African Journal of Environment and Natural Science Research
ISSN: 2689-9434
Volume 5, Issue 2, 2022 (pp. 27-35)
www.abjournals.org

PHYSICO-CHEMICAL AND METAL COMPOSITION OF SOME SACHET AND BOREHOLE WATER IN IMOTA COMMUNITY AREA OF LAGOS STATE, NIGERIA

Adeyemi Maria M.*, Olayemi Ifeoluwa O.,

Olemoh Afeez O., and Abegunde Folorunsho

Department of Chemistry and Biochemistry, Caleb University Lagos Nigeria

*Corresponding author contact: maria.adeyemi@calebuniversity.edu.ng

Cite this article:

Adeyemi M.M., Olayemi I.O., Olemoh A.O., Abegunde F. (2022), Physico-Chemical and Metal Composition of Some Sachet and Borehole Water in Imota Community Area of Lagos State, Nigeria. African Journal of Environment and Natural Science Research 5(2), 27-35. DOI: 10.52589/AJENSR-8CKPIWPW.

Manuscript History

Received: 11 Aug 2022

Accepted: 24 Sept 2022

Published: 18 Oct 2022

ABSTRACT: *The accessibility of quality water is an essential factor for preventing diseases and improving good quality of life. The physico-chemical parameters of sachet and borehole water in some selected locations of Imota Community of Lagos State was studied. Physico-chemical parameters such as colour, temperature, pH, salinity, electrical conductivity (EC), total dissolved solids (TDS) and heavy metals such as copper, magnesium, manganese and cadmium were determined following standard methods. All water samples were colourlesss with a temperature range of 27.1°C to 29°C at the point of collection. The physico-chemical properties ranges were: salinity (0.01–3.8), pH (2.10–7.52), electrical conductivity (1.5–200 µS/cm), micro voltage (22.7–184) and total dissolved solids (19.8–576 mg/L). Caleb University Ventures water was the only sample with a neutral pH of 7.52. The concentrations of metals in the selected water samples were within the permissible limit of USEPA (2022) and WHO (2017) guidelines. The study showed that physical water quality parameters such as pH, salinity, EC and TDS have variations at different locations, which suggests that different soil types, storage systems and environmental activities could interfere with the physico-chemical parameters. The water samples from Imota Community had low level of pollutants as indicated by the physico-chemical properties of the water. However, standard methods of water treatment should be maintained by the community to ensure the purity of water available for domestic use, so that problems commonly associated with impure and unclean water can be averted.*

KEYWORDS: Sachet water, Borehole, Caleb University, Heavy metals, Imota Community, Physicochemical.

Article DOI: 10.52589/AJENSR-8CKPIWPW
DOI URL: https://doi.org/10.52589/AJENSR-8CKPIWPW

African Journal of Environment and Natural Science Research
ISSN: 2689-9434
Volume 5, Issue 2, 2022 (pp. 27-35)

www.abjournals.org

INTRODUCTION

Water is the predominant chemical component of living organisms, which consists of hydrogen and oxygen atoms. Its unique physical properties include the ability to solvate a wide range of organic and inorganic molecules. Water can be defined as a chemical substance with two atoms of hydrogen and one atom of oxygen, with a molecular formula of H_2O. Water is a reactant or a product in many metabolic reactions. It is created by the direct reaction of hydrogen with oxygen. Water pollution due to man-made activities, especially dumpsite and lack of concern towards environmental sanitation, has been identified as a threat to public health as leachates from these dumpsites percolate into the underground. Over the years, groundwater from boreholes has been the main water supply in Nigeria due to inadequate circulation of government-provided piped water. Clean, fresh drinking water is essential for humans and other life forms (Egbueri et al., 2022).

Access to drinking water has improved steadily and considerably over the past decades in almost all regions of the world. There is a correlation between access to drinking water and GDP per capita. However, some observers have estimated that by 2025, more than half of the world's population might face water-related vulnerability, hence the need to preserve and maintain water quality (CDC, 2022; Egbueri et al., 2022; Ladipo et al., 2011; Ogundele & Mekuleyi, 2018). Water treatment and purification process involves a variety of steps which include storage, coagulation, filtration and disinfection (CDC, 2022; SDWF, 2017). Water to be used for human consumption must meet certain requirements; the quality of water required for specific application is as important as the availability of sufficient quantity of water. Thus, water treatment projects were indicated to improve its quality using various means including physical and chemical methods of disinfections involving the addition of chlorine compounds such as hypo-chlorides, chlorine dioxide and inorganic chloro amines. Surface waters are usually contaminated and require treatment before being used as drinking water. Ground water supplies free of surface drainage are better sources of drinking water (CDC, 2022) but could be contaminated from environmental activities.

The production of potable water requires further treatment to remove potential pathogens, eliminate taste and odour, reduce metals such as manganese and cadmium as well as decrease turbidity which is a measure of suspended solids. Physico-chemical quality is used to determine the acceptability of water as well as to determine its physical and chemical properties (WHO, 2004, 2017). The physicochemical properties of water that are of significant correlation to water quality and potability are pH, hardness, temperature, salinity, odor, color, residual chlorine, total dissolved solids (TDS), dissolved oxygen, total suspended solids (TSS) and turbidity (WHO, 2004; USEPA 2022).

Article DOI: 10.52589/AJENSR-8CKPIWPW
DOI URL: https://doi.org/10.52589/AJENSR-8CKPIWPW

African Journal of Environment and Natural Science Research
ISSN: 2689-9434
Volume 5, Issue 2, 2022 (pp. 27-35)
www.abjournals.org

MATERIALS AND METHODS

Study Area

Imota is located at 6º 40′ 0″ North and 3º 40′ 0″ East of Ikorodu in Lagos State, South-West Nigeria. It is situated along Ikorodu-Itoikin road of Lagos State (Figure 1). It is a residential community which hosted a faith-based institution of higher learning, an international outstanding university with quality educational and moral standards—Caleb University, Imota, Lagos (Swiss Golden Trophy Award, 2021).

Figure 1: Pictorial Representation of the Geographical Location of Imota Community

Collection of Samples

The study was conducted between February and May 2022. Sachet and borehole water samples were collected in February 2022 from different locations at Imota Community. The locations were selected due to the different activities carried out in the identified areas (Table 1) following methods described by APHA (2005), Ogundele and Mekuleleyi (2018) and CDC (2022). Prior to sampling, sample bottles (1L) were pretreated by soaking them in 10% nitric acid (AnalR grade) for 24h and rinsed with distilled water. The physico-chemical parameters analysed were temperature, pH, salinity, electrical conductivity, micro voltage and total dissolved solids. The heavy metals analysed were Copper (Cu), Magnesium (Mg), Manganese (Mn) and Cadmium (Cd), following a method reported by Baker et al. (2008).

Article DOI: 10.52589/AJENSR-8CKPIWPW
DOI URL: https://doi.org/10.52589/AJENSR-8CKPIWPW

African Journal of Environment and Natural Science Research
ISSN: 2689-9434
Volume 5, Issue 2, 2022 (pp. 27-35)

www.abjournals.org

Table 1: Name and Location of Water Samples Collected

S/N	SAMPLE NAME	LOCATION	Source
A.	CKG Global Water	Itamorisha, Oriokuta Imota, Lagos State	Sachet water
B.	B.M Water	Odo Aiyo Street, Imota	Sachet water
C.	Emis Water	Adeogun Street, Imota	Sachet water
D.	Pure Life Water	Oriokuta, Imota	Sachet water
E.	Imota Market A	Imota Market, part A	Borehole
F.	Imota Market B	Imota Market, part B	Borehole
G.	Demolack	Demolack Ventures, Imota	Borehole
H.	Caleb University	COPAS Building	Borehole
I.	Caleb University	Joshua Hall	Borehole
J.	Caleb University	Elisha Hall	Borehole
K.	Caleb University	Administrative Block	Borehole
L.	Caleb University	Joseph Hall	Borehole
M.	Caleb University	Architecture building	Borehole
N.	Caleb University Ventures	Caleb Campus	Sachet Water
O.	Ajegunle	Imota, Lagos State	Borehole
P.	Itunmoja	Imota, Lagos State	Borehole

Article DOI: 10.52589/AJENSR-8CKPIWPW
DOI URL: https://doi.org/10.52589/AJENSR-8CKPIWPW

African Journal of Environment and Natural Science Research
ISSN: 2689-9434
Volume 5, Issue 2, 2022 (pp. 27-35)

www.abjournals.org

RESULTS AND DISCUSSION

The physico-chemical properties of selected water samples as indicated in Table 4.1 show that all water samples are colourlesss with a temperature range of 27.1^{o}C to 29^{o}C at the point of collection. The physico-chemical properties ranges are salinity (0.01–3.8), pH (2.10–7.52), electrical conductivity (1.5–200 µS/cm), micro voltage (22.7–184) and total dissolved solids (19.8–576 mg/L). Samples collected showed that the physico-chemical parameters of water samples from selected locations differ. The pH of water is very important because it has an effect on the organisms living in the aquatic ecosystem (Tepe & Boyd, 2002). pH controls vital metabolic processes like respiration, which is the process by which living organisms produce energy (Adenosine Triphosphate) required for their activities. Water samples collected are below the pH standards set by the World Health Organization which is 6.5–8.5 which could be as a result of a high concentration of dissolved CO_2 in water, as stated by USEPA (2022) except Caleb University Ventures water, which has a pH of 7.52. This carbon dioxide can come from the atmosphere and air around polluted water. This causes the water to have a lower pH than neutral. Organic matter and living things also contain the element carbon (C), so when the decomposition process occurs, carbon is released into the water (Klemmel et al., 2022). The pH values of the water samples are similar to the findings of Ogundele and Mekuleyi (2018) from Agbara Industrial area but lower than pH values from Badagry Creek (Ndimele & Kumolu-Johnson, 2012).

Pure water is not a good conductor of electric current; it is rather a good insulator. Electrical conductivity measures the ability of the water samples to conduct electric current. Salinity and total dissolved solids (TDS) are used to calculate the EC of water, which helps to indicate the level of purity. The purer the water, the lower the electrical conductivity. The electrical conductivity of water samples in this research (15–200 µS/cm) was within the permissible limits set by WHO. The EC values are lower when compared with previous findings from Obeng (2015) and Ogundele and Mekuleyi (2018), with a conductivity range of 125.6 µS/cm–1139.0 µS/cm.

TDS is a measure of the dissolved combined content which consists of inorganic salts and organic matters that may have originated from various sources such as effluent discharge, sewage and natural bicarbonate. TDS content in water is a measure of salinity and its high content affects the density of water, influences freshwater organisms and reduces the solubility of gases (like oxygen). According to WHO, the permissible limit for TDS in water is 500mg/L. All water samples are within the permissible limit set by WHO except the borehole water from Ajegunle which is slightly above the permissible limit with TDS of 576 mg/L indicating that the water samples can be used for domestic and agricultural purposes. Findings from this study are similar to the report of Ogundele and Mekuleyi (2018) and Egbueri et al. (2022). However, the TDS in this study is higher than the values reported by Ndimele and Kumolu-Johnson (2012).

The presence of heavy metals in some of the samples may be due to the poor disposal of solid waste, which contributes greatly to the degree of pollution in developing countries. The concentrations of metals in the selected water samples are within the permissible limit of USEPA (2022) and WHO (2017) guidelines. Manganese acts as a cofactor of several enzymes involved in metabolic processes necessary for the skeletal development, reproductive function, oxidative phosphorylation and enzymes whose activities modulate insulin secretion (Lee et al., 2013). Copper serves as a cofactor for enzymes such as cytochrome oxidase, lysyl oxidase and

Article DOI: 10.52589/AJENSR-8CKPIWPW
DOI URL: https://doi.org/10.52589/AJENSR-8CKPIWPW

ceruloplasmin (Adeyemi & Osilesi, 2022). All the values of heavy metals in this study are lower than those reported by Ogundele and Mekuleyi (2018), Kamaruzzaman et al. (2011) and Mortuza and Al-Misned (2017).

Table 2: Physicochemical Properties of Selected Water Samples

Sample code	Source	Temp (°c)	pH	Salinity	Electrical Conductivity (µm)	Micro voltage	TDS (mg/L)
A	Sachet	29	5.47	0.02	40	94.8	33.6
B	Sachet	28	2.70	0.04	135	154.4	68.2
C	Sachet	27.1	5.10	0.01	81	86.0	22.0
D	Sachet	28.6	5.17	0.04	40	85.7	65.9
E	Borehole	28.9	5.42	0.02	40	85.7	26.8
F	Borehole	29.1	5.40	3.8	31	117.9	0.02
G	Borehole	28.9	4.04	0.01	95	100.3	19.8
H	Borehole	29.1	5.24	0.01	64	76.1	23.7
I	Borehole	28.7	5.25	0.01	54	101.7	22.9
J	Borehole	27.7	5.50	0.01	33	86.6	21.1
K	Borehole	28.0	4.40	0.02	22	102.7	25.8
L	Borehole	28.5	5.17	0.02	16	82.3	25.2
M	Borehole	27.9	5.00	0.02	15	98.5	29.2
N	Sachet	28.6	7.52	0.10	65	22.7	149

Article DOI: 10.52589/AJENSR-8CKPIWPW
DOI URL: https://doi.org/10.52589/AJENSR-8CKPIWPW

O	Borehole	28.3	2.10	0.40	200	184	576
P	Borehole	28.8	6.01	0.17	25	87.7	248
MAXIMUM		29.1	7.52	0.40	200	184	576
MINIMUM		27.1	2.10	0.01	15	22.7	19.8

where A represents CKG global, B represents B.M water, C represents Emis water, D represents pure life water, E represents Imota Market part A, F represents Imota Maket part B, G represents Demolack ventures water, H represents Caleb University COPAS building, I represents Caleb University Joshua hall, J represents Caleb University Elisha hall, K represents Caleb University administrative building, L represents Caleb University Joseph hall, M represents Caleb University architecture building, N represents Caleb University ventures, O represents Ajegunle, and P represents Itunmoja water.

Table 3: Concentration of Metals in Selected Water Samples

Sample code	Cu (µg/mL)	Mg (µg/mL)	Mn (µg/mL)	Cd (µg/mL)
A	1.024	0.950	1.770	0.224
B	1.805	1.700	2.320	0.306
C	1.024	0.246	0.070	0.393
D	0.341	0.734	0.320	0.311
E	N/D	0.114	0.070	0.481
F	N/D	0.168	N/D	0.593
G	N/D	0.332	N/D	0.610
H	N/D	0.461	N/D	0.710
I	N/D	0.289	N/D	0.727
J	1.171	0.223	N/D	0.809
K	1.756	1.756	N/D	0.860
L	1.841	0.293	N/D	0.944
M	0.927	0.292	N/D	0.856
N	N/D	0.231	0.770	0.915
O	N/D	5.789	1.770	0.985
P	N/D	4.504	1.170	1.447

where A represents CKG global, B represents B.M water, C represents Emis water, D represents pure life water, E represents Imota market part A, F represents Imota maket part B, G represents Demolack ventures water, H represents Caleb University COPAS building, I represents Caleb University Joshua hall, J represents Caleb University Elisha hall, K represents

Article DOI: 10.52589/AJENSR-8CKPIWPW
DOI URL: https://doi.org/10.52589/AJENSR-8CKPIWPW

Caleb University administrative building, L represents Caleb University Joseph hall, M represents Caleb University architecture building, N represents Caleb University ventures, O represents Ajegunle, and P represents Itunmoja water.

CONCLUSION

In conclusion, the results from this study revealed that physical water quality parameters such as pH, salinity, EC and TDS showed variations at different locations, which suggests that different soil types, storage systems and environmental activities could interfere with the physico-chemical parameters. The water samples from Imota Community had a very low level of pollutants as indicated by the physico-chemical properties of the water. In effect, three main parameters were identified as being principal in influencing the observed water properties distribution in the study area. These are pH, electrical conductivity and total dissolved solids. However, standard methods of water treatment should be maintained by the community to ensure the purity of water available for domestic use, so that problems commonly associated with impure and unclean water can be averted.

Conflict of Interest

The authors declared no conflict of interest in the preparation and submission of this manuscript.

REFERENCES

Adeyemi, M. M., & Osilesi, O.O. (2022). Nutritional composition of *Phragmanthera incana* (Schum) leaves selected from four host trees. *Journal of Phytomedicine and Therapeutics*. 21(1)

APHA, (2005). Standard Methods for the Examination of Water and Wastewater, 21st edition. America Public Health Association. Washington DC, 1368p.

Baker, B. (2008). Inorganic Quantitative Analysis Laboratory Manual Sacramento State University. *Chemistry* 31.

CDC, (2022). Drinking Water, Healthy Water. Center for Disease Control and Prevention. https://www.cdc.gov/healthywater/drinking/public/water_treatment.html accessed May 18, 2022

Egbueri, J., Ayejoto, D., & Agbasi, J. (2022). Pollution Assessment and Estimation of the Percentages of Toxic Elements to be Removed to make Polluted Drinking Water Aafe. *A case from Nigeria. Toxin Reviews*, 1-15.

Kamaruzzaman, B. Y., Shuhada, N. T., Zahir, M. S., Akbar, S. S., Jalal, K. C., Al-Barwani, S. M., & Goddard, J. S., (2011).Concentration of lead, copper and zinc in the bottom sediment of Tuba Island waters of Langkawi, Malaysia. *Oriental Journal of Chemistry*. 27(2):505-510.

Klemme, A., Rixen, T., Müller-Dum, D., Müller, M., Notholt, J., and Warneke, T.: CO_2 emissions from peat-draining rivers regulated by water pH, *Biogeosciences*, 19, 2855–2880, https://doi.org/10.5194/bg-19-2855-2022,

Article DOI: 10.52589/AJENSR-8CKPIWPW
DOI URL: https://doi.org/10.52589/AJENSR-8CKPIWPW

Ladipo, M.k., Ajibola, V. O., & Oniye, S. J. (2011). Seasonal variations in Physicochemical properties of water in some selected locations of the Lagos Lagoon. *Science World Journal* 6(4), 5-11

Lee S. H., Jouhan, H. A., Cooksey, R. C., Jones, D., Kim, H. J., Winge, D.R., & McClain, D.A. (2013). Manganase supplementation protects against diet-induced diabetes in wild type mice by enhancing insulin secretion. *Endocrinology*, 154: 1029 -1038.

Mortuza MG, Al-Misned FA, (2017).Environmental Contamination and Assessment of Heavy Metals in Water, Sediments and Shrimp of Red Sea Coast of Jizan, Saudi Arabia Journal of Aquatic Pollution & Toxicology, 1:1-23.

Ndimele PE, Kumolu-Johnson CA, (2012).Some Aspects of the Physicochemistry and Heavy Metal Content of Water, Sediment and Cynothrissa mento (Regan, 1917) from Badagry Creek, Lagos, Nigeria. Trends in Applied Science Research., 7: 724-736.

Obeng, F. (2015). Assessment of Quality of Groundwater Near a Dump Site: A Case Study of Kwadaso Sub-Metro in The Ashanti Region, Ghana. 10.13140/RG.2.1.3641.9923.

Ogundele O. & Mekuleyi G. O. (2018). Physicochemical properties and heavy metals concentration in waste water discharged from two industries in Agbara, lagos State, Nigeria. *International Research Journal of Public and Environmental Health* 5 (3) 32 – 37.

Pandey, L. (2022). Detection of Leakage of MSW-Landfill Leachates Through a Liner Defect Experimental and Analytical Methods. *Journal of Geotechnical and Geoenvironmental Engineering* 146(8) 04020060.

SDWF (2017). Conventional water treatment: Coagulation and Filtration. Safewater facts Sheets. Safe Drinking Water Foundation.

Tepe Y, (2014). Toxic Metals: Trace Metals – Chromium, Nickel, Copper, and Aluminum, In Encyclopedia of Food Safety, edited by Yasmine Motarjemi,, Academic Press, Waltham, Pages 356-362.

USEPA (2022). Ground water and Drinking Water. United States Environmental Protection Agency. USA. https://www.epa.gov/ground-water-and-drinking-water accesed June 2022

WHO (2004) Guidelines for Drinking-Water Quality (3rdedn). World Health Organization, Geneva.1546p

WHO (2017) Guidelines for Drinking-Water Quality (4thedn) Incorporating the first addendum. World Health Organization, Geneva. 631p

Article DOI: 10.52589/AJENSR-8CKPIWPW
DOI URL: https://doi.org/10.52589/AJENSR-8CKPIWPW