



Physico-Chemical Quality of Different Brands of Sachet Water Sold in Federal University of Technology Campus Imo State, Nigeria

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Abstract

Safe drinking water is essential to humans; hence the quality of drinking water is of paramount importance. The quest for sachet water consumption amongst Nigerian students makes the quality analysis of the different brands of sachet water available, an area of interest. Six different brands of sachet water namely: Wilnelly, prephil, apex, lephzzy aljonlife and mayln collected from different parts within the Federal University of Technology, Owerri campus were sampled using standard methods. Physiological and microbiological analysis were carried out according to Nigeria standard of drinking water quality (NSDWQ) and World Health Organization (WHO), the five brands of sachet drinking water had their Ph values below the lower permissible limit, ranging from 5.21 to 5.93. Only hephzzy sachet water brand had Ph valued within the permissible limit. Turbidity result ranged from 0.24 to 0.43, which could be sad to be acceptable. The total dissolved solids result of the brands of sachet water ranged from 21.00 to 156.00. The different brands of sachet water had close range results in most of the parameters analysed and satisfactorily met the set standards. However some parameters such as detection of various elements, Barium were found above its permissible limit in five out of the six samples ranging from 1.00 to 2.00, while lophzzy sachet water had its value below detection level. From the ANOVA test, Ph, total dissolved solids and Barium had significant difference ($P < 0.05$), while other physicochemical parameters tested were insignificant ($P > 0.05$) among the various sachet water sampled. Based on these results, there is need to observe good quality control analysis to ensure conformity with the set standards. Also random testing of market samples will be a good way of detecting whether the quality is meeting the required standards.

Keywords: Sachet water, set standards, permissible limit, physicochemical analyses.

Introduction

As a chemical compound, a water molecule contains one oxygen and two hydrogen atoms that are connected by covalent bonds. Water makes up about 60% of human body weight in mass; it is a crucial component for metabolic processes and serves as a solvent for many bodily solutes. In the blood it makes up to about 92% of the blood plasma which constituent 55% of blood fluid¹.

Access to safe drinking water has improved over the last decades in almost every part of the world, but approximately one billion people still lack access to safe water and over 2.5 billion lack access to adequate sanitation, which affects the source of water they access².

Water in sachet always contains a certain amount of minerals and trace elements, collected throughout their geological course and from anthropogenic sources. These inorganic elements and their interaction are essential for the functioning of the human body³.

However, certain range of these factors enhances microbial growth and are harmful to the human body when in excess. Poor water clarity, high colour, extreme pH, odour and taste affect

the palatability and general acceptability of drinking water and often result in consumer complaints. Water supplies containing high suspended solids greatly reduce the efficiency of disinfection⁴.

Carbon dioxide from the atmosphere dissolves into the water bodies as dissolved CO₂, and to maintain chemical equilibrium some of it reacts with the water to form carbonic acid. Some of these extra carbonic acid molecules react with a water molecule to give bicarbonate ion and hydronium ion which increases the waters acidity⁵. As an alternative to help bridge the gap of inadequacy of safe drinking water, sachet water with low cost price readily become an available alternative for water provision in most secondary and tertiary institutions in developing countries.

This paper aims to determine the physico chemical quality of different sachet water supplied and sold in Federal University of Technology, Owerri (FUTO) premises and to ascertain whether the different sachet water complies with maximum contaminant levels set by Nigeria standard for drinking water quality (NSDWQ), National Agency for Food and Drug Administration and Control (NAFDAC) and World Health Organization (WHO).

Material and Methods

Sample Collection: Six (6) different brands of sachet water, three (3) samples each were randomly bought from cafeterias, eating places and mini shops in Federal University of Technology (FUTO). Hence a total of eighteen (18) samples of sachet water were assembled. The samples were collected in good conditions (there was no visible opening on the sachet bag). The samples were taken to the laboratory within 1 hr of collection and were held refrigerated at 5°C until examined.

pH was measured using Beckman pH meter (model 7413), colour by Nessleriser with DISC NSA, odour by clean odour free glass bottles, turbidity by 2100P turbidimeter, conductivity and total dissolved solid (TDS) by HACH Sension 5. Total solids was measured by summing the values of total dissolved solids and total suspended solids (measured by filtering 100ml of water samples through known weight of filter paper, weighed later after drying). All other inorganic variables including nitrate, iron, copper, chloride, lead etc were measured using a portable data logging spectrophotometer (HACH DR 2010). Titrimetric method was used to determine total hardness and alkalinity⁷.

Analysis of variance (Anova) was used to statistically analyse the various data.

Results and Discussion

Physico-chemical quality of sachet water sold in FUTO were examined in this study and the results are hereby shown.

The results of odour, taste, turbidity, pH and colour are shown in table 1. From the table, the lowest pH value obtained was 5.10 which was the pH value for malyn sachet water. The highest pH value obtained was 7.40 and this was the pH value for hephzzy sachet water. From the ANOVA test carried out on pH, there was no significant difference among the various samples except with Hephzzy water sample. Odour and taste results of the water samples were all unobjectionable from the result displayed in table 1. Turbidity result had close ranges as shown in the table. The lowest turbidity value was prephil sachet water with 0.24 NTU and the highest value was Aljonlife sachet water with 0.43 NTU. There was no significant difference in turbidity ($p>0.05$). Also from the same table, colour test of the various samples ranged from 5 to 10 HTU. Only malyn sachet water had a result of 10 HTU. There was no significant difference in colour values ($P>0.05$) among the various water samples except with malyn sachet water.

Table 2 showed conductivity and total dissolved solids result. It ranged from 46.30 to 341.00 μ S/cm for conductivity and 21.40 to 156.20mg/L for total dissolved solids. There was significant difference in the ANOVA result on conductivity and total dissolved solids except between prephil and hephzzy sachet water which had no significant difference ($p>0.05$). Results of

other inorganic variables including nitrate, iron, copper etc in the water sample are shown in table 3. Some of the metals analysed in the water samples had values below detection level. All the water samples had floride content below detection level except apex sachet water which had 0.07mg/l value. There was no significant difference in the elements ($p>0.05$) except for barium.

Table 4 showed the result of chemical analyses. From the table below, free dissolved carbondioxide of the brands of sachet waters ranged from 0.88 to 5.28 while total alkalinity of the brands of sachet water ranged from 7.20 to 14.40 and total hardness ranged from 42.00 to 56.00.

Table 3 comprises of the results of heavy metals, trace metals, cations and anions. Some of the metals analysed in the water samples had values below detection level, that is, very minute amounts are present in the water samples. Example, all the water samples had fluoride (F) content below detection level, except Apex sachet water which had 0.07mg/L value. There was no significant different in the elements at table 3 ($P>0.05$) except for Barium which had significant difference ($P<0.05$) in the ANOVA test carried out.

The water samples were colourless, odourless and tasteless. This compares favourably with the results obtained by Nwosu and Ogueke⁷. They observed that poor odour and taste may result from contamination with dusty particles and dissolved solids.

The acceptable pH range by World Health Organization⁸, is 6.5 (lower permissible limit) to 8.5 (upper permissible limit). Five brands of the sachet drinking water had their pH values below the lower permissible limited, ranging from 5.21 to 5.93. only Hephzzy sachet water had pH value of 7.40 which is within the permissible limit. Studies conducted by Taiwo et.al.⁹, showed that the pH values observed for the water samples sold in Abeokuta metropolis were between 6.00 and 7.54.

Water with low pH can be acidic, naturally soft and corrosive¹¹. High pH levels are undesirable since they may impart a bitter taste to the water¹¹.

The various brands of sachet water had their turbidity results ranging from 0.24 to 0.43 NTU which is acceptable based on WHO standard. This result tallied with Akorli⁴ which ranged from 0.2 to 1.30 NTU during his research on packaged water in Ghana. The highest value for apparent colour allowed by Nigeria standard of drinking water quality (NSDWQ) is 15 HTU. All the six samples were within limit. These results tallied with the works of Taiwo et. al.⁹, Nwosu and Ogueke (2004) which had 5 HTU for all samples tested. The highest value obtained was 10 HTU by Malyn sachet which was still within limit.

There was no significant difference in the colour values obtained ($p>0.05$). The various brands of sachet water met the

standards in most of the trace metal, anion and cation analyses. Most of the elements checked for in the various brands of sachet water were far below Nigeria standard for drinking water quality¹² and World Health Organization permissible limits. Accumulation of Barium causes increase blood pressure and hypertension (Nigeria standard for drinking water quality, 2007). The values of Ammonia recorded for the packaged waters were low ranging from 0.0mg/l to 0.06mg/l. This result tallied with the result obtained for Ammonia by Akorli⁴ during his research on packaged water in Ghana ranged from 0.0mg/ to 1.0mg/l.

Hardness of the brands of sachet water ranged from 48.00 to 56.00mg/l which were far below the set guideline value of 500mg/l. From the result reported by Nwosu and Ogueke⁷ the values obtained for total hardness in the sachet water samples analysed in Owerri metropolis fall within 38.40 to 72.50mg/l.

Also total Alkalinity of the brands of sachet water ranged from 7.20 to 14.40mg/l which were also far below the set guideline value of 100-200mg/l. This result tallied with Nwosu and Ogueke⁷. There was no significant difference in total hardness and alkalinity ($p>0.05$).

Conclusion

The random testing of market samples will be a good way of detecting whether the water quality is meeting the required standards. Also, National Agency Food and Drugs Administration and Control (NAFDAC) should embark upon routine unannounced checks, monitoring the production process of the sachet water by their producers.

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Table-1
Physical Parameters Of The Various Water Samples

S/n	Sample	Odour	Taste	Turbidity (ntu)	Ph	Colour htu
1	Wilnelly	Unobjectionable	Unobjectionable	0.27	5.21	5
2	Prephil	„	„	0.24	5.92	5
3	Apex	„	„	0.37	5.78	5
4	Hephzzy	„	„	0.30	7.40	5
5	Aljonlife	„	„	0.43	5.93	5
6	Malyn	„	„	0.37	5.10	10

Table-2
Conductivity And Total Dissolved Solids Values Of Water Samples

S. No	Sample	Conductivity $\mu\text{S}/\text{CM}$	Total Dissolved Solids (MG/L)
1	Wilnelly	46.30	21.40
2	Prephil	162.40	74.50
3	Apex	317.00	146.30
4	Hephzzy	163.60	74.70
5	Aljonlife	182.20	82.90
6	Malyn	341.00	156.20

Table-3
Result Of Various Elements Analysed In The Water Samples

S. NO	Parameters	NSDWQ	Wilnelly	Prephill	Apex	Hephzzy	Aljonlife	Malyn
1	Phosphate (PQ ₄ ³⁺) MG/L	3.50	0.03	0.038	0.013	0.074	0.081	0.028
2	Iron (FE ³⁺) MG/L	0.30	0.02	0.03	0.05	0.10	0.05	0.03
3	Manganese MG/L	0.40	0.001	0.001	.0.013	-0.001 (BD)	0.005	0.001
4	Nitrates (NO ₃) MG/L	50.00	0.02	0.00	-0.01(BD)	-0.03(BD)	0.02	0.01
5	Nitrates (NO ₂) MG/L	0.20	0.002	0.002	0.001	0.004	0.004	0.003
6	Ammonia (NH ₃)	0.00	0.00	0.00	0.00	0.06	0.00	0.00
7	Total Silica (SIO ₂) MG/L	17.00	0.016	0.009	0.100	0.017	-0.249(BD)	0.007
8	Chloride (Cl) MG/L	250	0.10	0.10	0.20	0.10	0.10	0.10
9	Aluminium (Al ³⁺)MG/L	0.20	0.00	0.01	0.00	0.01	-0.09(BD)	0.00
10	Selenium (SE)MG/L	0.01	0.01	0.01	0.00	0.01	0.01	0.00
11	Chromium (CR ⁶⁺)MG/L	0.05	0.00	0.00	0.01	0.01	0.00	0.00
12	Cadmium (CD) MG/L	0.003	0.001	0.001	0.000	0.001	0.001	0.001
13	Copper (CU ²⁺) MG/L	1.00	0.03	0.03	0.84	0.12	0.05	0.02
14	Cyanide (CN) MG/L	0.01	0.000	0.001	0.009	0.000	0.001	0.000
15	Lead (PB) MG/L	0.01	0.000	0.001	0.000	0.002	0.003	0.001
16	Zinc (ZN) MG/L	3.00	0.01	0.00	-0.00(BD)	0.04	0.01	0.00
17	Barium (BA) MG/L	0.70	2.00	2.00	-15(BD)	2.00	2.00	1.00
18	Flouride (F) MG/L	1.50	BD	-0.05(BD)	0.07	-0.04(BD)	-0.08(BD)	-0.04(BD)

NSDWQ = Nigeria Standard for Drinking Water Quality, BD = Below Detection level.

Table-4
Result of chemical analyses of the water samples

S/N	Sample	Free Dissolved Carbondioxide (CO ₂)	Total Alkalinity (MG/L)	Total Hardness (MG/L)
1	Wilnelly	1.76	7.20	48.00
2	Prephil	3.52	10.80	56.00
3	Apex	4.40	10.80	50.00
4	Hephzzy	5.28	9.60	42.00
5	Aljonlife	0.88	9.60	50.00
6	Malyn	0.88	14.40	48.00

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