the capacity of water to spread diseases within a large population. This study was carried out to evaluate the microbiological and physicochemical properties of drinking water from different sources in Akola City, Maharashtra.

Natural resources are the important wealth of our country, water is one of them. Water is a wander of the nature. *" No life without water "* is a common saying depending upon the fact that water is the one of the naturally occurring essential requirement of all life supporting activities1 Since it is a dynamic system, containing living as well as nonliving, organic, inorganic ,soluble as well as insoluble substances. So its quality is likely to change day by day and from source to source. Any change in the natural quality may disturb the equilibrium system and would become unfit for designated uses. The availability of water through surface and groundwater resources has become critical day to day. Only 1% part is available on land for drinking, agriculture, and domestic power generation, industrial consumption, transportation and waste disposal. In India, most of the population is dependent on groundwater as the only source of drinking water supply. The groundwater is believed to be comparatively much clean and free from pollution than surface water. But prolonged discharge of industrial effluents, domestic sewage and solid waste dump causes the groundwater to become polluted and created health problems. The rapid growth of urban areas has further affected groundwater quality due to overexploitation of resources and improper waste disposal practices. Hence, there is always a need for and concern over the protection and management of groundwater quality. Heavy metals are priority toxic pollutants that severely limit the beneficial use of water for domestic and industrial application. The lakes have complex

and fragile ecosystem, as they do not have self cleaning ability and therefore readily accumulate pollutants. The physicochemical parameters and trace metal contents of water samples from Delhi were assessed. The most of water bodies in India needs to be treated before using it in domestic applications by various means. Ground water contains high amount of various ions, salts etc. so if we were using such type of water as potable water then it leads to various water-borne diseases. The consequence of urbanization and industrialization leads to spoil the water. For agricultural purposes ground water is explored in rural areas especially in those areas where other sources of water like dam and river or the canal is not available. During last decade, this is observed that the ground water get polluted drastically because of increased human activities. Hence it is very essential to maintain the quality of ground water for human consumption, for the aquatic life and for other subsequent uses. Considering the above aspects of groundwater contamination, the present study was undertaken to Investigate the impact of the groundwater quality of some open wells and bore well project work an attempt has been made to assess the physical and chemical parameters of groundwater like, Temperature (T), pH, electrical conductivity (EC), total dissolved solids (TDS), turbidity, dissolved oxygen (DO), total alkalinity (TA), total hardness (TH), calcium (Ca++) magnesium (Mg++), sodium (Na+), potassium (K+), chloride (Cl-), fluoride (F-), nitrate (NO- 3) sulphate (SO--4) and phosphate (PO3- 4) of Open Well and Bore well was determined. The analyzed data were compared with standard values recommended by WHO.

MATERIAL AND METHODS

Akola city which is situated in the heart of the nation in Maharashtra (Vidarbha region) has become an important city because of the natural resources available around it. There are various existing industries and industrial estates. These industries use huge quantity of water for processing and release most of the water in the form of wastewater. The wastewater being generated is discharged into the nearby water resources. Similarly the geochemical and morphological structural changes due to weathering may also leached out some chemicals/minerals from the geostrata into surface and groundwater and may change the original characteristics of water which could be rather harmful to human health after consumption. The people are using open well water, tube well water as well as municipal water 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. Hanuman Nagar (Bore well), Sudhir colony (bore well), Jatharpeth (bore well), Rautwadi (borewell), Civil line (bore well), Mothi Umri (Bore well), Ramdaspeth (bore well), Birla gate (Borewell) and Durga Chauk (bore well), sites selected were from different localities in Akola Town for samples collection.

Preparation of Water Samples:

The sample were collected from all the stations at 11.00 am to 12.00 noon in both the seasons for physico-chemical examinations, different methods of collection and handling were adopted based the standard procedures. The samples were collected in plastic canes of five liters capacity without any air bubbles. The instruments were used of accuracy. The temperatures of the samples were measured in the field itself at the time of sample collection. The samples were kept in refrigerator maintained at 4^{o}C. Water samples from ten sampling sites were collected during a post monsoon period of five months (November-2016 to March -2016). The sampling locations in Akot city for assessment of physico-chemical parameter status of ground water are given in Table- 1.

Physico-Chemical Analysis:

Analysis was carried out for various water quality parameters such as Temperature, pH, electrical conductivity (EC), total dissolved solids (TDS), turbidity, dissolved oxygen (DO), total alkalinity (TA), total hardness (TH), calcium (Ca++) magnesium (Mg++), sodium (Na+), potassium (K+), chloride (Cl-), fluoride(F-) nitrate (NO- 3), sulphate (SO--4) and phosphate (PO3- 4) using standard method. All The reagents used for the analysis were AR grade and double distilled water was used for preparation of solutions.

RESULT AND DISCUSSSION:

The physico-chemical parameters of the above mention sites in Akot city can be calculated and it is describe as bellow.

Temperature (T) in ^{0}C:

Temperature is an important biologically significant factor, which plays an important role in the metabolic activities of the organism. The temperature was ranging from 23.0°C to 27.00°C during the study period. Lowest water temperature was observed in the Ramtek Pura was 23.0 °C. A study increase in water temperature in the course of Shivaji College was

noticed ie 27°C. An increase in temperature was observed from Somwar Wesh (24.0 °C) to Mahalaxmi Nagar (26.0 °C). This might be due to presence of the effluents. Our property of water is that with change in temperature, its density varies and it becomes less with warming up and more with cooling.

pH:

pH is a term used universally to express the intensity of the acid or alkaline condition of a solution. Most of the water samples are slightly alkaline due to presence of carbonates and bicarbonates. The pH values of water samples varied between 8.0 to 7.1 and were found within the limit prescribed by WHO. The higher range of Ph indicates higher productivity of water.

Electrical Conductivity (EC) in Micro-ohm/cm:

Electrical conductivity (EC) is a measure of water capacity to convey electric current. It signifies the amount of total dissolved salts20. EC values were in the range of 1563 micro-ohms/cm to 390 microohms/ cm. High EC values were observed for five sampling points namely S1, S2, S3, S4, and S5 indicating the presence of high amount of dissolved inorganic substances in ionized form.

Total Dissolved Solids (TDS) in mg/l:

Total dissolved solids indicate the salinity behavior of groundwater. Water containing more than 500 mg/L of TDS is not considered desirable for drinking water supplies, but in unavoidable cases 1500 mg/L is also allowed21. TDS values varied from 108 mg/L to 1650 mg/L. The sampling points S1, S2 and S3 showed higher TDS values than the prescribed limit given by ISI.

Turbidity in NTU:

In most waters, turbidity is due to colloidal and extremely fine dispersions. The turbidity values varied between 0.00 to 0.2 NTU and found within the limits prescribed by ISI (10500-91).

Dissolved Oxygen (DO) in mg/l:

Dissolved oxygen is important parameter in water quality assessment and reflects the physical and biological processes prevailing in the water. The DO values indicate the degree of pollution in water bodies. DO values varied from 7.4 to 2.9. The sampling points S6 and S7 showed high DO values.

Total Alkalinity (TA) in mg/l:

Alkalinity of water is its capacity to neutralize a strong acid and it is normally due to the presence of bicarbonate, carbonate and hydroxide compound of calcium, sodium and potassium. Total alkalinity values for all the investigated samples were found to be greater in samples S1, S2, S3 and S4 than the value prescribed by WHO.

Total Hardness (TH) in mg/l:

Hardness is the property of water which prevents the lather formation with soap and increases the boiling points of water22 Hardness of water mainly depends upon the amount of calcium or magnesium salts or both. The hardness values shown range from 784 mg/L to 312 mg/L. The values for sample from point S2 and S3 were higher than the prescribed limit.

Calcium (Ca2+) in mg/l:

Calcium are directly related to hardness. Calcium concentration ranged between 80.00 mg/L to 34.00 mg/L and found below permissible limit of ISI, except samples from sampling point S1, S2 and S3.

Magnesium (Mg2+) in mg/l:

Magnesium are directly related to hardness. Magnesium content in the investigated water samples was ranging from 147.00 mg/L to 37.1 mg/L which were found within WHO limit.

Sodium (Na +) in mg/l:

Sodium concentrations were found in between 375.00 mg/L to 199.00 mg/L. Sampling sites S9, S10 showed lower sodium concentration than the prescribed limit by WHO and ISI.

Potassium (K +) in mg/l:

The major source of potassium in natural fresh water is weathering of rocks but the quantities increase in the polluted water due to disposal of waste water22. Potassium content in the water samples varied from 0.3 mg/L to 0.8 mg/L. It is found that the contents of potassium in site S1 is higher ie 0.80 mg/l, whereas for sites S4 to S10 is zero.

Chloride (Cl -) in mg/l:

The chloride concentration serves as an indicator of pollution by sewage. People accustomed to higher chloride in water are subjected to laxative effects20. In the present analysis, chloride concentration was found in the range of 257.00 mg/L to 38.2 mg/L. The values are within the limit except water sample collected from sites S2 and S3. Higher chloride concentration in samples from sites S1 may be due to big discharge of sewage near the sampling sites.

Fluoride (F -) in mg/l:

Probable source of high fluoride in Indian waters seems to be that during weathering and circulation of water in rocks and soils, fluorine is leached out and dissolved in ground water. Excess intake of fluoride through drinking water causes fluorosis on human being. In the present analysis, fluoride concentration was found in all

samples sites in Akot city. It is found zero for all sites ie from S1 to S10.

Nitrate (NO3 -) in mg/l:

Groundwater contains nitrate due to leaching of nitrate with the percolating water. Groundwater can also be contaminated by sewage and other wastes rich in nitrates. The nitrate content in the study area varied in the range 1.28 mg/L to 0.12 mg/L and found within the prescribed limit.

Sulphate (SO4 2-) in mg/l:

Sulphate occurs naturally in water as a result of leaching from gypsum and other common minerals18. Discharge of industrial wastes and domestic sewage tends to increase its concentration. The sulphate concentration varied between 80.9 mg/L and 19.1 mg/L. and found within the prescribed limit.

Phosphate (PO4 3-) in mg/l:

Phosphate may occur in groundwater as a result of domestic sewage, detergents, and agricultural effluents with fertilizers. The phosphate content in the study area was found in S1 site only it is 0.1 mg/L. All the data can be summarized in *Table-2*.

CONCLUSION

Deviations were observed by some groundwater samples in Akola City. The water samples from sites S1 and S2 showed poor water quality as compared to other water samples, probably due to River close to site S1 The water samples from sites S1 and S2 are polluted and unfit for drinking purpose. The sampling point S1 showed high TDS, total alkalinity and sodium content indicating the need of some treatment for minimization of the parameters. The sampling sites S9 and S10 showed physicochemical parameters within the water quality standards and the quality of water is good and it is fit for drinking purpose. The parameters namely F- and PO4 3- is found as zero for all sites.

REFERENCES

Mishra K.R., Pradip, Tripathi; S.P,(2002) Groundwater Quality of Open Wells and Tube Wells, *Acta Ciencia Indica*, XXXIIIC, 2, 179.

Gupta V., Agarwal J., Sharma S.; (2008)Adsorption Analysis of Mn(VII) from Aqueous Medium by Natural Polymer Chitin and Chitosan, *Asian J. of Chem.,* 20(8), 6195-98.

Tahir M.A., Rasheed H. and Malana A.;(2008)Method development for arsenic analysis by modification in spectrphotometric technique, *Drik. Water Eng.Sci. Discuss.* 1, 135-154.

Raja R E, Lydia Sharmila, Princy Merlin, Chritopher G,(2002) Physico-Chemical Analysis of Some Groundwater Samples of Kotputli Town Jaipur, Rajasthan, *Indian J Environ Prot.*, 22(2), 137.

Patil P.R, Badgujar S.R. and Warke A.M. (2001)Evaluation Of Ground Water Quality In Ganesh Colony Area Of Jalgaon City, *Oriental J Chem.,* 17 (2), 283.

Petrus R and Warchol J.K., (2005) Heavy metal removal by clinoptilolite. An equilibrium study in multi-component systems, *Water Res.*, 39, 819-830.

Lokeshwari H and Chandrappa G.T, (2006) Impact of heavy metal contamination of Bellandur Lake on soil and cultivated vegetation, *Curr Sci.*, 91(5), 584.

Massod Alam, Sumbul Rais and Mohd AslamS; (2009)Hydro-chemical Survey of Groundwater of Delhi, India, *E-Jour. of Chem.* 6(2), 429-436.

Arvnabh Mishra, Vasishta D. Bhatt, Nirav Sevak, Pinal Shah, Kirit Patel and Chaitanya Patel; (2010)Comparative Study of Physico-Chemical and Microbial Parameters on Lotic And Ground-Waters In Selected Outlying Areas Of Central Gujarat, *J. Chem. Pharm. Res.,* 2(4), 174-177.

Elizabeth K.M. and Premnath Naik L,(2005) Effect of polluted water On human health *Poll.* res., 24(2) 337-340.

Vijender Singh;(2006) Physico-chemical Examination of water, Sewage and Industrial effluents, *Res. J. chem and ENV*, 10(3), 62- 66.

Arunabh Mishra and Vasishta Bhatt;(2008) Physico- Chemical and Microbiological Analysis of Under Ground Water in V.V Nagar and Nearby Places of Anand District,Gujarat, India, *E-J. Chem.*, 5(3), 487-492.

World Health Organization,(1993) Guidelines for drinking water quality-I, Recommendations. *2nd Ed. Geneva WHO.*

Standard Methods for the Examination of Water and Waste Water,(1998) *20th Ed., APHA, AWWA, WEF. Washington DC.*

Standard Methods for the examination of water and waste water, *American Public Health Association, 17th Ed., Washington, DC*, (1989)

Trivedy R.K and Goel P.K; (1986)*Chemical and Biological methods for water pollution studies Environmental Publication, Karad.*

Manivaskam N. (2005)Physicochemical examination of water sewage and industrial effluent, *5th Ed. Pragati Prakashan Meerut.***)**

Khan, I.A. and Khan A.A.,(1985) Physical and chemical condition in Seika Jheelat, *Aligarh, Ecol.*, **3,** 269-274.

Sudhir Dahiya and Amarjeet Kaur,(1999) physic chemical characteristics of underground water in rural areas of Tosham subdivisions, Bhiwani district, Haryana, *J. Environ Poll.***,** 6 (4), 281.

Shrinivasa Rao B and Venkateswaralu P,(2000)Physicochemical Analysis of Selected Groundwater Samples, *Indian J Environ Prot.,* 20 (3), 161.

Trivedy R. K. and Goel P. K.;(1986) Chemical and Biological methods for water pollution Studies, *Environmental Publication*, Karad.

Table No. 1. Water Sampling Sites of Akola Town

S.N.	Sample Location	Source	Symbol used
1	Hanuman nagar	Borewell	S1
2	Jatharpeth	Borewell	S2
3	Sudhir colony	Borewell	S3
4	Mothi Umri	Borewell	S4
5	Civil line	Borewell	S5
6	Jawahar nagar	Borewell	S6
7	Rautwadi	Borewell	S7
8	Durga Chauk	Borewell	S8
9	Birla Gate	Borewell	S9
10	Ramdaspeth	Borewell	S10

Table No. 2 : Average results of the Physicochemical properties of different location in the Akola town.

S.N.	Parameter	WHO	ISI	Sampling sites of the Akot Town									
				S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
1	Temperature	--	--	27	26	26	26	25	24	24	23.3	23.1	23
2	pH	7-8.5	6.5-8.5	8.0	8.0	7.9	7.8	7.8	7.5	7.5	7.4	7.2	7.1
3	EC	1400	--	1500	1563	1477	1476	1476	1250	1249	780	390	390
4	TDS	1000	500	1650	1482	520	456	456	439	411	287	110	108
5	Turbidity	5.0	10	0.2	0.2	0.2	0.2	0.2	0.15	0.15	0.12	0.00	0.00
6	DO	--	5.0	5.1	5.1	5.0	5.0	5.0	7.4	7.3	3.4	2.9	2.9
7	TA	120	200	187	178	176	121	121	120	120	119	116	116
8	TH	500	300	513	784	389	336	336	334	334	331	312	312
9	Ca^{2+}	100	75	80	77	85	72	72	34	92	76	74	74
10	MG^{2+}	150	30	147	147	147	139	139	137	132	53.7	37.1	37.1
11	Na^{+}	200	200	255	234	375	214	214	210	207	204	199	199
12	Cl^{-}	250	250	257	211	186	123	123	78.2	71.6	78.7	38.2	38.2
13	F^{-}	1.5	--	00	00	00	00	00	00	00	00	00	00
14	NO_3^{-}	5	45	1.28	0.79	0.46	0.24	0.24	0.20	0.19	0.12	0.12	0.12
15	So_4^{2-}	250	200	22.3	22.1	80.1	62.3	62.3	56.8	55.7	47.4	19.1	19.1
16	PO_4^{3-}	--	--	01	00	00	000	00	00	00	00	00	00

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