Physicochemical Comparison of Ikogosi Spring and Bottled Water

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ABSTRACT

Water is very important for life, it is a useful resource for domestic, industrial and agricultural purposes. Water samples were taken for analysis from Ikogosi warm spring. Cold water (S1), warm water (S2), mixture of warm and cold water (S3) at a definite distance, distilled water (S4) and Gossy water (S5) samples were obtained. All the water samples were tasteless and odorless and they are clear in appearance. Sample 1, 2, 3 and 4 had the temperatures of 37^0C, 26^0C, 30^0C, 25^0C respectively. S1 value was highest in temperature due to the direct flow of water from the rock, but for the sample 5, Gossy bottled water was already refined to the ambient temperature of 25^0C. The concentrations of alkalinity, total hardness, sulphate (SO_4^{2-}), nitrate (NO_3^-), chloride (Cl^-) were all below WHO guidelines value. The turbidity of all the samples is within the tolerable range set by WHO. The results of some of these parameters are however below the quality standard specification for ground water meant to be used for consumption.

Keywords: Physicochemical Comparison, Ikogosi Spring, Bottled Water, Gossy Bottled Water, WHO, Turbidity, Consumption, Ground Water

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1. INTRODUCTION

Water is very important for life; we need water to drink, to wash our hands, to cook, to water plants and many other things. Water is a useful resource for domestic, industrial and agricultural purposes and it's important to man cannot be overemphasis due to its essentiality in body metabolism and proper functioning of cells (Mihayo and Mkoma, 2012). All plants and animals must have water to survive, if there was no water there would be no life on heart. Apart from drinking to survive, people have many other uses for water. These include Cooking, washing their bodies, washing clothes, washing cooking and eating utensils; such as billies, sauce pans, crockery and cutlery, keeping houses and communities clean, recreation; such as swimming pools, keeping plants alive in gardens and parks (Mariette, 2018). Ikogosi Warm Spring is about 55 km from Akure, the Ondo State capital, Nigeria. Ikogosi is located in Ekiti West L.G.A.

The warm spring roll down over at hilly landscape ay seventy degrees, from another hill rises a cold spring which joins the warm spring at a confluence at the end maintaining a temperature of 37^{0}C. Together they form a continuous stream. The whole landscape with its green vegetables is fascinating. The immediate surroundings of the spring (resort centre) is about 31.38 hectares and is protected from erosion by tall evergreen trees, forming a canopy under which tourists can relax. The aim of this research is to access the suitability of Ikogosi's portable water, spring's cold water and warm water for human consumption by estimating its physicochemical parameter in comparison with prescribed standards.

2. MATERIALS AND METHODS

2.1 Sample Collection and Preparation

Water samples were collected from Ikogosi warm spring at the outlets points. Cold water sample (S1) was obtained at the cold spring source, warm water sample (S2) was obtained from water source. The mixture (S3) was obtained at confluence point which has a warm temperature. A distilled water sample (S4) was obtained from the organization as well as the bottled Gossy water (S5). All the samples were conditioned and place in sample bottles. The samples were later transferred to the Osun State Polytechnic's Analytical Laboratory where analyses were carried out. All analyses were carried out according to the methods described by Association of Analytical Chemist (AOAC, 2010). The determinations were carried out in triplicate.

3. DISCUSSIONS

Table below represents the physicochemical parameters of water samples obtained from Ikogosi water Spring. The samples include cold water from source (S1), Warm water from source (S2), mixture of the warm and cold (S3), distilled water sample (S4), and bottled Gossy water (S5). Parameters like pH, temperature and conductivity were determined at sample points whereas other parameters were determined in the laboratory. pH value of warm and cold spring complies with the pH standard of World Health Organization (WHO) they fall in the range of 5.9 and 6.8 and the pH of warm and cold spring water mixture also comply to the standard of W.H.O. same with Gossy table water's pH (6.8). We know that every pH of water is 7.0, if it is greater than 7 is an alkaline, therefore, the pH of distilled water is exactly 7.0 due to change and forms which pH test was carried out on it. So, the distilled water also conforms to the W.H.O standard which is the exact value for pH in water. This pH has a mean of ±6.24 and standard deviation of ±0.62 and coefficient of variance of 9.75% that makes the water okay. pH value is the logarithm of reciprocal of hydrogen ion activity in moles per litre.

Conductivity indicates the presence of ions within the water usually due to elemental composition in the sample majorly caused by leaching. It can also indicate industrial discharges. Therefore, the W.H.O standard for conductivity in water is 1200µS/cm. The samples comply to the standard of W.H.O which are 93.0, 46.0 and 87.0 for the warm and cold spring water and mixture respectively. Gossy bottled water falls between the standard of W.H.O. the only sample with the highest conductivity is the distilled water with 169 µS/cm. This is an indication that the purer the water the freer the ability to conduct. The mean of the measurement is 83.8 and Standard Deviation is 51.3. The assessment of these waters samples complies with W.H.O standard.

Temperature can exert great control over aquatic communities if the overall water body temperature of a system is altered, an aquatic community shift can be expected. Temperature was measured here in degree Celsius (^{0}C); The maximum point indicated by W.H.O is 37^{0}C. The warm spring water sample (S1) of Ikogosi do not exceed this point at the time the sample was taken. It is also a point to note that the sample looks clearer compared to other samples which could be due to the influence of the heat energy on it.

The cold water sample (S2) has a temperature of 26.0^{0}C. the mixture at confluence (S3) has a temperature of 29.8^{0}C, the distilled water sample has 26.0^{0}C and also Gossy bottled water has temperature of 25.0^{0}C. the samples didn't exceed the maximum temperature recommendation of W.H.O. The mean of the result is 28.8 and Standard Deviation is 4.95.

Turbidity may be due to organic or inorganic constituents. Organic particulates may harbor microorganisms. Thus, the turbidity conditions may increase the possibility for water borne disease; therefore, the maximum standard for turbidity recommended by W.H.O is 5.0NTU. all the samples has turbidity below the maximum recommendation point. The warm spring sample (S1) has a value of 0.61 NTU, cold spring sample (S2) has 3.85NTU, mixtures of cold and warm spring sample (S3) has 0.62 NTU and the distilled water sample (S4) has 0.37NTU. the Gossy sample(S5) has no observable turbidity value, that is 0.00NTU. The samples values ranges from 0.00-3.85 NTU and the mean is 1.09 and Standard Deviation of 1.56. The only water that does not have impurities is the Gossy bottled water which have been treated and free from microorganisms and turbidity; the cold spring is more turbid than the warm spring.

Total dissolved solid in mg/L of warm spring (S1) is 62.3 and that of cold spring (S2) is 30.8, the mixture (S3) is 58.3, the distilled sample (S4) is 113 whereas the Gossy water sample (S5) is 16.1. All the samples fall below the maximum value for dissolved solid of 1500mg/l. the distilled water sample presented an unexpected value but this could be due to processes the water was made to pass through. Dissolved solid is a measure of the dissolved combined content of all inorganic and organic substances present in the solution in molecular, ionized or micro granular suspended forms.Alkalinity of water is generally due to the presence of carbonate and hydroxide ions. The alkalinity ranges of the samples are from 3.00-8.00mg/L. The average value with standard deviation is 5.40±1.81. All the samples fall below the maximum value of 100mg/L which makes them to conform with W.H.O standard. The alkalinity of warm sample source S1 is 5.00 while that of cold water source S2 is 3.00, the mixture (S3) is 6.00, the distilled water sample is 5.00 whereas the Gossy water sample has 8.00.all the samples comply with the standard stipulated by W.H.O.

Nitrate NO_3^- is the end product of decomposition of organic matter and indicates the organic matter present in water is fully oxidized and it is not harmful anymore. From the table above, the nitrate ranges from 1.08-2.40mg/L with a mean value and standard deviation of 1.64±0.51. All the samples fall below the maximum value of 50mg/L stipulated by W.H.O. The nitrate value of S1 (warm spring) is 1.50mg/L, cold spring (S2) is 1.34mg/L, the mixture (S3) is 2.40mg/L, the distilled sample (S4) is 1.89mg/L whereas the Gossy water sample (S5) is 1.08. Iron Fe^{2+} in water may be present in dissolved, colloidal or suspended form. Generally, the ferric form is predominant in natural water. The values of Iron in the samples are below the maximum permissible level as indicated by W.H.O. standard. The values of iron in the samples ranges from 0.02 – 0.05mg/L with the mean and standard deviation of 0.03±0.012. The value for S1 (warm spring water) is 0.03, S2(cold spring water) is 0.02, S3 (mixture) is 0.03, S4 (distilled water sample) is 0.02 whereas S5 (the Gossy water sample) is 0.05. For sample S5, the ion exchange resin purifier could be responsible for slight increase observed.

Calcium (Ca^{2+}) occurs in water mainly due to the presence of limestone, gypsum, dolomite and gypsiferrous materials. The ranges of calcium content of the water samples ranges from 6.41 -22.2mg/L. the maximum permissible level has not been determined by W.H.O. standard. This is an indication that calcium content negative effect on consumer's health has not been determined. Cold water sample S1 has a value of 8.02mg/L, warm water sample S2, has a value of 9.62mg/L, mixture S3 has a value of 10.4mg/L, the distilled water sample S4, has a value of 6.41mg/L whereas Gossy water sample S5 has a value of 22.4mg/L. Iron exchange treatment of processed water could be responsible this high value obtained. Magnesium (Mg^{2+}) salts occur in natural waters, sea waters. The range of Magnesium content in the samples ranges from 3.42-8.78mg/L. Cold water sample S1 has a value of 8.78mg/L, warm water sample S2 has a value of 5.86mg/L, the mixture sample S3 ha a value of 5,86mg/L, the distilled water sample S4 has a value of 3.42mg/L whereas the Gossy water sample S5 has a value of 8.30. As stated above, ion exchange process could be responsible for the observed value.

4. CONCLUSIONS

From the results obtained in this research, all the water samples contain physicochemical parameters which are below the maximum permissible limit for drinking water. S1 , the warm water sample was highest in term of total water hardness beside the Gossy water sample which could have been made hard through ion exchange process. Gossy water sample also exhibited higher elemental content , the reason is also suggested to be as a result of the processes the water was made to pass through. The nitrate, turbidity, alkalinity, total dissolved solid, pHand conductivity values are below the maximum values for portable water. The temperature value of warm water sample is not beyond the maximum value for water body so as to be able to support living organism. Microbiological assessment of these water samples could give vivid insight to their portability.

Table 1: Physicochemical Parameters of Water Samples from Ikogosi Spring Water

Parameters	Units	MP: WHO Standard	S1	S2	S3	S4	S5	Range
pH at 20^{O}C	^{O}C	6.50-9.50	5.9	6.8	5.6	7.0	6.8	5.6-7.0
Conductivity	µs/cm	1200µs/cm	93.0	46.0	87.0	169	24.0	24.0-169
Temperature	^{0}C	37^{0}C	37.0	26.0	29.8	26.0	25.0	25.0-37.0
Total Dissolved Solid	mg/L	1500mg/L	62.3	30.8	58.3	113	16.1	16.1-113
Turbidity	NTU	5.0NTU	0.61	3.85	0.62	0.37	0.00	0.00-3.85
Chloride (Cl^{-})	Mg/L	250mg/L	6.99	7.99	18.0	9.99	11.0	6.99-18.0
Fluoride	Mg/L	1.5mg/L	0.34	0.25	0.37	0.28	0.24	0.24-0.37
Sulphate(SO_4^{2-}	Mg/L	500mg/L	3.00	4.00	1.00	2.00	2.00	1.00-4.00
Alkalinity	Mg/L	100mg/L	5.00	3.00	6.00	5.00	8.00	3.00-8.00
Nitrate NO_3^{2-}	Mg/L	50mg/L	1.50	1.34	2.40	1.89	1.08	1.08-2.40
Calcium hardness $CaCO_3$	Mg/L	200mg/L	20.0	24.0	26.0	16.0	56.0	16.0-56.0
Total hardness	Mg/L	500mg/L	56.0	48.0	50.0	30.0	90.0	30.0-90.0
Magnesium hardness $CaCO_3$	Mg/L	20mg/L	36.0	24.0	24.0	14.0	34.0	14.0-36.0
Iron (Fe^{2+})	Mg/L	3mg/L	0.03	0.02	0.03	0.02	0.05	0.02-0.05
Manganese(Mn)	Mg/L	0.4mg/L	0.01	0.01	0.01	0.02	0.01	0.01-0.02
Calcium(Ca^{2+})	Mg/L	ND	8.02	9.62	10.4	6.41	22.4	6.41-22.4
Magnesium(Mg^{2+})	Mg/L	20mg/L	8.78	5.86	5.86	3.42	8.30	3.42-8.78
Copper(Cu^{2+})	Mg/L	2.0mg/L	0.05	0.04	0.05	0.04	0.05	0.04-0.05
Chromium(Cr^{6+})	Mg/L	0.05mg/L	0.03	0.02	0.03	0.03	0.04	0.02-0.04
Sodium(Na)	Mg/L	200mg/L	4.54	5.19	12.0	6.49	7.14	4.54-12.0

REFERENCES

1. Braun, Charles, L. and Sergei N. Smirnov (1993): Why is Water blue? *Journal of Chemical Education*. 70(8); 612.
2. Debenedetti, Pablo, G. and Stanley, H. Eugene. (2003): "Super cooled and Glassy Water" *Journal of America Institute of Physic*, S-0031-9228-0306-020-4
3. Leigh, G.J, H. A. Favre and W. V. Metanomski (1998): Principles of Chemical Nomenclature, guide to IUPAC Recommendations. *Online journal of Blackwell Science,* last modified 23, May 2006.
4. Campbell *et al.,* (2007) Biochemistry 6th (sixth) edition. Publication of Amazon.com.
5. Dawney, B. and Pearce, J.M. (2012): Optimizing Solar Water Disinfection (SODIS) Method by Decreasing Turbidity with NaCl. *The journal of water, sanitation and Hygiene for Development* 2(2) pp 87-94.
6. Lewis William Cudmore Mccullagh and Rice, James (1922): chemistry, physical and theoretical, Quantum theory, Thermodynamics. A system of physical chemistry publication. 2(3).
7. Mihayo I. Z. and Mkoma S. L. (2012): Chemical Water Quality of Bottled Drinking Water Brands Marketed in Mwanza City, Tanzania. *Research journal of chemical sciences*. 2(7) pp 21-26.
8. Business Dictionary (2019): m.businessdictionary.com/definition. Lastly modified 2019.
9. International Organization for Standardization 9000 (1987): Quality management systems. A publication of international organization for standardization.
10. Water chemistry (2011): chapter 7, Introduction to Volunteer Water Quality Monitoring Training Notebook. pp 1.
11. Mariette Mifflin. (2018): How is Water made Portable or Safe to Drink. A publication of The Spruce- a part of Dotdash Publishing Family. Last updated 09/29/18.

Development Of An Improved Palm Vein Recognition System Using A Swarm Intelligent Based Support Vector Machine

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