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Physico-Chemical Analysis of Bore well water Samples of Jath City, MS, India

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Manuscript details:	ABSTRACT
  Cite this article as: Mali Vidya C, Rangar Krishna K, Kumbhar Deepak A and Lavate Rajendra A (2018) Physico-Chemical Analysis of Bore well water Samples of Jath City, MS, India *Int. J. of. Life Sciences*, Special Issue, A10: 12-16. 	The study aims to find out the quality of borewell water used for drinking purpose and at household level in Jath city of Maharashtra. Underground water is the most necessary source of water. So, the present work deals with valuation of borewell water of different ten places in Jath city carried out in year 2016-2017. The Physico-Chemical Parameters such as pH, Electrical Conductivity, Dissolved Oxygen, Total Dissolved Solid, Alkalinity, Temperature, Total Hardness are studied to measure quality of water. **Key words**: Physico-chemical analysis, Borewells, drinking water. ## INTRODUCTION Water is one of the most intrinsic and most valuable natural resources. It is imperative in the life of all living organisms (Onifade, 2008). Water is fundamentally important to all plants, animals and man. It is significant due to its unique chemical and physical properties. Water is a combination of two hydrogen atoms and one oxygen atoms and its chemical formula is H_2O and known to be the most abundant compound (70%) on earth surface (Ajewole, 2005). All over the world borewell water represents the largest and most important source of fresh potable water. Borewell water is the enormous source of drinking water in both urban and rural areas. Due to increasing demand of water, most people in rural areas resort to bore-well water sources such as boreholes as an alternative water resource. Thus, humans can abstract bore-well water through a borehole, which is drilled into the aquifer for industrial, agricultural and domestic use. However, borewell water resources are commonly not secure to pollution, which may degrade their quality. Generally, borewell water quality changes from place to place according to the nature of soils, rocks and surfaces through which it moves (Seth, 2014, Okoro N 2017). In addition, human activities can change the natural composition of bore-well water through the disposal of chemicals and microbial matter on the land surface and into soils, or through injection of wastes directly into borewell water.

Industrial discharges, urban activities, agriculture can affect borewell water quality (Govindarajan, 2014). Pesticides and fertilizers applied to lawns and crops can accumulate and migrate to the water tables thus affecting both the physical, chemical and microbial quality of water. The key to sustainable water resources is to ensure that the quality of water resources are suitable for their intended uses, while at the same time allowing them to be used and developed to a certain extent. Surface water is the main source of water supply in Jath city. But due to unpredictable rainfall, high evaporation rates and low conversion of rainfall to runoff, Jath City is a water stressed city, where demand is fast approaching available supply. This, coupled with rising water consumption is placing increasing demands on the city's existing water resources.

METHODOLIGY

Analysis of Water Sample:

The water quality parameters were pH, Alkalinity, Dissolved Oxygen, Total Dissolved solid, Temperature, Electrical conductance, Hardness. These parameters analyzed by the standard methods recommended by Standard methods recommended by APHA (2005) and Trivedi and Goel (1984) for the examination of Water. Comparative table between Indian Standards (IS), Bureau of Indian Standards (BIS) and World Health Organization (WHO).

Collection of Water Samples:

The present work is outcome of during the year 2016-2017 innovations. Drinking water samples from ten randomly selected boreholes in the Jath city municipal area were collected using three sterile 250 ml plastic bottle for each sample to study the variations in physico-chemical properties as shown in Table: 2 and Fig. 1.

Study Area:

Jath is the largest Tahsil in Maharashtra which is located to the eastern part of Sangli District having total area 871.93 sqkm. Jath lays in the Krishna and Man basins and located between 20.00 to 24.51 degrees to the north latitude while it is about 74.56 to 77.56 degrees to the east longitude having the elevation of 567 m above msl (Fig.1). Jath stands last regarding rainfall in Maharashtra state with an average rainfall about 449.5 mms. The average summer temperature is 25^0-40^0 C and average winter temperature is 20^0-27^0 C. It has been historically demographic part of Man Desh.
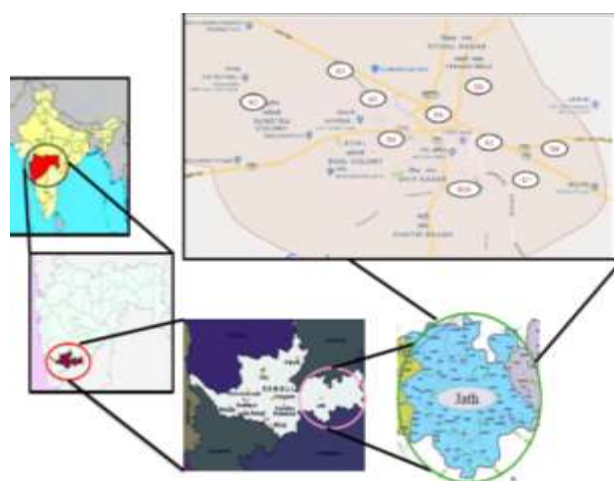
Fig: 1 Shows Sample Locations Such as S1 = Shivanubhav Mandap, S2 = R. R. college, S3= Datta colony, S4 = Mangalvar Peth, S5 = More colony, S6 = Vidya nagar, S7 = Laxmi nagar, S8 = Sainik nagar, S9 = Anand Ground, S10= Ramrao Nagar.

Table: 1 Water Standards for ISI, BIS and WHO.

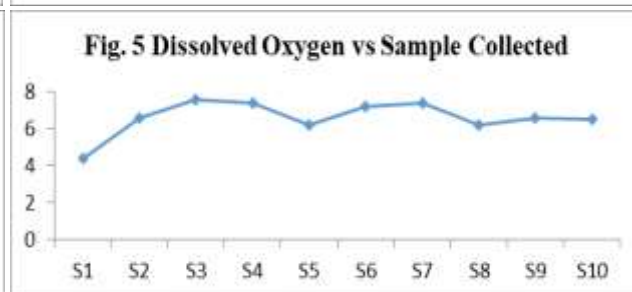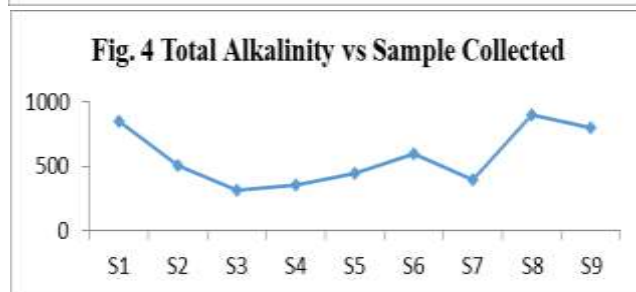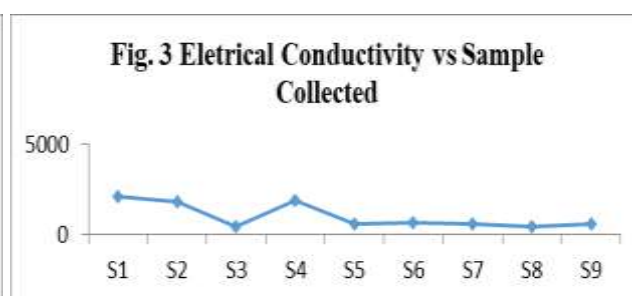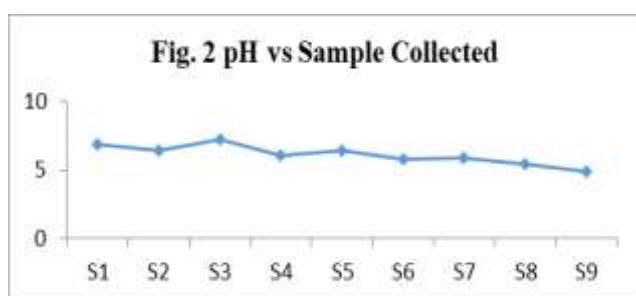| Sr. No.	Parameters	IS	BIS	WHO
1.	pH	6.5 – 7.5	6.5 – 7.5	7 - 8
2.	Electrical Conductivity	--	--	1400
3.	Total Alkalinity	200 - 600	600	--
4.	Dissolved Oxygen	--	--	--
5.	Temperature	--	--	--
6.	Total Dissolved Solid	500 – 2000	2000	1000
7.	Total Hardness	200 - 600	600	100

RESULTS AND DISCUSSION

1. pH:

It is an important ecological parameter in aquatic habitat. Since most of the organisms are adopted to an optimum pH range and to not withstand small changes.

pH value of samples in the study area varied from 4.91 to 7.2 with mean 6.13 indicating slightly acidic in nature. The limit of pH value for drinking water is specified as 6.5 to 8.5. (IS 2012). pH below 6.5 causes corrosion in pipe. Their by realizing toxic metals such as cadmium, zinc, copper (Shrivastava and Patil, 2002). The pH

Table : 2 Physico-Chemical Analysis of Bore-well Water Samples of Jath City.

S. N.	Parameters	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
1	pH	6.84	6.40	7.2	6.0	6.4	5.79	5.85	5.44	4.91	6.5
2	Eletrical Conductivity (μmho/cm)	2100	1800	400	1900	560	620	560	440	560	670
3	Total Alkalinity (ppm)	850	504	320	360	450	600	400	900	800	550
4	Dissolved Oxygen mg/lit	4.4	6.6	7.6	7.4	6.2	7.2	7.4	6.2	6.6	6.5
5	Temperature (^{0}C)	24	26	28	26	25	26	26	24	25	25
6	Total Dissolved Solid (ppm)	1400	507	1125	1132	578	883	676	500	1700	750
7	Total Hardness (ppm)	260	253	320	352	260	230	240	270	320	250

Fig. 2 pH vs Sample Collected

Fig. 3 Eletrical Conductivity vs Sample Collected

Fig. 4 Total Alkalinity vs Sample Collected

Fig. 5 Dissolved Oxygen vs Sample Collected

Fig : 6 Temperature vs Sample Collected

Fig : 7 Total Dissolved Solid vs Sample Collected

Fig : 8 Total Hardness vs Sample Collected
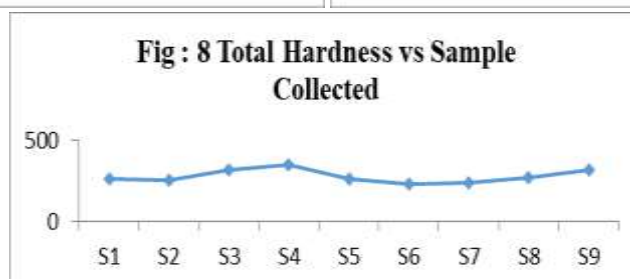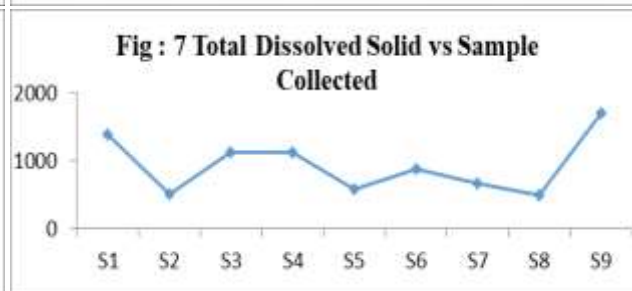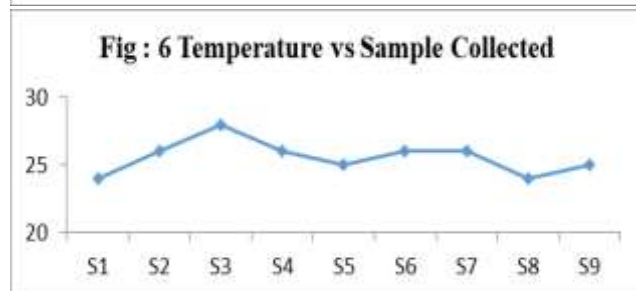
values of samples collected at S1, S3 and S10 are within permissible limits and that of S2, S4, S5, S6, S7, S8 and S9 are below the permisible limits as shown in Fig : 2

2.   Electrical Conductivity:

The ability of an aqueous solution to conduct the electric current is known as Electrical conductivity (EC). Electrical Conductivity is a useful tool to evaluate the purity of water (Acharya, 2008). It is a measure of the ability of a solution to conduct an electric current which depends upon the presence of free ions, mobility, nutrient status, variations in dissolved solid contents and temperature of water. Generally, borewell water tends to have high electrical conductivity due to the presence of high amount of dissolved salts. Electrical conductivity is a measure of water's capacity to conduct electric current. The electrical conductivity of the water samples ranged between 290µmho/cm to 2100µmho/cm at all the sampling sites. The mean conductivity was found to be 961µmho/cm. S3 had the least value of 400µmho/cm and highest value is of S1 i.e. 2100 µmho/cm as shown in Fig : 3.

3.   Total Alkalinity:

The value of alkalinity in water provides an idea of natural salts present in water. The cause of alkalinity is the minerals which dissolve in water from soil. It is usually imparted by the salts of weak acids. The alkalinity of the water sample ranged between 320ppm to 900ppm at all the sampling sites as shown in Fig : 4. The mean alkalinity was found to be 573.4 ppm. The IS limits of alkalinity 200ppm – 600ppm. The alkalinity values of samples collected at S1, S8 and S9 are above the standard limits. The excess of alkalinity could be due to the minerals, which dissolved in water from mineral rich soil. The various ionic species that contribute mainly to alkalinity includes bicarbonates, carbonates, hydroxides, phosphates, borates, silicates and organic acids. In some cases, ammonia or hydroxides are also accountable to the alkalinity (Sawyer *et. al.,* 2000).

4. Dissolved oxygen: Dissolved oxygen is an intrinsic parameter in water quality assessment and biological processes prevailing in the water. The DO values indicate the degree of pollution in the water bodies. The presence of DO enhances the quality of water and also acceptability. The dissolved water of the water sample ranged between 4.4mg/lit to 7.6mg/lit. The mean dissolved oxygen was found to be 6.61mg/lit. The IS limits of dissolved oxygen 4mg/lit – 7mg/lit. The

dissolved oxygen values of samples collected at S3, S6 and S7 are above the standard limits as shown in Fig : 5.

4.   Temperature:

Temperature is one of the most essential parameters in water. It affects the physical and chemical properties of water and also affects the aquatic vegetation, organisms and their biological activities. The temperature of water sample ranged between 24ºC and 28ºC as shown in Fig : 6.

5.   Total dissolved Solids:

Total dissolved solids (TDS) denote mainly the various kinds of minerals present in water. The total dissolved solids of water sample ranges from 507ppm to 1400ppm. The mean value of total dissolved solid was found to be 825.1 as shown in Fig : 7. The IS limits of total dissolved solid 500ppm - 2000ppm. All total dissolved solids of water samples are in safe level. It elevates the density of water and reduces solubility.

6.   Total Hardness:

It ranges between 320ppm to 320ppm. The mean of total hardness was found to be 275.5ppm. The IS limits of total hardness 15 ppm – 375 ppm as shown in Fig : 8. Hardness in water is caused by certain salts held in solution Total hardness of water is caused by the presence of Ca & Mg salts. The most common are the carbonates, fluorides and sulphates of calcium and magnesium. The principal hardness causing cations are calcium, magnesium, strontium, ferrous and manganese ions. The cations plus the most important anions that contributes are bicarbonates, sulphates, chlorides, nitrates and silicates. The hardness may be advantageous in certain conditions; it prevents the corrosion in the pipes by forming a thin layer of scale, and reduces the entry of heavy metals from the pipe to the water (Shrivastava , 2002).

CONCLUSION

The important physico-chemical parameters of bore well water samples collected from 10 locations in Jath city during 2016-17. It was observed that pH values of S1, S3 and S10 are normal as per ISI and BIS. As per WHO standards only the S3 shows normal pH. All other samples are showing slightly acidic nature. Electrical Conductivity values are normal as per WHO standard except at S1, S2, and S4. Total alkalinity values are

normal as per ISI and BIS standard except S1, S8 and S9. Values of Total Dissolved Solids are normal as per ISI standards while according to WHO standards they are less at S2, S5, S6, S7, S8 and S10 and greater at S1, S3, S4 and S9. Total Hardness values are normal in all samples. Only very few samples showed values above or below the desirable limits. So it states that all drinking water quality parameters were found well within suitable limit for all studied water samples prescribed by ISI, BIS and WHO. Therefore the water from all Bore-wells is suitable for drinking as per specifications.

Though alkalinity is high but is in the permissible limit. Total dissolved solids, pH, Conductivity are in the standard limits. Therefore, the water should be subjected to softening methods and also boiling before used for drinking. It is only S3 water sample is most suitable for drinking and domestic use.

Overall observation reveals that the borewell water quality of Jath City is currently very good as there is no any percolation of industrial effluents. But there are no gutters constructed in the city except in few regions. Again it is necessary to construct and clean the central stream as well as to strengthen the gutters to avoid percolation of dirty polluted water. The sewage water must be pre-treated and then disposed of into the environment to minimize the contamination for avoiding health hazards.

Acknowledgement:

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