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ANALYSIS OF POTABLE WATER QUALITY IN BERHAMPUR TOWN ODISHA

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ABSTRACT: With regard to testing of the different samples from sampling points of Berhamapur town, Odisha; it can be concluded that in Bijipur town (bore well), Balaji Nagar (bore well), Sastri Nagar (deep bore well) and Muthipadara (bore well) respectively showing high level of contamination or pollutant level. In many parameters like, pH- which indicates little acidic, TDS- maximum in Muthipdara (Borewell), TSS- maximum in Balaji Nagar (bore well), another important point like redox-potential in Balaji Nagar (bore well); which indicates high amount of solids, salts, ions, etc. Also the lowest value of dissolved oxygen in Balaji Nagar (bore well)Hardness and chloride also found maximum in the Balaji Nagar (bore well)So, in the present investigation it was found that the maximum parameters were found beyond the level of the WHO guideline limits in the deep bore well and the old bore wells. As compared to aqua-purifier and open well, they were more polluted and not suitable for the drinking purposes. The municipal supply drinking water is safer as compare to these polluted areas. Improper waste disposal practice, decrease in ground water level (due to deep bore well digging within a short area by many people), use of old bore wells, eutrophication of organic wastes to the water bodies and ultimately leads to the drinking water.
Key words: Water quality, BOD, Bore well water, TDS

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INTRODUCTION

Water is the most important constituent of life and also it is the most important of all natural resources; known on earth. Almost 2/3rd of earth's surface is covered by water. Water is considered as a superb solvent and a critical component that make the process of life possible. Due to availability of minerals in water, it is essential for survival of life on earth [1]. The quality of drinking water is a powerful environmental determinant of health. According to WHO, 80% diseases in the world are caused by inadequate sanitation, pollution and contaminated drinking water sources. Water is essential to sustain life, and a satisfactory (adequate, safe and accessible) supply must be available to all. Improving access to safe drinking-water can result in tangible benefits to health. Every effort should be made to achieve a drinking-water quality as safe as practicable. Safe drinking-water, as defined by the WHO guidelines, does not represent any significant risk to health over a lifetime of consumption, including different sensitivities that may occur between life stages. Those at greatest risk of waterborne disease are infants and young children, people who are debilitated or living under unsanitary conditions and the elderly. Safe drinking-water is suitable for all usual domestic purposes, including personal hygiene. [2].Safety is a foundation for the prevention and control of water borne diseases.

There are many chemicals that may occur in drinking-water; however, only a few are of immediate health concern in any given circumstance. The priority given to both monitoring and remedial action for chemical contaminants in drinking-water should be managed to ensure that scarce resources are not unnecessarily directed towards those of little or no health concern.

In Odisha there are some studies about physio-chemical analysis of surface and ground water and waste water by some workers. The physio-chemical analysis of surface and ground water of Baragarh town [3]. Their study about dug well and bore well water of Baragarh town indicates that both type of ground water is not polluted and satisfy the requirement for the use of various purposes (domestic, agricultural, industrial). But the study of pond water indicates that ponds are highly polluted and unsafe for human use. The value of iron and turbidity was found in higher range in most of the locations which may be due to leaching of toxic substances of municipal solid waste into the ground water in the Bhubaneswar location [4].

The main objective of this work to analyze various physio-chemical analysis of the ground water borewell water, municipal (Berhampur municipal supply) water, and different deep bore well water along with the tap water and aqua purifier, from different locations of the Berhamapur town, Ganjam district, Odisha; which is used by the people in the city dominantly for drinking purposes. So the aim was to check the quality of drinking water, whether it is safe for the drinking purpose or not, as compare to the standards provided by WHO [5] and FEPA [6].

MATERIALS AND METHODS

Berhamapur is a municipal corporation located on the eastern coastline of Ganjam district of the Indian state Odisha, about 169 kilometers south of the state capital and 255 kilometers north of the Visakhapatnam. It is the oldest and is one of largest cities of Odisha, and also known as "The Silk City". Berhampur lies approximately at 19.32 N and 84.78 E. It rises to height of 27 meters or 88 feet above the mean sea level.

SAMPLING

The drinking water for physic-chemical analysis were sampled from the site of consumers in prewashed (with detergent, and rinsed two times with double distilled water and dried in hot air oven at 30˚C) polyethylene bottles from the different sampling stations of Berhampur town. The water samples have been collected from both open and bore wells of various depths, municipal supply water and tap water points, which were frequently used by the peoples for drinking purposes. After sampling, bottles were stored in cool place for laboratory analysis. Temperature was measured while collecting the samples, with the help of mercury-in-glass thermometer graduated in degree Celsius (-10 to 110˚C). Water samples from the selected sites were collected during July-December 2015 and brought to the laboratory and processed within 5 hour of collection. The samplings were done in the morning season in between 7 am to 9 am. The sampling were done from 10 different locations of Berhampur town, including Khallikote University, Bijipur, RCM (P.G.) hostel, Sastri Nagar , Tatabenz Square, Ramalingaum Road, Muthipadara near new bus stand, Panitanki (BMC) supply water point and Balaji Nagar. Which includes aqua-purifier water, dug well, bore well, deep bore well, Berhampur municipal supply drinking water.

Physiochemical Analysis

Physio-chemical parameters of collected water samples like pH, temperature, odour, test, dissolved oxygen, chloride, total suspended solids, total dissolved solids, chemical oxygen demand, biological oxygen demand, redox potential, ammonia, total alkalinity, total hardness were analyzed [7].

Table No.1: The area of location or the sampling points are as follows:

S.No.	Area of sampling (location)
1	Khallikote University campus. (Aqua-purifier water)
2	Old petrol pump square, Bijipur town. (Bore well water)
3	R.C.M.(P.G.) Hostel (Aqua-purifier water)
4	Panitanki (BMC supply water)
5	Tatabenz square. (open well)
6	Ramalingam Road (bore well)
7	Bijipur (bore well)
8	Balaji Nagar (bore well)
9	Sastri Nagar (deep bore well)
10	Muthipadara (Bore well)

RESULTS AND DISCUSSIONS

The results of Physio-Chemical study of all pond are given in Table No.2

Table No:2 : Physio-chemical parameters studied in different water samples with WHO standard

Area of sampling / Parameters.	Khallikote University (Aquaguard)	Old petrol pump square Bore well	R.C.M.(P.G.) HostelAqu aguard	Panitanki (BMC supply)	Tatabenz sq.(open well)	Ramalingam Road (borewell)	Bijipur (bore well)	Balajinagara (bore well)	Sastrinagara (deep bore well)	Muthipadara (Bore well)	WHO
Temp (℃)	27.9℃	27.6℃	27.9℃	28.2℃	28.1℃	28.0℃	27.5℃	28.1℃	28.2℃	28.0℃	<35℃
pH	7.7	6.6	7.6	6.5	7.2	6.4	6.4	6.2	6.6	6.5	6.5-8.5
TDS(g/L)	0.04	1.160	0.160	0.940	0.740	0.740	0.160	0.880	1.220	1.00	0.500
TSS(g/L)	0.00	0.04	0.04	0.10	0.12	0.02	0.20	0.56	0.00	0.24	
RedoxPotential (milli volt)	0±2	68±3	7±4	72±2	63±2	84±2	78±1	98±1	74±2	75±1	
D.O.(mg/L)	6.256	5.449	5.651	3.633	7.266	2.220	3.229	1.614	5.045	3.431	
Total Hardness(g/L)	0.1030	0.1931	0.0708	0.2253	0.2124	0.3090	0.2124	0.8435	0.5151	0.2189	0.200
Chloride(g/L)	0.0852	0.1846	0.0710	0.1420	0.1846	0.2840	0.1846	0.7242	0.6390	0.2130	0.250
BOD (mg/L)	0.986	2.622	0.594	0.402	2.172	0.603	2.016	0.805	2.218	0.660	10
COD (mg/L)	211.2	176.0	35.2	105.6	176.0	70.4	211.2	352.0	176.0	457.6	0.250
Total alkalinity (g/L)	0.608	1.267	0.778	0.949	0.314	0.384	1.024	0.677	0.704	0.336	
Carbonate (CO_3^{--}) g/L	0.096	0.096	0.120	0.120	0.168	0.336	0.000	0.360	0.216	0.312	0.200 to 0.600
Bicarbonate (HCO_3^-)g/L	0.512	1.171	0.658	0.829	0.146	0.048	1.024	0.317	0.488	0.024	
Ammonia (mg/L)	0	0	0	0	0	0	14.50	0	0.75	4.25	
Odour and Taste	palatable	palatable	palatable	palatable	palatable	palatable	bitter	bitter	brackish	palatable	Agreeable

Temperature

In the present study, there was no great difference between the temperatures of the dug well, bore well, deep bore well and aqua-purified water. And all the samples were fall in between the guide lines limits by WHO. Researchers [8] have reported the similar range of temperature in their investigation in between 24.75°C to 28.5°C [8].

pH

All the samples were fall in between the guidelines limits by WHO. Dissolved gases and industrial wastes and affect the pH value of water and this finally changes the test of drinking water. In the present study the maximum pH value was found in the sample number-1, which indicates the alkaline nature of water and might be due to the high temperature that reduces the solubility of CO_2 .Including the sample number-1, two other samples; i.e. in the sample number-3 and sample number-5 and the other remaining samples were fall between the pH ranges 6.4 to 6.6; which indicates little acidic. Abnormal values of pH cause bitter taste to water, which affects mucous membrane and causes corrosion..Similar findings also reported by many workers [9] had reported pH ranged between 5.0 to 8.5 and [3] the pH range of potable water was in between 6.72±0.68 to 7.55±0.50.

Total dissolved solids

Total dissolved solids in all the samples were found in between the range 4 mg/L to 1.220 g/L. out of which many samples shows, beyond the guidance limit given by WHO. It was also found that only in the aqua-purifier water were shows the lowest value. And all other samples including open well, bore well and deep bore well were found more concentration of dissolved solids and the maximum value was found in the deep bore well sample. i.e. (1.220 g/L).In the deep bore well sample the dissolved solid found in more amounts, which was beyond the level of limits and it was may be due to the geographical and soil or the over pumping activity. Various types of water soluble minerals and organic matters denote total dissolved solid. High concentrations are generally not harmful to humen beings but may affect persons who are suffering from kidney and heart diseases. High TDS, elevates the density of water, influences osmo regulation of fresh water organism, reduces solubility of gases and reduces utility of water for drinking, irrigation and industrial purposes. Continuous consumption of water with high TDS content can cause gastro-intestinal irritation. The maximum value of TDS was recorded which reflects the pollution of deep bore well.

Reports of authors [3] and [10] showed that the TDS was in between the ranges 100.91±12.14 mg/L to 120.78±0.40 mg/L, 90.2 mg/L to 118 mg/L and 2900 ppm respectively^] . The TDS were in between 668 ppm to 942 ppm as compare to the other workers the present result was comparatively too high which indicates the high pollution level in many samples [11].

Total suspended solids

Total suspended solids in all the samples were found in between the range 0.00 g/L to 0.560 g/L. It was found that in aqua-purifier water samples and in some other bore well samples the concentration was low i.e. within the WHO guideline limits. In sample number-8, 10, and 5, TSS was little bit high. The TSS value which ranged in between 41.95±1.13 mg/L to 82.05±0.53 mg/L[3]. Water high suspended solid maybe aesthetically unsatisfactory for bathing. The total suspended solids are composed of carbonates, bicarbonates, chlorides, phosphates and nitrates of calcium, magnesium, sodium, potassium, manganese, organic matter, salt and other particles. The effect of presence of total suspended solids is the turbidity due to slit and organic matter.

Redox-potential

The redox-potential were ranged between 0±2, and 98±1. The maximum value was found in the sample number-8 (bore well) and the lowest in sample number-1 (aqua-purifier). According to the findings of some workers the electrical conductivity was ranged in between the range of 378.4±130.2 µmhos/cm to 117.3±91.01µmhos/cm. The redox-potential is direct function of its total dissolved salts [12].

Dissolved oxygen

In the present investigation, it was found that the maximum value in the sample number-5 (7.226 mg/L), and the lowest value found in the sample number- 8 (1.614 mg/L). According to the WHO guideline only one sample fulfills the criteria, and others were below the limit. It indicated that other samples were not getting the saturation point to bring the level of DO. High amount of DO gives good taste to drinking water. Similar results were also reported by different workers; In a case study, the estimated DO was in between the range 4.8±0.76 mg/L to 6.30±0.17 mg/L, 3.4 to 7.8 ppm respectively [3].

Total hardness

From the present study it was found that in most of the samples were excess the beyond limit (given by WHO). In the sample number- 8, 9, 6; indicates the presence of pollutants in these samples. The lowest value was found in the sample number-3. High amount of hardness in drinking water leads to heart diseases and kidney stone problems. Exceeding the permissible limit of hardness causes poor lathering with soap, deterioration of the quality of clothes, scale formation and skin irritation. However other workers reported slightly high hardness values as compare to the present investigation. [10] reported the total hardness values between the range 115 to 960 ppm,222.8 mg/L to 1094.4 mg/L respectively.

Chloride

From the present study it was found that in most of the samples were excess the beyond limits given by WHO. In the sample number-8, 9, 6 maximum values was reported by us and lowest value was found in sample number- 3. It indicates the sample number-8, 9, 6 were more contaminated or polluted. Similar study reported the chloride content in between the range 4.8±0.76 mg/L to 6.30±0.17 mg/L, 3.4 to 7.8 ppm respectively [3].

Biochemical Oxygen Demand

The maximum BOD level was recorded in the sample number- 2, and lowest in the sample number- 4.But all the samples were present within the WHO guideline limits. Ground water with high value of BOD is due to microbial activities related to the dump sites.

Chemical Oxygen Demand

The maximum value of COD was found in the sample number- 10. And the lowest value in the sample number- 3. Many of the samples were beyond the WHO guideline limits. Water with high COD indicates that there is inadequate oxygen available in the water samples. So COD determines the oxygen required for chemical oxidation of organic matter.COD values convey the amount of dissolved oxidizable organic matter including the non-biodegradable matters present in it. Results showed that the COD of dug well water ranged from 2.15±0.16 mg/L to 2.64±0.14 mg/L, while present investigation reported too high COD values in samples [3].

Total Alkalinity

The maximum value for alkalinity was found in the sample number- 2 and the lowest value was found in the sample number- 5.High amount, results in unpleasant taste to water and it turns boiled rice to yellowish colour. Alkalinity of water was caused mainly due to OH, CO_3, HCO_3 ions. Alkalinity is an estimate of the ability of water to resist change in pH upon addition of acid. Low temperature brings down the rate of decomposition of salts to a minimum there by increasing the alkalinity.

It was found that around all the samples, except three samples; the alkalinity level was too high, indicating poor qualities of the water. Authors have reported that the alkalinity in the potable water samples and surface water samples ranged in between 11.75±1.16 mg/L to 13.17±0.96 mg/L, 100 to 650 mg/L, 0.0 to 1930 mg/L respectively [3] and [10].

Ammonia

Out of the all samples, only in three samples ammonia was found i.e. in sample number- 7, 9, and 10 (14.50, 0.75, 4.25 mg/L respectively), two samples, were exceed from the prescribed WHO limits, and showing that those samples were more polluted. These two sampling points were present near a pond which is polluted and in the pond many organic matters were littered and macrophytes were grown, and also about a distance of 30 meters litter dump yard were present, Hence it was expected that ammonia came from the organic matters through the soil pores and contaminated or polluted the ground water sources.

Odour and taste

Out of the all water samples, it was found that in the two samples i.e. in the sample number- 7, 8 showing the bitter taste, which indicates the samples, were not good for health and in the sample number- 9 showing the brackish taste; which indicates the samples were polluted.

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REFERENCES

[1] Venkatesan,G, Swaminathan, G,and Nagarajan R. 2013. Study of groundwater quality in and around soil waste landfill site at Tiruchirappalli, Tamilnadu, India, Int. J. of Environmental Engineering,2013-vol.5,No. pp. 176-196.

[2] WHO, Geneva 1992. "Guidelines for Drinking Water Quality, Volume.1, Recommendations" 3rd Ed.1992

[3] Mahananda, M.R. , . Mohanty,B.P. and. Behera N.R 2010. Physicochemical Analysis of surface and ground water of Bargarh district, Odisha, India. IJRRAS, 2(3), 284-295.

[4] Mishra,S, Mohanty, S.K. and Rout,S.P. 2013. Physicochemical analysis of ground water near municipal solid waste dumping site in bhubaneswar municipal corporation, odisha. IJPAES,3(3),05-16

[5] World Health Organization WHO. Geneva, Switzerland.1984: Joyce Morrissey Donohue, Charles O. Abernathy, Peter Lassovszky, George Hallberg. "The contribution of drinking water to total dietary intake of selected trace mineral nutrients in the United States".

[6] FEPA. Washington D.C. 2010. "Drinking water Contaminants: Microorganisms". 2010 -09-21.

[7] Gupta, P.K. 2001. Methods in Environmental Analysis: Water, soil and air (Methods in Environmental Analysis: Water, Agrobios (INDIA), pp. 33-71.

[8] Shyamala R, Shanthi M, Lalitha P. 2008. Physicochemical analysis of Borewell water samples of Telungupalayam Area in Coimbatore District, Tamilnadu, India. E-Journal of Chemistry, 5(4): 924-929.

[9] Umavathi S, Longakumar K, Subhashini. 2007. Studies on the nutrient content of Sulur pond in Coimbator, Tamil Nadu. Journal of Ecology and Environmental Conservation, 13(5): 501-504

[10] Gupta, D.P., Sunita and. Saharan, J.P.2009. Physiochemical analysis of ground water of selected area of Kaithal city (Haryana) India. Researcher, 1(2), ISSN: 1553-9865.

[11] Shukla D, Kinja,B, Jain N.K, and Modi ,H.A. 2013. Physicochemical Analysis of water from various sources and their comparative studies. IOSR Journal of Environmental science, Toxicology and Food Technology. E-ISSN: 2319-2402, p-ISSN: 2319-2399. Volume 5, Issue 3 (Jul-Aug. 2013), pp. 89-92.

[12] Keremah R.I., Davies O.A., Abezi I.D. 2014. Greener Journal of Biological Sciences. Vol. 4 (2), pp. 033-038.

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