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COMPARATIVE STUDY OF PHYSICO CHEMICAL CHARACTERISTICS OF WATER QUALITY IN BHAMA RIVER & BORE WELL, PIMPARI (BK), PUNE

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Abstract

Water pollution is an acute problem in India which is causing health problems for the people staying in those areas. Taking this into account I tried to study the physico chemical properties of water of Bhama river & it's bore well which is most commonly used to fulfil their daily needs by the people staying in that area. The physico chemical parameters of Bhama river water namely pH , turbidity, total dissolved solids, alkalinity and hardness, phosphate content, chloride content, chemical Oxygen demand and sulphate content were measured every year thrice in the month of December for the three consecutive years i.e.2009, 2010 & 2011 by collecting water samples from the river & bore well on 1st ,16th & 31st December every year. The purpose was to assess the quality of water from the sources in pre winter and winter season because during this period the water quality varies due to atmospheric changes and there is lot of dampness in the air due to heavy moisture content .This leads to variation the physical parameters of water and also enhances the growth of microbes in the water beds. The values obtained for these parameters are pH: 7.51, hardness17.4 mg/lit, phosphate 0.98mg/lit, chloride content: 42.6ppm/lit, Chemical oxygen demand) 120mg /lit respectively. Coli forms microbial characteristics & mineral oils were not found in the well water. As lots of microbes are present in the water, they can be analysed for further analysis its quality.

Keyword: Bhama River, Post monsoon, hardness, turbidity, pH.

INTRODUCTION

Water is the most abundant molecule on the earth surface comprising of about 70% of the earth surface as liquid and solid state in addition to being found in the atmosphere as vapour.

There is dynamic equilibrium between the liquid and vapour state at standard temperature

and pressure . At room temperature, it is nearly colourless, tasteless and odourless liquid, many substances are dissolved in water and it is commonly referred to as the universal solvent. Water plays a very important role in our

lives for it is very important role in our lives for it is very useful for our lives for it is very useful for our bodies as well as keeping ourselves clean. It is an essential requirement for the growth of flora and fauna in various ecosystems. The chemical and physiological process of organisms involves utilization of water in some form or the other water plays an essential role in several life activities. The prime sources of water for drinking, irrigation and other domestic purposes are the water bodies such as river and lakes (Solanki et al 2006). The most unfortunate part which is disturbing all of us is the disposal of sewage, industrial wastes and also the human activities which keep on polluting these water bodies (Khathavkar et al.2004). It has become our prime responsibility to maintain the quality of water from such water samples from rivers and lakes creates an excellent platform to the study of various physicochemical parameters of water namely pH . turbidity, total dissolved solids, alkalinity and hardness, phosphate content, chemical oxygen demand(COD) and sulphate content(Eswaralal Sedamkar and Angadi,S.B 2003).

OBJECTIVE

Water pollution is an acute problem in all the major rivers and dams in India. Water is known to contain a large numbers of chemical elements (Hutchinson, 1957).The interactions of both the physical and chemical properties of water play a significant role in composition, distribution and abundance of aquatic organisms(Mustapha and Omotosho, 2005). In the wake up increasing urbanization and industrialization, the pollution potential of Bhama River is giving momentum day by day.

Though physicochemical characteristics of many water bodies have been studied by many researchers from time to time (Mathew Koshy and T.Vasudevan Nayer.1999) still a large number of water bodies have been left untouched. Taking this into consideration it became essential to study the water quality of Bhama River & its bore well which is the only source of water for the people staying in the Pimpri (Bkd), in order to make a provision of good quality of water for these people.

RESEARCH METHODOLOGY

A major area of interest in studies of stream water quality is the evaluation of trends over time in certain constituent concentrations that can be attributed to human activities.

Many causes of water pollution including sewage and fertilizers contain nutrients, (such as nitrites (NO₃-), sulphates (SO₄-2), and phosphates (PO₄-3). If added in excess levels, nutrients over stimulate the growth of aquatic plants and algae. Excessive growths of these types of organisms consequently clog our waterways. Pollution is also caused when silt and other suspended solids, such as soil, wash of ploughed, construction and logging sites, urban areas and eroded riverbanks when it rains. Pollution in the form of organic matter enters waterways in many different ways as sewage leaves and grass clipping. When natural bacteria and protozoan in the water break down this organic material, they begin to use up the oxygen dissolved in the water. Many types of fish and bottom dwelling animals cannot survive when dissolved oxygen drops below two or five part per million.

Since Bhama River is the only source of water available in the area it receives heavy loads of domestic sewage which is organic and it is a waste of biological oxygen demand and also the industrial effluents from small and large scale industries. Hence to define the paucity of drinking water the samples of bore well water and Bhama river water were compared which were collected at the same time and same day.

Three water samples were collected in the month of for each year i.e. Dec 2013, Dec 2014 & Dec 2015. The samples were of grab or catch samples and collected in sterilized bottles using the standard procedure in accordance with the standard method of American Public Health Association (1995). Spectrophotometer (Digital Systolic Range 340 to 960 u/m) was used for analysis and chemicals used were of analytical grade.

Analysis

Variation of pH, parameters was analyzed graphically by plotting graphs against temperature on those particular dates.

Parameters and methods employed in the chemical examination of water samples are as follows:

Sr. No. Parameters of water analysis Methods

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2

3

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8

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14.

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16.

17. Odor

Temperature

pH

E.C.

B.O.D

C.O.D.

Chloride

Sulphate

Phosphate

Zinc

Copper

Manganese

Lead

Ammonia

Total hardness

Coli forms (cfus/100ml)

Microbial characteristics

Mineral oil Smelling

Thermometric

Potentiometric

Conductometric

Azide modification

Dichromate reflux

Gravimetric

Spectrophotometric

Spectrophotometric

Spectrophotometric

Titrimetric

Titrimetric

Titrimetric

Titrimetric

Microbial test

Titrimetric

Report of Bhama river water analysis of Pimpari (Bk)

The water parameters data collected from Bhama River is as follows:

TABLE I WATER PARAMETERS ON 1ST DECEMBER OF 2013, 2014 & 2015

Sr.

no	Parameter	Result				Inference
1st Dec 2013						
(T 280 C)	Dec 2014					
1st						
(T 270 C)	Dec 2015					
1st						
(T 280 C)	Standard specifications					Inference
1	Color	Colorless	Colorless	Colorless	Colorless	Ok
2	pH	7.51	7.7	7.66	5.5 to 9	Ok
3	Electrical conductivity	0.475 mmhos	0.48mmhos	0.48mmhos	1.05mmhos	Ok
4	C.O.D	201.8 mg/lit	201mg/lit	199.7mg/lit	250 mg/lit	Ok
5	B.O.D	21.0 mg/lit	21.4mg/lit	20.9mg/lit	30 mg/lit	Ok
6	Copper	0.691 mg/lit	0.693mg/lit	0.692mg/lit	3 mg/lit	Ok
7	Lead	0.57 mg/lit	0.66mg/lit	0.59mg/lit	2 mg/lit	Ok
8	Phosphate	1.3 mg/lit	1.33mg/lit	1.32mg/lit	5 mg/lit	Ok
9	Zinc	1.31 mg/lit	1.33mg/lit	1.31mg/lit	5 mg/lit	Ok
10	Nickel	0.60 mg/lit	0.62mg/lit	0.615mg/lit	3 mg/lit	Ok
11	Manganese	0.31 mg/lit	0.295mg/lit	0.3mg/lit	2 mg/lit	Ok

12	Ammonia	13.6 mg/lit	13.5mg/lit	13.2mg/lit	100 mg/lit	Ok
13	Micro					

Organisms

found Arcella valgaris, Paramoecium, Nostoc, Spe.of Diatoms Arcella valgaris, Paramoecium, Nostoc, Spe.of Diatoms Arcella valgaris, Paramoecium, Nostoc, Spe.of Diatoms

TABLE II WATER PARAMETERS ON 16TH DECEMBER OF 2013, 2014 & 2015

Sr.no	Parameter	Result				
		16th Dec 2013 (T 270 C) Dec 2014				
		16th (T 270 C) Dec 2015				
		Standard specifications	Inference			
1	Colour	Colourless	Colorless	Colorless	Colorless	Ok
2	pH	7.52	7.6	7.61	5.5 to 9	Ok
3	Electrical					
	conductivity	0.474 mmhos	0.477mmhos	0.48mmhos	1.05mmhos	Ok
4	C.O.D	200.3 mg/lit	200.6mg/lit	199.7mg/lit	250 mg/lit	Ok
5	B.O.D	21.72mg/lit	21.77mg/lit	20.9mg/lit	30 mg/lit	Ok
6	Copper	0.695 mg/lit	0.697mg/lit	0.698mg/lit	3 mg/lit	Ok
7	Lead	0.54 mg/lit	0.60mg/lit	0.582mg/lit	2 mg/lit	Ok
8	Phosphate	1.294 mg/lit	1.332mg/lit	1.341mg/lit	5 mg/lit	Ok
9	Zinc	1.332 mg/lit	1.334mg/lit	1.316mg/lit	5 mg/lit	Ok
10	Nickel	0.604 mg/lit	0.607mg/lit	0.60mg/lit	3 mg/lit	Ok
11	Manganese	0.313 mg/lit	0.304mg/lit	0.303mg/lit	2 mg/lit	Ok
12	Ammonia	13.25 mg/lit	13.54mg/lit	13.33mg/lit	100 mg/lit	Ok
13	Microorganisms found	Arcella valgaris, Paramoecium, Nostoc, Spe.of Diatoms			Arcella valgaris, Paramoecium, Nostoc, Spe.of Diatoms	

TABLE III WATER PARAMETERS ON 31ST DECEMBER OF 2013, 2014 & 2015

Sr.no	Parameter	Result
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31st Dec 2013 (T 260 C) Dec 2014

31st (T 270 C) Dec 2015

31st (T 250 C) Standard specifications Inference

1	Colour	Colourless	Colorless	Colorless	Colorless	Ok
2	pH	7.59	7.68	7.5	5.5 to 9	Ok
3	Electrical					
	conductivity	0.468 mmhos	0.479mmhos	0.448mmhos	1.05mmhos	Ok
4	C.O.D	200.3 mg/lit	199.0 mg/lit	198.7mg/lit	250 mg/lit	Ok
5	B.O.D	21.73 mg/lit	21.77mg/lit	20.97mg/lit	30 mg/lit	Ok
6	Copper	0.694 mg/lit	0.693mg/lit	0.694mg/lit	3 mg/lit	Ok
7	Lead	0.54 mg/lit	0.61mg/lit	0.58mg/lit	2 mg/lit	Ok
8	Phosphate	1.28 mg/lit	1.31mg/lit	1.334mg/lit	5 mg/lit	Ok
9	Zink	1.28 mg/lit	1.292mg/lit	1.302mg/lit	5 mg/lit	Ok
10	Nickel	0.601 mg/lit	0.609mg/lit	0.61mg/lit	3 mg/lit	Ok
11	Manganese	0.311 mg/lit	0.33mg/lit	0.322mg/lit	2 mg/lit	Ok
12	Ammonia	13.22 mg/lit	13.52mg/lit	13.13mg/lit	100 mg/lit	Ok
13	Microorganisms found	Arcella valgaris, Paramoecium, Nostoc, Spe.of Diatoms	Arcella valgaris, Paramoecium, Nostoc, Spe.of Diatoms	Arcella valgaris, Paramoecium, Nostoc, Spe.of Diatoms	Arcella valgaris, Paramoecium, Nostoc, Spe.of Diatoms	Ok

Water analysis of bore well water of Pimpari(Bkd)

The water parameters data collected from bore well and their comparison with the ISI specification of potable water

TABLE I BORE WELL WATER PARAMETERS ON 1ST DECEMBER OF 2013, 2014 & 2015

Sr. No Parameter Result

1st Dec 2013

(T 280 C) Result

1st Dec 2014(T 270 C)		Result	
1st Dec 2015(T 280 C)		ISI Desir	
able	Limit	Re	mark
1	pH	7.24	7.27 7.78 6.5 to 8.5 Ok
2	Electrical Conducti		
vity	0.646 mmho	0.655 mmho	0.675mmho < 0.20 mml High
3	Carbonate	7200 ppm/lit	6993ppm/lit 7209ppm/lt 300 mg/lit High
4	Bicarbonate	63440 ppm/lit	63558 ppm/lit 63448ppm/lit 300 mg/lit High
5	Total Hardness	40.1mg/lit	39.4mg/lit 38.3mg/lit 17 mg/lit High
6	Calcium	12.1 mg/lit	13.6mg/lit 12.6mg/lit 21 mg/lit Average
7	Phospho		
rous	0.98 mg/lit	0.97mg/lit	0.98mg/lit < 0.3 mg/lit Ok
8	Acidity	0.063	0.07 0.065 - Ok
9	Chlorine	42.6 ppm/lit	42.8ppm/lit 42.9mg/lit 250 mg/lit High
10	BOD	13.2 mg/lit	14.6mg/lit 13.5mg/lit 30 mg/lit Ok
11	COD	120 mg/lit	124mg/lit 120.5mg/lit 250 mg/lit Ok
12	Colour	Colourless	Colourless Colourless Colourless Ok
13	Taste	Agreeable	Agreeable Agreeable Agreeable
14	Coliforms (cfus/		
100ml)			
Microbial characteristics	Not found	Not found	Not found 1 to 10 /lit Ok
15	Mineral oil	Not found	Not found Not found 0.01 mg/lit Ok

TABLE II BORE WELL WATER PARAMETERS ON I6TH DECEMBER OF 2013, 2014 & 2015

Sr. No.	Parameter	Result				
16th Dec 2013						
(T 270 C)	Result					
16th Dec 2014						
(T 270 C)	Result					
16th Dec 2015						
(T 260 C)	ISI Desirable					
Limit	Re					
mark						
1	pH	7.14	7.17	7.21	6.5 to 8.5	Ok
2	Electrical					
	Conducti					
vity	0.642 mmho	0.651 mmho	0.644mmho			
	< 0.20 mml	High				
3	Carbonate	7188 ppm/lit	6999ppm/lit	7203ppm/lit	300 mg/lit	High
4	Bicarbonate	63456 ppm/lit	63511 ppm/lit	63442 ppm/lit	300 mg/lit	High
5	Total Hardness	32.6mg/lit	37.8mg/lit	39.6mg/lit	17 mg/lit	High
6	Calcium	12.08 mg/lit	13.1mg/lit	11.09mg/lit	21 mg/lit	Average
7	Phospho					
rous	0.966 mg/lit	0.98mg/lit	0.966mg/lit	< 0.3 mg/lit	Ok	
8	Acidity	0.067	0.072	0.068	-	Ok
9	Chlorine	41.8 ppm/lit	42.3ppm/lit	42.63ppm/lit	250 mg/lit	High
10	BOD	12.6 mg/lit	13.8mg/lit	13.0mg/lit	30 mg/lit	Ok
11	COD	120.6 mg/lit	124.3mg/lit	119.8mg/lit	250 mg/lit	Ok
12	Colour	Colourless	Colourless	Colourless	Colourless	Ok
13	Taste	Agreeable	Agreeable	Agreeable	Agreeable	

14	Coliforms (cfus/100ml)	Not found	Not found	Not found	1 to 10 /lit	Ok
15	Mineral oil	Not found	Not found	Not found	0.01 mg/lit	Ok

TABLE III BORE WELL WATER PARAMETERS ON 31ST DECEMBER OF 2013, 2014 & 2015

Sr. No.	Parameter	Result				
31st Dec 2013						
(T 260 C)	Result					
31st Dec 2014						
(T 270C)	Result					
31st Dec 2015						
(T 250 C)	ISI Desire					
able						
Limit	Re					
mark						
1	pH	7.13	7.19	7.09	6.5 to 8.5	Ok
2	Electrical Conductivity	0.636 mmho	0.658 mmho	0.637mmho	< 0.20 mml	High
3	Carbonate	7109 ppm/lit	6998ppm/lit	6895pm/lit	300 mg/lit	High
4	Bicarbonate	63437 ppm/lit	63547 ppm/lit	61997pm/lit	300 mg/lit	High
5	Total Hardness	30.4mg/lit	33.7 mg/lit	41.2 mg/lit	17 mg/lit	High
6	Calcium	12.5 mg/lit	13.7mg/lit	14.2mg/lit	21 mg/lit	Average
7	Phosphorous	0.94 mg/lit	0.96mg/lit	0.93mg/lit	< 0.3 mg/lit	Ok

8	Acidity	0.061	0.072	0.056	-	Ok
9	Chlorine	41.7 ppm/lit	42.6ppm/lit	42.3ppm/lit	250 mg/lit	High
10	BOD	13.7 mg/lit	14.9mg/lit	12.9mg/lit	30 mg/lit	Ok
11	COD	120.5 mg/lit	124.2mg/lit	118mg/lit	250 mg/lit	Ok
12	Colour	Colourless	Colourless	Colourless	Colourless	Ok
13	Taste	Agreeable	Agreeable	Agreeable	Agreeable	
14	Coliforms (cfus/ 100ml)					
	Microbial characteristics	Not found	Not found	Not found	1 to 10 /lit	Ok
15	Mineral oil	Not found	Not found	Not found	0.01 mg/lit	Ok

Comparative graphs

Graphical Presentation of COD value of both Bhama River and Bore well water

Figure 1

Graphical Presentation of Electrical conductivity of both Bhama River and Bore well water

Figure 2

RESULTS & DISCUSSION:

Variation of pH between 7.13- 7.7 indicates that the water of both river & bore well is practically neutral & is fit for drinking. As pH does not bring major health hazards, Dissolved Oxygen plays an important role in assessing the quality of water. Saturation of oxygen gives taste to water. Results show that the B.O.D. & C.O.D. values of both, river as well as bore well water are well within the ISI desirable limits.

Presence of contents of chlorine does not make difference in the taste of water. But the high contents of sulphates, phosphates, calcium, carbonates & bicarbonates make water hard, hence increases the total hardness of water, which is the case of Bhama River water.

Electrical Conductivity:

Values of Electrical conductivity for Bhama river water are 0.48 mmhos which is less than the standard value i.e. 1.05mmhos; hence this doesn't affect the taste of water. But the values of bore well water are on higher side. High EC indicates a large quantity of dissolved minerals, salt thereby making it sour and unsuitable for drinking. Similar observation was also reported by Srivastava and Shina (1996)

BOD

BOD is the amount of oxygen required by the bacteria to stabilize the decomposable organic matter. The aim of BOD test is to determine the amount of biochemically oxidisable carbonaceous matter (Gupta et al., 2003). The BOD values indicate absence of sewage water and sedimentation in both the river and bore well water.

COD

COD is the amount of oxygen consumed during the chemical oxidation of organic matter using strong oxidizing agent like acidified potassium dichromate. The values of COD indicate absence of any chemical effluent in the bore well and river water.

Total hardness

In most of the fresh water total hardness is imparted mainly by the Calcium and Magnesium ions, which apart from Sulphate, Chloride and Nitrates are found in combination with carbonates and bicarbonates. In the present study of total hardness of bore well water is high, which indicates that it is not fit for drinking purpose. Although hard water has no known effect on health but it is unsuitable for domestic use. It also forms heat insulating scales in the boilers thereby reducing their efficiency (Ashish Kumar and Yogendra Bahadur, 2009).

Chloride

Chlorides are found in practically all natural waters. This is the most common inorganic anion present in water. Man and animals excrete high quantities of chlorides therefore it indicates sewage contamination. Variation observed is usually associated with the hydrology of the basin (Ownbey and Kee, 1967). In the bore well water the chloride concentration has been found to be on higher side. High concentrations of chloride give a salty taste to water. Taste thresholds for the chloride anion depend on the associated cation like calcium whose value is on average level.

Acidity

The comparative values indicate that the acidity of bore well water is within agreeable limits due to subdued values of carbonates and bicarbonates in the water.

Conclusion

Water quality standard vary significantly due to different environmental conditions, soil of river beds and ecosystem. The presence of microorganisms in the Bhama river water proves the desirable values of BOD and COD. It also shows the alkaline character of water which makes it fit for drinking. The analysis of bore well water clearly indicates that it should neither be used for drinking purpose nor for domestic work without suitable treatment.

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