

PAPER • OPEN ACCESS

Quality assessment of sachet packed water in Omu-Aran, Kwara State

To cite this article: A J Gana *et al* 2021 *IOP Conf. Ser.: Mater. Sci. Eng.* **1036** 012069

View the [article online](#) for updates and enhancements.

You may also like

- [On the use of household expenditure surveys to monitor mismanaged plastic waste from food packaging in low- and middle-income countries](#)
Jim Allan Wright, Simon Damkjaer, Heini Vaisanen et al.
- [A Detailed Comparison of Multidimensional Boltzmann Neutrino Transport Methods in Core-collapse Supernovae](#)
Sherwood Richers, Hiroki Nagakura, Christian D. Ott et al.
- [Quality Improvement of Herbal Sachet in filling Powder Machine Using Six Sigma Method](#)
Hayu Kartika, Candra Setia Bakti and Sri Purwanti

Quality assessment of sachet packed water in Omu-Aran, Kwara State

A J Gana¹, I A Adeniyi², S O Braimoh¹, D O Oguntayo¹, E M Ibitogbe¹ and P O Ejigboye¹

¹Department of Civil Engineering, College of Engineering, Landmark University, Omu-Aran, Nigeria

²Department of Industrial Chemistry, landmark University, Omu-Aran, Kwara State

*Correspondence Author: ibitogbe.enoch@lmu.edu.ng

Abstract. The importance of potable water supply in the socioeconomic life of the public cannot be over emphasized. Hence, it is necessary to know and determine the quality of water especially drinking water. This study therefore investigates the quality of sachet packed water in *Omu-Aran* metropolis with a view of ascertaining its suitability for consumption purposes. Water samples from the three major factories were taken to laboratory for analysis. The parameters of interest are the Physical, chemical and biological contents. The results obtained showed that physical and chemical properties of the water samples are within the WHO/NIS standard limit for potable drinking water while biological and microbial examination showed that coliform count and DO of all the sachet water samples from factory 'B' and 'C' did not conform to the WHO/NIS standard. This indicates that the sachet packed water produced from factory 'A' were of good quality and hygienic for consumption while the ones from factory 'B' and 'C' should be improved upon in terms of their coliform count and DO contents. It is recommended that quality assurance be implemented through all the stages of production to ensure the quality of sachet packed water is improved for safe consumption.

Keywords: Quality, Assessment, Sachet packed water, *Omu-Aran*, WHO/NIS.

1. Introduction

Water is generally known to be essential for life on earth. According to [14] it plays an essential role in and is a basic factor for determining the health of any community, since 80% of diseases in developing countries can be traced to poor water quality. Due to its importance, its availability has frequently determined the model of human settlement throughout history [15]. Of all basic needs required human survival, research has proved that water is perhaps the most precious asset on the earth. In addition to drinking water requirements, water resources are of major importance in different economic areas such as agriculture, livestock production, forestry, industrial activities, hydro-power generation, fisheries, etc. (Shweta et al, 2013). Water is available in different sources which may not be always safe and available throughout the year [1, 11, 13]. These sources can be analyzed for quality and suitability using physical, chemical and biological parameters. These parameters impair human health and become harmful if they surpass the guideline values defined by relevant organizations [5, 8, 9, 17, 18].

Water should be *potable* and be of good quality without having any adverse effect on the health of consumers. It should also be free from harmful impurities, such as bacteria, viruses, minerals and



Content from this work may be used under the terms of the [Creative Commons Attribution 3.0 licence](https://creativecommons.org/licenses/by/3.0/). Any further distribution of this work must maintain attribution to the author(s) and the title of the work, journal citation and DOI.

other organic substances. While contamination of sachet water leading to disease outbreak ever rarely occur, contamination would ultimately lead to a widespread epidemic due to its high demand. Several studies have demonstrated that bacterial contamination of packaged water can occur at various production phases [6, 7, 10, 16].

In the recent years, *Omu-Aran* has witnessed rapid growth and development with increase in demand for resources including water. Packaged water is also growing at a very high rate of production and consumption. However, there is no regulation on the quality of water manufactured for consumers and this could lead to contaminated supply. Therefore, this study is aimed at evaluating the quality of sachet packed water in *Omu-Aran*, Nigeria.

2. Study Area

Omu-Aran town is situated to the south of Ilorin which serves as the capital of Kwara State and 16km North-East of *Otun* in Ekiti State. It is located on the latitude 0.9N and longitude 50.61E. The location of the town confers advantages of centrality in the midst of other *Igbomina*, *Ekiti* and *Mopa* towns. The town has a tropical climate characterised by long wet season. The economy of the city is driven by many small and medium-sized industries.

3. Sampling Method and Analysis

Sachet samples of water were collected from three major water producing factories that are functioning every day and producing large quantities of sachet water for consumption for the people of the town and also for distribution to other places. The sachet packed water were left unopened in their original sealed containers and labeled as:

- Factory A
- Factory B
- Factory C

The sachet packed water samples were taken to Water Resources and Environmental Engineering laboratory of Landmark University, Omu-Aran for analysis to ascertain the physical, chemical and biological contents in the sachet packed water. The test was conducted using standard water and waste water examination methods [2].

4. Results and Discussions

4.1 Physical Parameters

The physical characteristics of the sachet packed water samples are shown in Table 1 and Figure 1 below. All the water samples were colourless, odourless, tasteless and clear, this could be as a result of the filtration methods employed during sachet packed water production by the factories [12]. All the physical composition of the water samples was within the WHO and NIS standard limits, though the temperature is higher than WHO/NIS limits, this could be because of the environment in which they are stored and tested.

Table 1: Mean and standard deviation for physical properties of sachet packed water samples

NO	PARAMETERS	UNIT	FACTORY A	FACTORY B	FACTORY C	WHO	SON
1	Temperature	0C	29.0 ± 0.05	29.1 ± 0.05	29.3 ± 0.05	Ambient	Ambient
2	Ec	µs/cm	63.2 ± 0.08	61.17 ± 0.55	72.6 ± 0.16	1000	1000
3	TDS	mg/L	31.6 ± 0.16	30.57 ± 0.26	36.3 ± 0.08	500	500
4	Turbidity	NTU	0	0	0	5	5
5	Colour	mg/L	0	0	0	15	15

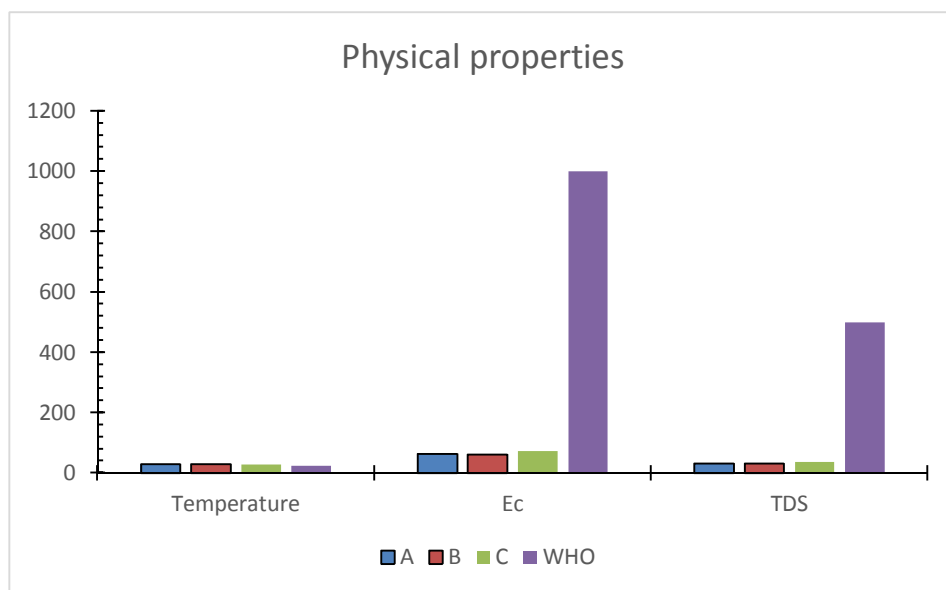


Figure 1: Physical properties of water samples compared with WHO standard

4.2 Chemical Parameters

The result of the chemical qualities of sachet packed water samples investigated in this study such as Iron, magnesium, manganese, copper, zinc, total alkaline, potassium, chloride etc. are all within WHO/NIS standard for portable water. The pH of the sachet packed water as seen from Figure 2 ranged from 7.18 to 7.38. The result of the pH analysis showed that sachet packed water were within the standard range (6.5-8.5) for quality water specified by WHO/NIS (Table 2), same goes for the potassium level for all the samples and the calcium level. It is worthy to note that water samples with pH values that fall within the regulatory guideline values are unlikely to pose health issues like as acidosis [3, 4]. The total hardness of sachet packed water in this study ranged from 62-78mg/L (figure 2). According to [4], hardness in water does not necessarily constitute any health risk.

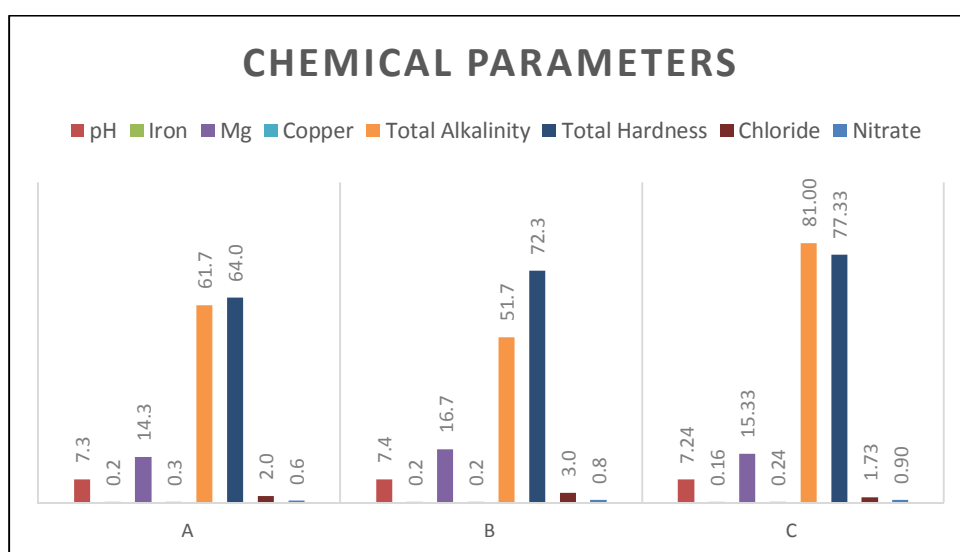


Figure 2: Chemical Parameters of sachet packed water

Table 2: Mean and standard deviation for chemical properties of the sachet packed water samples

NO	PARAMETERS	UNIT	FACTORY A	FACTORY B	FACTORY C	WHO	SON
1	pH	mg/L	7.3 ± 0.02	7.4 ± 0.02	7.2 ± 0.05	6.5-8.5	6.5-8.5
2	Iron	mg/L	0.2 ± 0.008	0.2 ± 0.008	0.2 ± 0.005	0.3	0.3
3	Magnesium	mg/L	14.3 ± 0.5	16.7 ± 0.5	15.4 ± 0.5	50	20
4	Manganese	mg/L	0	0	0	0.1	0.2
5	Copper	mg/L	0.3 ± 0.008	0.2 ± 0.008	0.24 ± 0.16	2	2
6	Zinc	mg/L	0.8 ± 0.16	2.0 ± 0.16	2.4 ± 0.16	3	3
7	Total hardness	mg/L	64.0 ± 1.64	72.3 ± 2.06	77.4 ± 0.94	150	150
8	Total Alkaline	mg/L	61.7 ± 2.36	51.7 ± 6.24	81.0 ± 2.95	20-200	20-200
9	Potassium	mg/L	2.9 ± 0.05	4.4 ± 0.13	2.4 ± 0.05	250	250
10	Calcium	mg/L	42.7 ± 2.50	49.3 ± 1.89	63.7 ± 1.25	75	75
11	Chloride	mg/L	2.0 ± 0.05	3.0 ± 0.08	1.73 ± 0.05	250	250
12	Sulphate	mg/L	7.3 ± 0.94	11.7 ± 1.25	14.4 ± 1.25	100	100
13	Nitrate	mg/L	0.6 ± 0.05	0.8 ± 0.05	0.9 ± 0.08	50	50
14	Nitrite	mg/L	0	0	0	0.2	0.2
15	Phosphate	mg/L	0.1 ± 0.008	0.2 ± 0.012	0.2 ± 0.008	0.1	0.1
16	Phosphate	mg/L	0.1 ± 0.008	0.2 ± 0.012	0.2 ± 0.008	0.1	0.1

4.3 Biological and Microbial Parameters

The results of COD obtained were all within the WHO/NIS standard. The result for DO and coliform count for samples from factory 'B' and 'C' were not within the limit specified by WHO for drinking of zero (0) coliform and 4.0-5.0mg/L of DO content, while the sample from factory 'A' were within the WHO/NIS standard. This means that the water samples from factory B and C contain coliforms, suggesting that there could be some health implications from the sachet packed water from these factories depending on the type of coliform found. As reported by [12], the presence of coliforms in these samples could be as a result of the poor sanitary nature of the various places of production. The water filters could also be clogged

Table 3: Mean and standard deviation for biological/microbial properties of sachet packed water samples

NO	PARAMETERS	UNIT	FACTORY A	FACTORY B	FACTORY C	WHO	SON
1	DO	mg/L	4.8 ± 0.05	5.0 ± 0.08	5.1 ± 0.08	4.0-5.0	4.0-5.0
2	COD	mg/L	0	0	0	0	0
3	Coliform	mg/L	0	TN	7.7±2.4	0	0

*TN- Too numerous to count

5. Conclusion and Recommendation

The physical, chemical and biological/microbial properties of sachet packed water in Omu-aran metropolis were investigated to ascertain the quality of water being supplied and consumed within the town. The water samples from three major factories were analysed in the water resources and environmental laboratory of Landmark University. The analysis of the water revealed that the water samples is within by WHO/NIS for portable water in terms of their physical and chemical properties while the biological/microbial parameters revealed that only samples from factory A meet the criteria of portable water by WHO/NIS. It is concluded that the quality of water from

factory 'B' and 'C' should be improved upon in terms of their coliform count and DO contents to make the water more suitable, productive and healthy.

- From the results obtained, the following recommendations were made:
- The production water sachet packed should be encouraged within the town based on daily demand and consumption.
- Skilled workers in terms of water quality should be employed water factory for a hygienic production of sachet water.
- Local government authorities in conjunction with rural water development authority should enforce regulations and standards for the production of sachet water in the areas. This will increase the quality expected from water sachet factories in the area.
- Further research should be carried out to determine the quality and suitability of water sources within the area.

Acknowledgement

The authors will like to appreciate Mr Ajayi Oluwasegun of Water Resources and Environmental Engineering Laboratory, Landmark University for helping with the laboratory work.

Reference

- [1] Ahmed S N 2002 Water quality general module of national water supply training network National water rehabilitation project, 58-72
- [2] APHA 2005 Standard Methods for the Examination of Water and Wastewater, 21st (edn.), American Public Health Association, American Water Works Association, Water Environment Federation, Washington DC, USA
- [3] Asamoah DN and Amarin R 2011 Assessment of the quality of bottled/ sachet water in the Tarkwa-Nsuaem municipality (TM) of Ghana. *Res. J. Appl. Sci. Eng. Techno.* **3**:5, 377-385
- [4] Airaodion AI, Ewa O, Awosanya OO, Ogbuagu EO, Ogbuagu U, et al 2019 Assessment of sachet and bottled water quality in Ibadan, Nigeria *Glob J Nutri Food Sci.* **1**:4, GJNFS.MS.ID.000518
- [5] Bureau of Indian Standards 2012 Specification for drinking water. IS: 10500, New Delhi, India
- [6] Dada A C 2011 Packaged water: optimizing local processes for sustainable water delivery in developing nations. *Globalization and health*, **7**:1, 1-8
- [7] Gangil R, Tripathi R, Patyal A, Dutta P and Mathur K N 2013 Bacteriological evaluation of packaged bottled water sold at Jaipur city and its public health significance. *Veterinary World*, **6**:1, 27
- [8] Guide Manual: Water and Waste Water, Central Pollution Control Board, New Delhi, http://www.cpcb.nic.in/upload/Latest/Latest_67_guidemanualw&wanalysis.pdf
- [9] Guidelines for Drinking Water Quality 2012 Fourth Edition, World Health Organization ISBN 978 92 4 154815 1
- [10] Halage AA, Ssemugabo C, Ssemwanga DK, Musoke D, Mugambe RK, Guwatudde D and Sempebwa JC 2015 Bacteriological and physical quality of locally packaged drinking water in Kampala, Uganda. *Journal of environmental and public health*
- [11] Hines D 2001 *The power of water American fitness* **19**, 23-25
- [12] Ikon GM, Ohagim PI, Amadi CP, Abasiubong VN, Ekerenam EU and Udoudo EM 2017 Quality assessment of selected sachet water sold in Uyo metropolis, Nigeria *World Journal of Pharmaceutical Research*, **6**:8, 86-95. Doi: 10.20959/wjpr20178-8900
- [13] Negoianu D and Goldfaid S 2008 Just add water *Journal of American society of nephrology* **19**:6, 1041-1043

- [14] Pooja DS, Siddharath R and Sanjay S 2014 Assessment of Water Quality *International journal of scientific and engineering research*, **5**:12, 2229-5518
- [15] Saleh MA, Ewane E, Jones J and Wilson BL 2001 Chemical Evaluation of Commercial boiled drinking water from Egypt *Food Comp and Anal* **14**, 27-152
- [16] Semerjian LA 2011 Quality assessment of various bottled waters marketed in Lebanon, *Environmental monitoring and assessment*, **172**:1-4, 275-285
- [17] Shweta T, Bhavtosh S, Prashant S and Rajendra D 2013 Water quality assessment in terms of water quality index *American Journal of Water Resources* **1**:3, 34-38. DOI:10.12691/ajwr-1-3-3
- [18] United State EPA 816-F-09-004, May 2009, <http://water.epa.gov/drink/contaminants/upload/mcl-2.pdf>
- [19] World Health Organisation 1989 World Health Organisation and United Nations Environmental Program (GEMS) Global fresh water quality Alden press Oxford