International Journal of Applied Chemical and Biological Sciences (2023), 4(4), 1-6
ISSN- 2582-788X

RESEARCH PAPER

Article Identifier: https://identifier.visnav.in/1.0001/ijacbs-23g-12002/

Microbiological analysis of sachet water in Ayingba town in Dekina Local Government Area of Kogi State

Mathias Akoji [1]*, Ekwoba Lucky [1], Charles David N. [2], Isaac O. Agbane [3], Ozonkwu Mary [4], Ottu Paul [2], Oladejo Damilola [5], Okeme Theresa O. [6] and Omeje Helen E. [7]

[1] Department of Chemistry, Kogi State University, Anyigba, Nigeria
[2] Department of Biochemistry, Olusegun Agagu University of Science and Technology, Okitipupa, Nigeria
[3] Department of Geology, Federal University Lokoja, Nigeria
[4] Department of Biology, Ahmadu Bello University Zaria, Nigeria
[5] Department of Microbiology, Olusegun Agagu University of Science and Technology Okitipupa, Nigeria
[6] Department of Biology, Federal University Lokoja, Nigeria
[7] Department of Food Science, Kogi State University, Anyigba, Nigeria

* For correspondence: akojigodwinmathias@gmail.com

Received on: 12 July 2023 *Published on: 30 August 2023*

ABSTRACT

Sachet water, often called "pure water," is generally safe for consumption. Eight brands of sachet water are mainly marketed in Anyigba and Agbeji. Four of these are NAFDAC-registered. Bacteriological analysis of 40 samples of each of the sachet drinking water samples was examined to ascertain the portability of the samples. General accepted conventional standards were employed for coliform detection (presumptive count, viable count, multiple tube method coliform count). A microscopic examination was taken for the sediment and other debris, fungal hyphae and other protozoa. Bacteriological analysis from both sites showed the presence of pathogens (15cfu/ml), E. coli (30cfu/ml). Almost all the brands fell below WHO standards for drinking water and therefore had poor qualities. Of the eight brands tested, five showed the presence of contamination in the form of high coliform numbers and the occurrence of pathogens. This indicates that the pure water available in Anyigba and its environs is unfit for consumption due to operations below NAFDAC (2010) and WHO (2011). Efforts need to be intensified to monitor the rapidly growing pure water factory in order to meet the WHO standard.

Keywords: Satchet water, bacteriological analysis, coliform count, protozoa multiple tube method

1. INTRODUCTION

The microbiological quality of drinking sachet water is a concern to consumer, water suppliers and regulatory body. It is a basic human right and a component of effective policy for health protection. The quality of drinking water is powerful environmental determination of health [1-5]. Diseases related to contamination of drinking water constitute a major burden on human health; intervention to improve the quality of drinking water provides significant health benefits [6-11]. Recently the united nation General Assembly declared the period from 2005 to 2015 as the international decade for action, 'water for life. Wide spreads production and consumption of inadequately processed or contaminated packaged drinking water can lead to water borne disease outbreaks. In order to safeguard the public health, it is essential that the available packaged water is of the highest quality [12-17].

Water related diseases continue to be one of the major health problems globally. The high prevalence of diarrhea among children and infants can be traced to the use of unsafe water and unhygienic practices [18]. Many people depend on water vendor for provision of water for domestic and daily needs and these have led to the advent of locally sourced low cost alternatives sachet water called "PURE WATER". These "pure waters" have become a major source of drinking water. The production, marketing and consumption of sachet water have increased tremendously in Nigerian and other developing Nations. Packaged drinking water is defined as water packaged in cans, plastic sachets and pouches for the main purpose of consumption [19]. It is mostly common in low socio economic countries has means of salvaging scarce potable, safe water and to generate income, yet, various studies have shown that some packaged drinking water may not be safe for drinking due to presence of pathogens [2][13].

An understanding of these sachet water microbial quality and safety are therefore imperative and should be a cause of concern to consumers, water suppliers, and regulation and public health authorities. Disease causing microorganisms transmitted through drinking water are predominantly "Faecal origin" and are referred to enteric pathogen. The world health organization (WHO) estimates that about 1.1 billion people globally drink unsafe water and vast majority of diarrhea diseases in the world (88%) is attributed to unsafe water sanitation and hygiene. Poor water quality account for 1.7 million deaths a year worldwide (3.1% of annual death).

The WHO standards state that drinking water should not contain any micro-organisms known to be pathogenic or any bacteria indicative of faecal pollution. The concept of faecal indicator bacteria in determining the sanitary quality of water was first proposed in the 1880s when workers began to use bacteriologic media to assess microbial presence in water and food commodities. Bacterial contamination cannot be detected by sight, smell or taste. A basic laboratory test is the best way to tell if Coliform organisms are present as they can be there with no appearance or taste difference [20].

Coliform bacteria have been used as indicators of unsanitary conditions in water and foods over a century. The concept of coliform bacteria emerged in 1892 when shardinger proposed the use of an indicator for faecal contamination determination. This was based on the premise that E.coli is abundant in human and animal faeces and is not usually found in other "Niches" and could be easily detected by its ability to ferment lactose. Coliform bacteria generally belong to four genera of the

Enterobacteiacea family, Citrobacter, Enterobacter, Escheria and Klebsiella [21].

In Anyigba and its immediate environs in Kogi State, there is no access to improved or portable water for drinking and other essential purpose such as cooking and bathing. The sources of water available to the people of the area include river, stream and pond and are mostly faecally contaminated and untreated [22]. As a consequence, a large proportion of the residents are exposed to waterborne disease [22]. These diseases include cholera, Shigellios, Salmonellosis, diarrhea and many other bacterial, fungal, typhoid and parasitic infections [9].

2. METHODOLOGY

The study area covers Ayingba town which is located in Dekina local government Area of kogi state Nigeria.

2.1. Apparatus

Filter manifold, Membrane filter, Forceps, Petri dish, Incubator, Bunsen burner, Weighing balance , Filter paper, Conical flask, Measuring cylinder, Foil paper , Hand gloves, Morning fresh (liquid soap), Morning fresh (liquid soap), Vacuum pump , Refrigerator.

2.2. Reagents

Nutrient agar (Coliform agar), 70% ethanol, Distilled water.

2.3. Washing and sterilization of glasswares

All the glass wares used for this project sampling and analysis were thoroughly washed with detergents and rinsed with distilled water to remove leftover detergents bactericidal materials which may contaminate the work or causes alteration in result of the analysis. The glass wares were then sterilized using 70% ethanol before use.

2.4. LABORATORY ANALYSIS

Sample Collection: A total of three sachet water (3) samples was obtained from the describe location above. Two of these sample were obtained from the producer and one from the retailer (same product as that of the producer) and were labeled accordingly and was transported in ice box containing ice packs after which it was then stored in the refrigerator at a temperature of about 4oc.

2.5. Media Preparation

The environment used for the preparation of media was disinfected using 70% ethanol. 4g of the coliform agar was measured and poured into 250 ml conical flask.150mls of distilled water was added into the conical flask; the mixture was stirred and heated to boil for about a minute using a hotplate. The mixture was allowed to cool to a temperature of about 45°C before pouring the plate. The plate is allowed to set and then stored in the refrigerator at a temperature of about 4°C.

Note: while pouring the plate, gently shake the mixture at interval to avoid separation of the mixture.

2.6. Determination of Faecal Coliform

2.6.1. Filtration

The filtration process is carried out using the membrane filtration technique. The membrane filter is placed in the filter manifold using the forceps, quantities of 100mls of water sample was measured and filter, with forceps the membrane filter is taken out and placed in the plate, and this process was repeated for each sample. The filter manifold was constantly flamed after each filtration to avoid contamination.

Table 1. Result showing colonies counts and their colors for both retailers and producers samples of hyers oasis sachet water

Sr. No.	Sample: producer	Colonies colours	No.of colonies	Possible organism
1	Plate A	Violet/Dark blue	TNTC	*E.coli*
		Green	30 CFU/100mls	
		Cream	TNTC	
2	Plate B	Green	15 CFU/100mls	
		Violet /Dark blue	TNTC	*E.coli*
		Cream	TNTC	
3	Plate C	Green	25 CFU/100mls	
		Violet /Dark blue	TNTC	*E.coli*
		Cream	TNTC	
4	Plate A	Violet /Dark blue	3 CFU/100mls	*E.coli*
		Cream	TNTC	
5	Plate B	Violet /Dark blue	TNTC	*E.coli*
		Cream	TNTC	
6	Plate C	Violet /Dark blue	25 CFU/100mls	*E.coli*
		Cream	3 CFU/100mls	

Note: The membrane filter has a pore size of 0.45 micrometers.

2.6.2. Incubation

The plates were labeled and incubated at 45°C for 24 hrs.

Note: while placing and taking the membrane filter on and off the filter manifold care was taken to prevent the membrane filter for falling off.

Note: Coliform agar partially inhibits the growth of Enterococcus faecalis.

3. RESULTS AND DISCUSSION

Table 1. shows colonies counts and their colors for both retailers and producers samples of hyers oasis sachet water.

The degree of purity of sachet drinking water is a significant factor in the production of sachet water. After the Investigation carried out on the general microbiological quality of sachet water sold at hyers oasis production facility in Anyigba preliminary results obtained as shown in plate A, B, C of factory and retailer samples, result shows several colour colonies after incubation for 24hr at 45oC.of the sachet water sample which is a pointer that feacal coliforms were present. These feacal coliform indicate the presences of human and animal waste contaminant which causes diseases such as typhoid, cholera, salmonellosis and parasitic infections. Following the bacteriological quality standard of sachet water given by the WHO and National Standard for drinking water quality, [23-25], it can be said that there is a tendency that the people of Anyigba, who consume these brand of sachet are expose to high risk of water borne diseases.

4. CONCLUSION

This study has provided information about the water quality sold in Anyigba does not satisfy the bacteriological quality of water because faecal coliform was observed in the water. It is very much important to treat our water for the sole purpose of making portable water awesome for human consumption and for the safety of life to avoid any outbreak of waterborne diseases which could even result in death. Monitoring

faecal contamination in sachet water is an important issue because it is important to protect all water sources.

5. RECOMMENDATION

Appropriate treatment processes of water should be utilized for the production of high quality and safe packaged drinking water. Assessment of water quality at different stages of production and post-production is essential in order to ensure their quality and safety. There is also need for regulatory bodies like National Agency for Food and Drug Administration and Control (NAFDAC), Standard Organization of Nigeria (SON) and other health agencies both at the states and local government to enforce compliance to the required standards. They should also ensure that all Sachet water contains manufacturing and expiry date as well as batch number for easy recall. There should be proper handling and storage of the sachet water to prevent contamination.

6. ACKNOWLEDGEMENT

NA

7. CONFLICT OF INTEREST

The authors have declared that there is no conflict of interest.

8. SOURCE/S OF FUNDING

NA

9. REFERENCES

1. Adekunle, L. V, Sridhar, M, Ajayi A.A, Oluwade P.A, Olawuyi, J.F.(2004). An Assessment of the health and social economic implications of satchet water in Ibadan Nigeria: A public Health Challenge.African of Journal Biomediation Research, 7:5-8.
2. Ahmed, W., Yusuf, R., Hassan, I., Ashraf, W., Goonetilleke, A., Toze, S., Gardner T (2013). Faecal indicators and bacterial pathogens in bottle water from Dhaka Bangladesh Braz. J. Microbiol 44(1):97-103
3. Anon (1982): Water Microbiology: Medical laboratory Manual for tropical countries 2nd ed. FPs New York P.154.
4. Bartram, J., Balance R. (1996). Water quality monitoring centre. Afr. J. Med. 40(3) 233-235.
5. Bonde, G. (1966). Bacteriological methods for estimation of water pollution. Health Laboratory Science 3: 124-128.
6. Gadgil, A.J. and Derby, E.A.(2003). Providing Safe drinking water to 1.2 billion unserved people. Paper #70492 submitted for presentation to 96th Ann AWMA conference, San Diego, CA June 22-26, 2003.
7. Geldreich., E.E. (1996). The worldwide threat of water borne pathogens. In: water quality in Latin America; Balancing the disinfection and chemical risk from drinking water disinfection Washington: ILSI press. Pg 19-43
8. Gerba, C.P. 2001. Assessment of enteric pathogen shedding by bathers during recreational activity
9. Grawbow W (1996): on the trial of the virus water quality 4:pp23-25
10. Greenberg A., Eaton A., and cleceri L., (1992): standard method for the examination of water and waste water, 8th ed. American Public Health Association
11. Kenner, B.A., clark, H.f., Kabler, P.W (1991) fecal Streptococci cultivation and enumeration of streptococci n surface water. Applied Microbiology, 9:15-19

12. National water research institute (1997).
13. Obiri-Danso, k., Okore Hanson A, Jonesk (2003). The microbiological quality of drinking water sold on the street in kumasi Ghana. Appl. Microbiology 37(4):334-339
14. Oladipo, I.C., Onyenike, I.C. and Adebiyi, A.O.(2009). Microbiological analysis of some vended satchet water in ogbomoso. Nigeria African Journal of food Science. 3(12): 406-412.
15. Oyedeji, o., olutiola, P.O and Moninuola, M.A. (2010). Microbiological quality of package drinking water brands marketed in Ibadan metropolis and ille-ife city in south Western Nigeria. African journal of Microbiology Research. 4(1): 096-102.
16. Refai M.K. (1979): Manual on food quality control, FOA, ROME Italy.
17. Stainer T. Y. (1992): General Microbiology, 5th edition, Macmillan publishers Pp.440-441.
18. Tortora, J.G, funke, R.B, Case, L.C (2002), Microbiology an Introduction. Media update of 7 edition, including bibliography and Index publisher Daryl fox; Pp 258-260.
19. Warburton DW (1993). A review of the microbiological quality of bottled water sold in canada. Part 2.The need for more stringent standard and regulations. Microbiol 39(2):158-168.
20. WHO, (1984). Guidelines for Drinking water quality. Recommendation. World health organization, Geneva 1:1-39.
21. Wolfgang, k., joklit, D.P. (1988): Zinseer Microbiology, 19th edition, Appleon and Lange, California Pp. 467, 475.
22. World health organization (WHO, 1993): Guideline for drinking Water Quality: Vol.1 WHO, Geneva.
23. World Health Organization Guidelines for drinking-water quality. Microbial Fact Sheet. P. 229-31.
24. World health organization (1984): Guidelines on quality drinking water volume 2: health criteria and other support information. WHO, Geneva.
25. World health organization (WHO) (1998). Guidelines for drinking water quality.Health Criteria and other supporting information.Geneva, World Health organization. 192pp.