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Physiochemical Study of Sachet Quality Water Sold in Michael Okpara University of Agriculture Umudike Nigeria.

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Abstract

Water has been identified as a necessity to life. For water to fulfill its purpose of sustaining life, it has to comply with some stipulated global and local standards. In this paper, the physiochemical characteristics of four brands of sachet water sold in Michael Okpara University of Agriculture Umudike (MOUAU) Abia state, Nigeria were studied so as to ascertain its level of compliance with World Health Organization(WHO) standard andNigerian Industrial standard (NIS). Triplicate batches of each of the brands were purchased randomly and analyzed for the following physiochemical parameters; pH, Temperature, Electrical conductivity (EC), Turbidity, Colour, Dissolved oxygen (DO), Total dissolved solid (TDS), Biochemical Oxygen demand (BOD),Total suspended solid (TSS), Chlorine, Iron (Fe), Calcium (Ca), Sodium (Na), Magnesium (Mg) and potassium. All the parameters analyzed were in compliance with the stipulated standards except Iron which ranges between 11.50mg/l to 14.00mg/l. The results showed

that the sachet water samples were not polluted. However, proper aeration and pH adjustment of the water samples before consumption are recommended.

Keywords: Sachet water, Physiochemical characteristics, pH adjustment, aeration, global and local standards.

Introduction

Water has been identified as a necessity to life. Good quality water helps to maintain life. Ugwu *et al* (2016) stated that water has been found indispensable to the wellbeing of man and that explains the saying that water is life. In simple term, water is necessary for the sustenance of growth in every part of the society (UNCSD, 2000).

The composition of water in the universe is almost equal to the same composition of water in human beings (Gore, 1993). Drinking water quality has often been adulterated owing to several anthropogenic factors which render it unfit for drinking. Ezeugwunne (2009) pointed out that for water to be of good quality, it must be tasteless, odourless, colourless and devoid of faecal pollution.

Good quality water is necessary for the sustenance of development (Asonye *et al* 2007). Mustapha and Adamu (1991) emphasized that a reliable supply of clean wholesome water is of high importance in promoting wellbeing of inhabitants in a certain location. Lamikanra (1999) stated that water of good quality is important to the physiology of man and his continued existence depends so much on its availability. The affordability of standard industrialized world model for delivering reliable drinking water and sanitation technology in most of the developing world is still low (Dada, 2009). Hence, some people resort to water sources of doubtful quality so as to make ends meet. In developing countries, the use of water packaged in polythene sachets

has been a common practice. The rationale behind the popularity of sachet water is because it has been seen as a very affordable source of water. Some people are often prejudiced over packaged water called sachet water that they named it “pure water”. So many factors such as the source of the water, the level of purification and the handling may constitute threat to life. Previous studies have identified handling as the source of infection in food and water-borne diseases in several countries (Dada, 2009). Several researchers have tried to study water quality in various locations and with respect to different water quality parameters. While some focused on the biological parameters, others focused on the chemical parameters. Some researchers have also studied the physiochemical parameters while others have studied bacteriological parameters. In the same vein, some researchers have equally studied both physiochemical and bacteriological parameters. For instance, Ugwu *et al* (2016) studied the physiochemical and bacteriological characteristics of borehole water quality in Umudike Abia state Nigeria. In their study, they examined the following parameters; Chloride, Biochemical Oxygen Demand (BOD), Nitrate, Sulphate, Dissolved Oxygen (DO),Temperature, Electrical Conductivity (EC), Total Dissolved Solid (TDS), Total Suspended Solid (TSS), Salinity, pH, Turbidity, Total Hardness (TH), Acidity, Alkalinity, Zinc, Lead, Nickel, Manganese, Residual Chlorine, Colour, and Iron Presence of minerals (such as magnesium and calcium, Total viable bacteria count, Total Coliform count and Escherichia Coli count (ECC). Their findings indicated that all parameters studied were within WHO and SON permissible limits. Yusuf *et al* (2015) in their study on sachet water quality in Zaria Area of Kaduna State, Nigeria, analyzed the following parameters;

Taste, chloride, colour, odour, pH, potassium, calcium, electric conductivity, biochemical oxygen demand (BOD) and total dissolved solid (TDS) and coliform counts**.**

Their results showed that all samples analyzed were colourless, odourless and tasteless. Most of the physico-chemical parameters conformed to NIS and WHO standards with the exception of coliform count in which none of the samples analyzed conformed to the stipulated standards. Onwughara *et al* (2013) in their study on Physicochemical Studies of Water from Selected Boreholes in Umuahia North Local Government Area, Abia State, Nigeria analyzed the following parameters; Temperature, pH, Electrical conductivity (EC), Total dissolved solids (TDS), Total suspended solids (TSS), Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Alkalinity, Acidity, Total hardness, Turbidity, Salinity, Nitrate, Phosphate, Calcium ion, and Magnesium. Their results showed that all physicochemical parameters analyzed in borehole water samples were within recommended standards except total suspended solids (TSS), Salinity, Nitrate, phosphate, Biochemical oxygen demand (BOD) and Dissolved Oxygen (DO).

In Michael Okpara University of Agriculture, Umudike (MOUAU), the most affordable type of drinking water used is sachet water. This paper became necessary owing to the fact that in such a federal University with a population of over 8000 including staff and students, the quality of water being used has to be investigated. This paper is therefore aimed at ascertaining the physical and chemical characteristics of sachet water sold within the vicinity of Michael Okpara University of Agriculture Umudike Abia State, Nigeria.

Materials and Methods

Description of the study Area

Michael Okpara University of Agriculture Umudike (MOUAU) is located in Ikwuano Local Government Area of Abia State. It lies on latitude 5.4801° N and longitude 7.5437° E. It is

situated 10 kilometers from Umuahia; the state capital. The University can be accessed via Umuahia-Ikot Ekpene Road as the major link road and it has a direct route to Uyo; Akwa Ibom state capital and Calabar; Cross River state capital.

Ikwuano can be described geologically as being found within Benin formation which consists of sediments as well as sand/shale and layers of thin clay beds(Asseez,1976; Murat,1972).

Fig 1: Topographical Map of Umudike showing the study Area (Adapted from Google 2016)

Sample Collection

Triplicate batches of each of the four brands of sachet water were purchased randomly within MOUAU. In all, twelve (12) samples were collected. The samples to be analyzed were collected with a neat container and conveyed to the laboratory. Prior to the analysis, the water samples were stored with the sachet at a room temperature. The Following physiochemical parameters were analyzed; pH, Temperature, Electrical conductivity (EC), Turbidity, colour, Dissolved oxygen (DO),Total dissolved solid (TDS), Biochemical Oxygen demand(BOD),Total suspended

Solid (TSS), Chlorine, Iron (Fe), Calcium (Ca), Sodium (Na), Magnessium (Mg) and potassium. All the sachet water companies selected were NAFDAC approved. The brands of sachet water selected include; MOUAU sachet water (SW1), Kechi's Sachet water (SW2), Mensa Sachet water (SW3) and St. Nick Sachet water(SW4).

Physiochemical Analysis of the Water Samples

The physiochemical analysis of the water samples were done in accordance with standard methods (APHA, 1992; DPR, 2000; WHO, 1984).The results of the analysis were compared with World Health Organization(WHO) standard and Nigerian Industrial standard (NIS) for drinking water quality

Results and Discussions

The results of the physiochemical characteristics of water samples are shown in Table 1. From the analysis carried out, with the exclusion of Iron which exceeded the permissible limits for both global and local standards, the remaining parameters conformed to both World Health organization (WHO) and Nigerian Industrial standard (NIS) for drinking water quality.

The pH of water is a measure of acidity and alkalinity. The pH ranges between 0 – 14 with 7 as the neutrality level. A water pH of less than 7 indicates the acidity of that water sample while a pH exceeding 7 implies that the water is alkaline. The results of pH in the present study ranged from 6.89-7.32. This is similar to the results obtained by Ugwu et al (2016). Although the pH of all the samples fall within permissible limit, sample SW1 was found to be a bit acidic while the remaining water samples are alkaline. Alkaline water has been proven to be better than acidic water. Wynn *et al* (2009) enunciated that minerals like calcium can be 30% easier to be absorbed by the body from water than from food. If water is alkaline, healthy minerals are got, if it is

acidic toxins like mercury can be absorbed from it. (Wynn *et al* 2009). To adjust the pH, its values can be increased or decreased. pH can be either increased or decreased by the addition of alkaline and acidic reagents respectively.

The temperature of water refers to the measure of its hotness or coldness. The temperature of the samples in the present study ranged between 25.90 to 26.30°C. Electrical conductivity of water is a measure of its capacity to conduct electric current which is determined by the concentration of dissolved organic salts or ions. It also indicates whether water is saline or fresh.

The values of electrical conductivity in the present study ranges from 0.08 to 0.34 (us/cm). The low range of electrical conductivity is a result of the low values of total dissolved solids (4.23-6.10mg/l). Deepali *et al* (2009) pointed out that high values of Electrical conductivity portrays that the ions concentration is high.

Turbidity in water refers to the degree of its cloudiness which caused by the presence of suspended particles. Putz (2003) defined turbidity as the reduction of transparency as a result of the presence of particulate matter like clay or silt, plankton or other microscopic organisms or finely divided organic matter. The values of Turbidity in the present study ranged between 0.03 to 0.04 NTU. The values of Turbidity were low owing to the fact that the values of total suspended solids were low (0.94-3.30mg/l).

Iron is of high importance in drinking water. This is because it is required for haemoglobin formation and serves as a co-enzyme. Deficiency of iron leads to anaemia and fatigue. However, when in excess it makes water to have a metallic taste and deposits of sediments which can habour bacteria and minor impurities. The values of iron in the present study ranges between

11.50mg/l to 14.00mg/l which indicates the presence of high iron content. This therefore exceeds WHO and NIS standards.

Table 1: Mean Value Results for physiochemical Parameters of Water Samples

Parameters	*SW1*	*SW2*	*SW3*	*SW4*	*WHO Standards*	*NIS*
pH	6.89	7.32	7.06	7.19	*6.50-8.50*	*6.50-8.0*
Temperature °C	25.90	26.15	26.30	25.99	35.00-40.00	*Ambient*
Electrical Conductivity (µs/cm)	0.08	0.15	0.34	0.15	*1000.00*	*1000*
Turbidity(NTU)	0.03	0.05	0.03	0.04	*5.00*	*5.00*
Colour(TCU)	0.02	0.22	0.02	0.03	*Colourless*	*15.00*
Total Hardness	10.09	90.05	80.08	80.15	*100.00*	*150.00*
Dissolved Oxygen(mg/l)	12.27	10.92	10.32	11.25	-	-
Total Dissolved Solids(mg/l)	4.85	6.10	4.55	4.23	*1000.00*	*500.00*
Biochemical Oxygen Demand(mg/l)	8.65	7.95	7.91	8.09	*10.00*	*10.00*
Total Suspended Solids(mg/l)	2.45	3.30	0.94	2.95	30.00.00	-
Chlorine(mg/l)	58.89	115.51	108.39	107.10	*250.00*	*250.00*
Iron(mg/l)	11.50	13.75	14.00	12.50	*0.03*	*0.30*
Calcium(mg/l)	25.05	20.04	20.04	22.03	75.00-200.00	*10.00-200.00*
Sodium(mg/l)	1.39	1.08	0.57	1.00	200.00	*200.00*
Magnesium(mg/l)	9.83	9.03	7.90	9.07	50.00-150.00	-
Potassium(mg/l)	0.68	3.88	0.65	0.69	*12.00*	*12.00*

Conclusion

This study was aimed at assessing the physiochemical characteristics of sachet water sold in Michael Okpara University of Agriculture Umudike Nigeria. Twelve (12) samples involving four brands of sachet water were collected randomly for the analysis. The samples were analyzed and

the results showed that the sachet water samples were not polluted owing to the fact that almost all parameters conformed to both Nigerian Industrial standard as well as World Health Organization standard. High content of Iron in the range of 11.50mg/l to 14.00mg/l was observed in all the samples studied. The values exceeded the stipulated standards, therefore proper aeration of the sachet water is recommended before consumption. There is also a need for pH adjustment of one of the water samples; MOUA sachet water (SW1) which has a pH of 6.89 (acidic) before it is consumed.

Conflict of Interests

The authors have not declared any conflict of interests

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