Journal of Multidisciplinary Engineering Science Studies (JMESS)
ISSN: 2458-925X
Vol. 3 Issue 2, February - 2017

Appraisal Of The Portability Of Some Selected Packaged Water On Sale In Ado Ekiti, South Western Nigeria

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***Abstract*—Over time potable water production in sachet and bottles of various sizes has overtaken the erstwhile "ice water" which was common sights in public places. Ever since, quite a lot of interested investors have entered into the lucrative and profitable venture of making drinkable water available in Nigeria. Thirty samples of sachet water were collected from various locations within Ado Ekiti Metropolis and its Environs, the samples were prepared for analyses which include physical, chemical and bacteriological compositions respectively. The aim of this study is to assess the level of compliance of the sachet water plants to the laid down standards of World Health Organization[2009] and NAFDAC[2007], and as well as to advice the government on improvement strategies. The results from the analyses indicate that the total dissolved solids[TDS] ranges from 92 – 305mg/l, Turbidity [1.50 – 10.20mg/l], Temperature [14.4 – 28.9ºC], pH [5.5 – 7.4], Magnesium [23.0 – 142.5mg/l], Calcium [74.0 – 225.5mg/l], Chloride [25.4 – 192-0], Iron[0.1 – 0.3], Sulphate [10.15 – 115mg/l] and Total hardness [20 – 260mg/l] respectively. The general overview of the results indicate that only 10% of the samples are in conformity with the drinking standard of World Health Organization [WHO, 2009], while the remaining 90% failed the drinking water standard test.**

Keywords—Ado Ekiti, sachet water, bacteriological electrical conductivity, turbidity, TDS

INTRODUCTION

The production of sachet water has been very good and profitable business in which individual would be interested to invest when properly managed. Since the introduction of sachet table water in Nigeria, the outbreak of cholera epidemics has reduced drastically to the bearest minimum compare to what is obtained in previous years. National Agency for Food and Drug Administration and Control (NAFDAC) is mandated to enforce compliance with internationally defined drinking water guideline, but regulation of the packaged water aimed at good quality assurance has remained a challenged to the agency (Dada A. C 2009)

Water is necessary for the digestion of food, the elimination of toxins and waste materials, and the circulation of body fluids like blood and lymph and to help regulate body temperature. (Mohapatra, *et al,* 2005; Mara and Oragui,1985). Vomiting or diarrhea leads to dehydration if not balanced by adequate fluid intake. Fever, coughing, rapid breathing and watery nasal secretion also can dramatically raise the amount of water lost (World Health Organization WHO, 2009). The fluoridation of water in many communities has contributed greatly to reduction in dental caries. The centers for disease control and prevention named water fluoridation as one of the top 10 public health achievements of the 20th century. (NAFDAC, 2007).

Some recent studies by Aderibigbe [2008], Gbadegeshin and Olorunfemi (2007) have corroborated the inadequacy of the country water supply and how less than 50 percent of the population have access to safe drinking water especially in rural areas. According to Akunyili (2003), the government inability to provide adequate potable water for the growing population has tremendously contributed to the proliferation of the so called 'pure water' producer in Nigeria. The United Nations in 2000 set a goal in their millennium declaration to reduce the amount of people without safe drinking water by half in the year 2015 (Dada A. C 2009). Safe drinking water for human consumption should be free from pathogen such as bacteria, viruses and protozoan parasite, meet the standard guideline for taste, odour appearance and chemical concentrations and must be available in adequate quantity for domestic purpose. Diarrhea diseases are responsible for approximately 2.5million death annually in developing countries, affecting children younger than 5years of age especially those in area devoid of access to portable water supply and sanitation (WHO, 2009). Microbiological contamination of the water may occur between the collection point and the point of use in the household due to hygienic practices causing the water to become a health risk Sobsey (2002).

Figure.1: Map of Ado-Ekiti, Ekiti State

The aim of this project is to assess the quality and portability of sachet water within and around Ado Ekiti and its metropolis in Ekiti State Nigeria and compare it with approved standard limit of WHO and NAFDAC. This is to assess compliant status to the laid down standards of drinking water and to proffer possible remedies towards effective compliance.

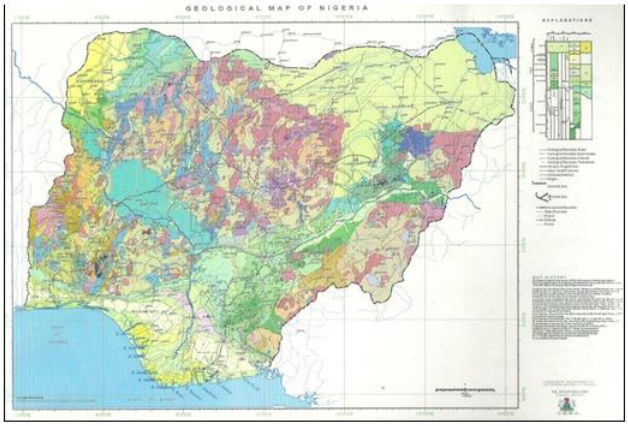

Figure 2: Geological map of Nigeria

GEOLOGY OF SOUTHWESTERN NIGERIA BASEMENT COMPLEX

The area covered by the southwestern Nigeria basement complex lies between latitude 7^0 and 10^0 Northings and longitude 3^0 and 6^0 Eastings, right in the equatorial rain forest region of Africa (fig 2). It has been establish that the Precambrian basement complex of Nigeria including Southwestern Nigeria is polycyclic in nature. The southwestern Nigeria basement complex had undergone 4 major orogenesis in:- Liberian (Archaean) 2500Ma+- 25Ma, the Eburnean orogeny (Early proterozoic) 2000Ma-2500Ma, the kibaran orogeny(mid proterozoic), 1100Ma-2000Ma, and the pan African Orogeny , 450Ma-750Ma (Rahaman 1976). The main lithologies include the amphibolites, migmatite gneisses, granites and pegmatites as well as schists.(Rahaman 1988).

GEOLOGY OF ADO-EKITI, EKITI STATE

The geology of Ado-Ekiti reveals that rock of the various units of the geological succession range in age from the Precambrian rock which are partly overlain by cretaceous sediment dated millions of years old. These Precambrian rocks (Old age rock) are known as basement complex. This consists of the oldest known rocks which are the remnant of an ancient sediment series. The meta-sediments which was later transformed to migmatite and granite includes quartz, feldspatic, biotite hornblende, gnesis, schist, marble and calcium silica rocks (Oyinloye, 2007). Generally in Ado Ekiti, charnockites are found in addition to granite gneiss while to the west of the town, schist and quartzite are predominant along with dark coloured pegmatites and granite (Dada, 1997).

MATERIALS AND METHODS

Thirty sachet water samples were collected within and around Ado-Ekiti township which is located between longitude 5º 13'0''E and latitude 7º 38'0''N within the Southwestern Nigeria. (Figure.1). Prior to final selection of the thirty samples, personal interaction (popular products identification), coupled with preliminary selective sampling was conducted to ensure adequate representative sampling within the study area. The samples were collected at various factories within and around the city from those already passed for distribution to consumers. Physical examination such as temperature, taste, colour, odour total dissolved solid, electrical conductivity, while chemical analyses: calcium, magnesium, iron, chloride, nitrate and other tests were carried out. Conductivity probe meter was used to measure the electrical conductivity and the temperature, turbidity meter was used to determine the turbidity while Ph meter was used to measure the pH. Colorimetric analysis was employed for some other parameters such as calcium, magnesium, iron, chloride using atomic absorption spectrophotometer.

RESULTS AND DISCUSSION

The results of the sachet water samples conducted is presented in the Table 1. The includes the physical, chemical and microbiological parameters of all the samples as compared to the standards of drinking water according to WHO, 2009 and NAFDAC, 2007.

PHYSICAL ANALYSIS OF SACHET WATER SAMPLE:

The Physical properties analyzed for this water includes the odor, color, taste, temperature and total dissolved solid Considering the color of all the samples, it was within the limit of WHO (2009) standard. The odour of the samples range from non objectionable [90%] to objectionable [10%] as expressed in Table 2. The samples appearance range from not clean and cleared to very clean and clear (Table 3). Also the tastes of some of the samples indicate objectionable [23%] while the other [77%] of the samples are unobjectionable. This is indicative that an average [80%] of the samples are within the standard limit of drinking water. The **total dissolves solids** of all the sachets samples range from 92.0-305.0mg/L with a mean value of 197.7mg/l. The WHO 2009 and NAFDAC 2007 standards is 1500mg/l. Total dissolved solid in the water sample is below the standard limit, below the highest desirable level, this makes the water safe for human consumption.

PHYSICAL PARAMETERS

Table. 1: Result of the Physical Parameters of the study sample

S/N OF SAMPLES OF SAMPLE	NAME OF THE SAMPLE	Temperature (°c)	Appearance	Taste	(N.T.U) Turbidity	(H.U) colour	T.D.S (mg/l)	Odour	Electrical conductivity µ/s	Dissolved oxygen (ppm)
1	**SAMPLE 1**	26.4	Clean/clear	Tasteful	2.20	5	201	Faint odour	105	0.23
2	**SAMPLE 2**	26.4	Clean/clear	Tasteless	5.75	5	92	odourless	162	0.22
3	**SAMPLE 3**	26.1	Clean/clear	Tasteless	5.20	5	213	odourless	213	0.23
4	**SAMPLE 4**	26.8	Clean/clear	Tasteless	6.88	5	175	odourless	174	0.23
5	**SAMPLE 5**	26.8	Clean/clear	Tasteful	5.15	5	162	odourless	244	0.24
6	**SAMPLE 6**	26.8	Clean/clear	Tasteless	4.15	5	205	odourless	196	0.24
7	**SAMPLE 7**	26.8	Clean/clear	Tasteless	5.20	5	262	odourless	175	0.24
8	**SAMPLE 8**	27.1	clean/clear	Tasteful	5.88	5	180	odourless	133	0.25
9	**SAMPLE 9**	27.3	Clean/clear	Tasteful	6.50	5	175	odourless	108	0.23
10	**SAMPLE 10**	27.1	Clean/clear	Tasteful	5.40	5	305	odourless	379	0.25
11	**SAMPLE 11**	27.6	Clean/clear	Tasteless	5.90	5	268	odourless	196	1.25
12	**SAMPLE 12**	28.9	Clean/clear	Tasteless	7.20	5	109	odourless	106	0.25
13	**SAMPLE 13**	27.6	Clean/clear	Tasteless	5.55	5	102.5	odourless	96.4	0.26
14	**SAMPLE 14**	28.3	Clean/clear	Tasteless	6.25	5	266	odourless	120	0.26
15	**SAMPLE 15**	27.6	Clean/clear	Tasteless	10.15	5	250	odourless	111.6	0.26
16	**SAMPLE 16**	18.6	Clean/notVclear	Tasteful	5.25	3	305	Faint odour	390	0.22
17	**SAMPLE 17**	16.0	Very clean/clear	Tasteless	2.42	6	75	Odour less	1457	0.22
18	**SAMPLE 18**	15.0	Very clear/clean	Tasteless	2.04	5	95	Odour less	237	0.23
19	**SAMPLE 19**	14.5	Clean/clear	Tasteless	1.50	5	250	Odour less	310	0.26
20	**SAMPLE 20**	15.5	Clean/notVclear	Fait taste	2.00	6	462	Faint odour	196.0	0.24
21	**SAMPLE 21**	16.0	Clean/clear	Tasteless	3.04	4	108	Odour less	161	0.24
22	**SAMPLE 22**	16.5	Very clear/clean	Tasteless	2.34	5	132	Odour less	224	0.25
23	**SAMPLE 23**	16.0	Very clear/clean	Tasteless	3.05	5	146	Odour less	237	0.24
24	**SAMPLE 24**	14.5	Very clear/clean	Tasteless	2.05	4	174	Odour less	190	0.25
25	**SAMPLE 25**	15.5	Clean/clear	Tasteless	1.50	6	213	Odour less	148.5	1.25
26	**SAMPLE 26**	15.5	Very clear	Absent	25	5	1500	Virtually absent	-	0.24
27	**SAMPLE 27**	28.9	Very clear	Virtually absent	5	5	500	Virtually absent	-	0.26
28	**SAMPLE 28**	27.6	Clean/clear	Tasteless	5.55	5	102.5	odourless	96.4	0.24
29	**SAMPLE 29**	28.3	Clean/clear	Tasteless	6.25	5	266	odourless	120	0.23
30	**SAMPLE 30**	27.8	Clean/clear	Tasteless	10.20	5	251	odourless	110.2	0.25
WHO, 2009		-	CLEAN AND CLEAR	Tasteless	25				1500	
NAFDAC 2007		-							1500	

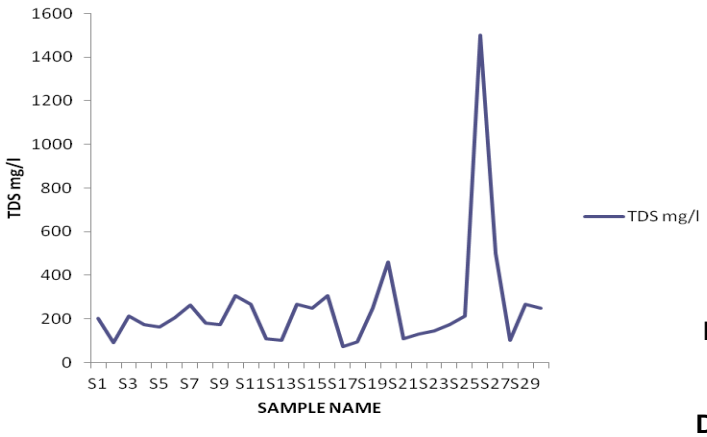

Figure 3: The T.D.S of the analyzed sample

TURBIDITY: The total turbidity of the water samples ranged from 1.75-10.15mg/l with a mean value of 3.76. The WHO standard limit for turbidity in water is $\leq$ 25mg/l. therefore the entire samples are within the standard limit.

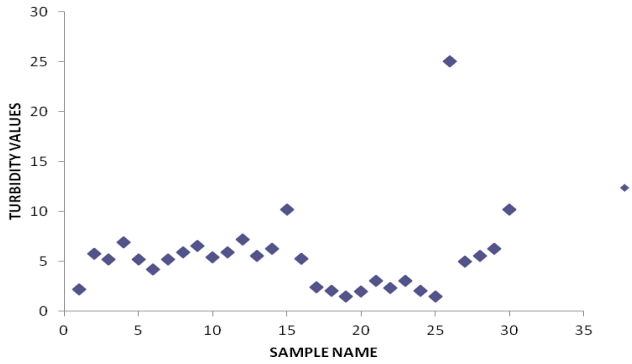

Figure 4: The turbidity of the analyzed samples

TEMPERATURE: The temperature of the packaged water samples ranges from 26.1- 28.9^{0}C with a mean value of 27.17. Although there is no guideline for temperature, it depends on the ambient temperature parameters of the samples. Studies indicate that the hot water is not usually palatable. At times temperature value may affect the state and level of other parameter such as EC and bacteriology activity. Warm temperature increases bacterial activities resulting in odour development from reduction and depletion of oxygen from oxidation of organic and nitrogenous compounds present in water. The pH level may be connected with oxyic state of the water and turbidity level and presence of colloidal matters studied. From the result obtained, all the samples were within the standard. When the temperature is above this standard, such water may cause effect on human health.

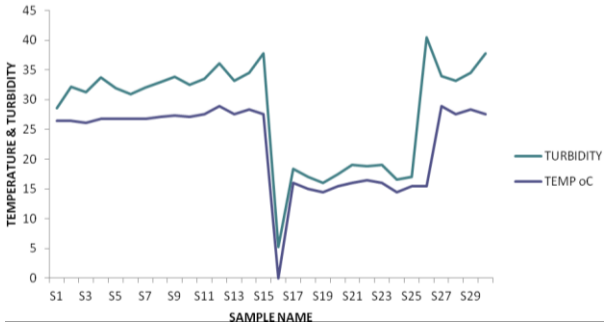

Figure 6: Temperature and Turbidity

DISSOLVED OXYGEN: The WHO standard limit for dissolved oxygen in water ranges from (4-6ppm). The samples of dissolved oxygen value ranges from 0.22-1.25 which shows that they are within the standard limit, the high temperature in water makes the dissolved oxygen to be very low. Low dissolve oxygen primarily results from excessive algae growth caused by phosphorus. The sharp decline in the dissolved oxygen is probably resulted from introduction of organic matter in the water which consumed oxygen during decomposition. The decrease in dissolved oxygen generally accompanied by a corresponding decrease in Ph results in the lowering of the pH as acidic products are formed in the process

ELECTRICAL CONDUCTIVITY: The EC of the sachet water was found to be in the range of [96.4-1457µ/s] these values are much lower compare to the standard limit of WHO [2009]. The graphical relationship between EC and TDS of the samples (Fig. 8) indicate the two parameters complement one another. Conductivity is affected by the presence of dissolved ions in water. The importance of EC is its measure of salinity which generally affects the taste. This will impact on the users acceptance of the water [Ahmed *et al*, 2000]

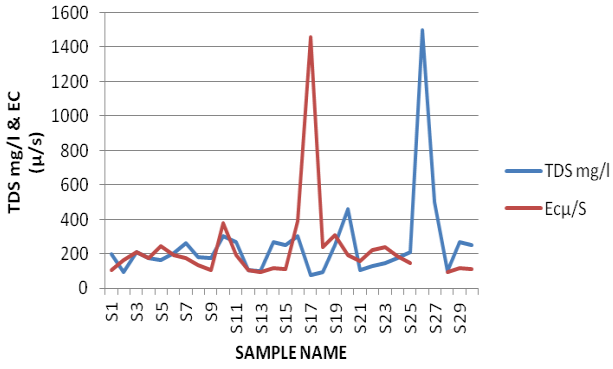

Figure 8: Comparison of TDS and EC per sample (Line Plot)

Table 3 : Physical Classification of Analyzed Samples(in percentages)

Physical Characteristic	Percentage		Classification Parameter
Odourless	**90%**	**100%**	**Odour**
Odour present	**10%**		
Not clean and not clear (A)	**6.6%**	**100%**	**Clarity and cleanness**
Clean and clear (B)	**70.1%**		
Very clean and clear (C)	**23.3%**		
Tasteful	**23%**	**100%**	**Taste**
Tasteless	**77%**		

OTHER PHYSICAL PARAMETER ANALYSIS OF THE SAMPLES

PARAMETER	RANGE	AVERAGE	WHO/NAFDAC STANDARD 2007	COMMENT & REMARK
TDS	92-305 mg/l	197.7 mg/l	1500 mg/l	Below the standard limit, > highest desirable level. Safe for drinking
Turbidity	1.75-10.15	3.76	≤ 25 mg/l	Within standard limit
Temp	26.1-28.9 ^{o}C	27.17 ^{o}C	No guideline	But studies say that hot water is not palatable i.e it affects EC & bacteria activity hence the taste. Safe for drinking
Dissolved O_2	0.22-1.25 ppm	0.28 ppm	4-6 ppm	Within limit. Low O_2 = low PH = acidity
EC	96.4-1457 µ/s	229 ppm	1550	Lower limit affects ions & it measures salinity which affects taste

CHEMICAL ANLYSIS OF SACHET WATER SAMPLES

pH: It was observe that the pH value of the sachet water samples ranged from 5.5 - 7.4 with a mean value of 6.41 $\pm$0.881. From the result obtained 33.3% of the samples were acidic while 66.7% are within the standard set by WHO (6.5 – 8.5) for drinking water. Acidity or low pH of drinking water could be either resulted from natural geological parameters of the source rock from the aquifer or from acid rain. Acidic water can be corrected using neutralizing filters to increase the pH by passing water through a filter bed of calcium carbonate ($CaCO_3$) this neutralize the acid and increases the pH. Compound of both sodium and calcium carbonate are the most common compound used in increasing pH in drinking water. The pH of water is the most important parameter in determining the corrosive nature of the water; the lower the pH the higher the corrosive level(WHO, 2009), any water that is exposed to extreme ph values of less than 4 and greater than 11 may result in irritation of the eyes,skin and mucous membranes.

MAGNESIUM: magnesium hardness ranges from 23.0-142.5mg/l with a mean value of 61.63 the guideline standard limit is (150 mg/l) so all the sample are within the standard limit. High concentration of magnesium in water may cause muscle slackening, nerves problem, depression and personality changes. Magnesium compound are usually removed from water due to the role magnesium plays in water hardness, this is achieved by means of water softening.

CALCIUM: Calcium hardness ranges from 74.0-225.0mg/l. WHO, SON and NAFDAC standard implies that it must not be more than 200mg/l. all the sample meet up with the standard except sample (K) which is above the standard. Calcium phosphate is supporting substance and causes bone and tooth growth. Hard water may assist in strengthening bones and teeth because of its high calcium concentration. It may also decrease the risk of heart condition.

CHEMICAL PARAMETERS

Table. 5: Showing the chemical parameters analytical result of the study sample

S/N	NAMES OF THE SACHETWATER SAMPLE	Ph	Ca (mg/l)	Mg (mg/l)	Cl (mg/l)	Iron (mg/l)	Pb (mg/l)	Total hardness	Alkalinity (mg/l)	$N0_3$	$S0_4$
1	**SAMPLE 1**	5.5	75.0	39.0	99.26	0.1	N.D	20	2.0	70.40	12.4
2	**SAMPLE 2**	6.5	82.0	62.0	113.44	0.1	N.D	20	2.0	50.80	110.5
3	**SAMPLE 3**	6.5	75.0	61.0	113.44	0.1	N.D	20	2.0	51.30	16.2
4	**SAMPLE 4**	6.5	74.0	70.5	45.20	1.0	N.D	100	1.6	50.20	15.20
5	**SAMPLE 5**	5.5	80.0	95.0	32.10	3.0	N.D	60	0.4	60.80	14.51
6	**SAMPLE 6**	6.8	123.0	50.0	80.20	1.5	N.D	20	0.8	50.80	12.80
7	**SAMPLE 7**	6.5	145.0	90.0	142.00	0.3	N.D	20	0.4	61.40	10.15
8	**SAMPLE 8**	5.5	118.5	23.0	25.40	2.0	N.D	100	1.6	50.40	11.07
9	**SAMPLE 9**	5.5	119.5	25.0	140.20	1.0	N.D	60	0.8	63.00	12.75
10	**SAMPLE 10**	5.5	115.5	40.0	35.60	1.5	N.D	60	0.8	50.50	14.50
11	**SAMPLE 11**	6.5	225.5	142.5	192.50	1.0	N.D	260	0.8	51.30	17.20
12	**SAMPLE 12**	7.4	94.8	25.2	115.98	0.1	N.D	100	1.5	50.80	12.20
13	**SAMPLE 13**	7.3	135.2	75.5	141.80	0.3	N.D	120	3.0	51.30	19.42
14	**SAMPLE 14**	7.4	190.5	60.2	56.72	0.3	N.D	120	3.0	50.05	112.20
15	**SAMPLE 15**	7.2	145.7	65.5	127.62	0.7	N.D	80	5.0	51.05	115.50
16	**SAMPLE 16**	6.0	3.6	2.0	304	3.0	N.D		N.D	51.30	102
17	**SAMPLE 17**		44.5	34.0	35	35	N.D	100	N.D	50.20	32.5
18	**SAMPLE18**	6.8	40	25	40		N.D	60	N.D	60.80	45
19	**SAMPLE 19**	6.5	33.4	32.0	65	1.0	N.D	80	N.D	50.80	54
20	**SAMPLE20**	6.0	46.5	25.7	105	2.0	N.D	80	N.D	61.40	155
21	**SAMPLE 21**	6.6	25.8	36.45	60	0.1	N.D	60	N.D	50.40	50
22	**SAMPLE 22**	6.8	36.0	30.2	55	1.0	N.D	100	N.D	63.00	44
23	**SAMPLE 23**	7.2	22	35	100	1.0	N.D	60	N.D	50.50	50
24	**SAMPLE 24**	7.0	30	20.2	75	1.0	N.D	80	N.D	51.30	30
25	**SAMPLE 25**	6.0	200	150	600	1.0	N.D	1500	500	50.80	200
26	**SAMPLE 26**	7.2	75	50	200	0.1	N.D	500	200	51.30	200
27	**SAMPLE 27**	7.0	30	20.2	75	1.0	N.D	80	N.D	50.05	30
28	**SAMPLE 28**	6.5	82.0	62.0	113.44	0.1	N.D	20	2.0	51.05	110.5
29	**SAMPLE 29**	6.5	75.0	61.0	113.44	0.1	N.D	20	2.0	51.30	16.2
30	**SAMPLE 30**	6.5	225.5	142.5	192.50	1.0	N.D	260	0.8	51.30	17.20
WHO STANDARD ON DRINKING WATER QUALITIES (2009)											
	P.L	6.5-9.2	200	150	600	0.3	-	-	-	45	250
	T.L	7-8.5	75	30	250	0.1	-	-	-	20	I50

CHLORIDE: The water sample define ranges from 25.4 –192.5mg/l while the acceptable standard for chloride content in water by SON, WHO and NAFDAC is 200mg/l. Therefore all the water samples fall within the range and are consumable. The implications of this is that low amount of chloride in water has no effect on human health but high consumption of chloride in water cause respiratory problem. Chlorine is a disinfectant in most residential water supplies. Chlorine controls microbe in drinking water can lead to eye, skin, nasal irritation and stomach ache which include aeration, boiling and installation of activated carbon filter on the primary drinking source.

IRON: The concentration of Iron in the sample range from 0.1- 3.0, while World health Organization (WHO) guideline/standard limit is 0.3. From the result obtained, water samples D, E, F, H, I, J, K with the percentage of 46.7% did not meet the standard limit. While water samples A, B, C, G, L, M, N and O with the percentage of 53.3% falls within the standard WHO (2009) limit for drinking water. Iron is an

essential element in human nutrition. The high level of iron could be due to the occurrence of iron present in source rock.

TOTAL HARDNESS: Water hardness is the traditional measure of the capacity of water to react with soap, hard water considerably more soap to produce lather. The concentration of the hardness in the sample varies from soft to hard. Samples 1, 2, 3, 5, 6, 7, and 10shows hardness range from (20-60mg/l) indicative of soft water, samples 4, 8, 9, 12, 13, 14 and 15 shows hardness range from (80-120) which indicate moderately hard water and sample K is more than 180mg/l, it shows a very hard water. The WHO standards for total hardness of water are these: soft water (0-60mg/l), moderately hard water (61-120mg/l), hard water (121-180mg/l) and very hard water $\geq$ 181. It often causes aesthetic problems such as an alkali taste to the water, building up of deposit on dishes, utensils and laundry basins; difficulty in getting soap and detergent to foam and lowered efficiency of electric water heaters. Hard water can be treated by adding a water softener to laundry and the dish washer or by installing an ion exchange system to treat the drinking water.

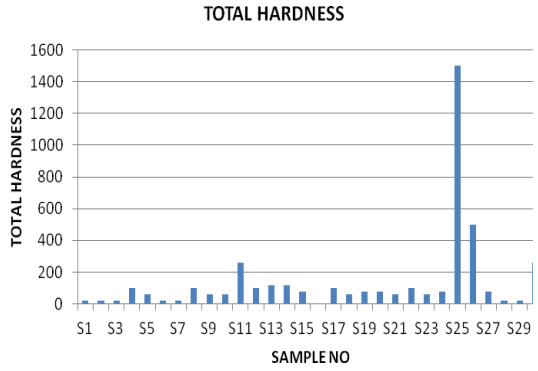

Fig.10: Total hardness of the analyzed sample

NITRATE AND SULPHATE:The packaged water samples had nitrate values ranged from 50.05-70.40mg/l with a mean value of 54.27 and sulphate values of between 10.15-115.5mg/l. The WHO standard for the oxides are $\leq$ 45mg/l and 250mg/l respectively. Therefore the entire water sample is above the standard limit for nitrate and within for sulphate. Higher nitrate level in water causes methemoglobenemia or blue baby syndrome, condition found especially in infants less than six months. Proper management of fertilizer, manures and other nitrogen source minimizes contamination of drinking water supplies. This could be treated by passing the activated carbon primary filtration. Although high level of Sulphate causes diarrhea and dehydration, this is more sensitive in infants than adults. (Sridhar, 2000). High Sulphate in the water can be corrected by reverse osmosis, distillation or ions exchange.

BACTERIOLOGICAL ANALYSIS: Table 5shows the bacteriological results of the sachet water samples conducted. About 20% of the samples falls within the World Health Organization (WHO, 2006) and NAFDAC (2007), While the other 80% falls outside the standard limit of drinking standard. The majority of the samples are worst affected probably from the production personnel, dirty environment, post contamination during packaging, sealing of nylon. Contamination of samples is usually from faecal matter and the most common indicator is Escherichia organisms.

Table 6. The Microbiological Result of the Studied Samples

S/N	NAME OF THE SACHET WATER SAMPLE	GROUP OF ORGANISMS	
		E. coli C.F.U×10^4	COLIFORM COUNT C.F.U×10^3
1	SAMPLE 1	4	8
2	SAMPLE 2	12	16
3	SAMPLE 3	3	5
4	SAMPLE 4	-	-
5	SAMPLE 5	5	2
6	SAMPLE 6	7	15
7	SAMPLE 7	5	20
8	SAMPLE 8	1	2
9	SAMPLE 9	-	-
10	SAMPLE 10	6	12
11	SAMPLE 11	-	-
12	SAMPLE 12	5	15
13	SAMPLE 13	7	16
14	SAMPLE 14	15	4
15	SAMPLE 15	14	10
16	SAMPLE16	12	3
17	SAMPLE17	7	10
18	SAMPLE 18	-	-
19	SAMPLE 19	15	8
20	SAMPLE 20	13	15
21	SAMPLE 21	6	18
22	SAMPLE 22	8	7
23	SAMPLE 23	12	2
24	SAMPLE 24	-	-
25	SAMPLE 25	5	18
26	SAMPLE 26	6	14
27	SAMPLE 27	2	10
28	SAMPLE 28	-	-
29	SAMPLE 29	3	14
30	SAMPLE 30	5	2

CONCLUSIONS

Based on the result obtained, it was observed that not all the samples met with the World Health Organization (WHO, 2009) standards and NAFDAC (2007). An average of 75% of the samples met up with the physical and chemical tests, while 25% of the samples failed the standards of drinking water. The microbiological results show that about 25% of the samples meet up with the World Health Organization (WHO, 2006) standard. The linear trend of Electrical

conductivity values and that of total dissolved solids (TDS) indicates that the higher the EC of the sachet water the higher the values of TDS. This is a proof that the level of total dissolved solids is a function of an increased EC values. The source of these total dissolved solids could be from source rocks or aquifer through the water is tapped. The study has attempted to examine the public health implication of sachet water produced in Ado Ekiti and its environs. Most packaged water apparently is of good quality, but some are contaminated. It should however, not be automatically assumed that packaged water in sachet is generally safe. From the analysis it was discovered that only sample D met the standard of drinking water according WHO (2009) and NAFDAC (2007)

RECOMMENDATIONS

On this note I can therefore recommend that the World Health Organization (WHO) and the national agency for food and drug administration and control (NAFDAC) should ensured the safety of the public by making efforts to monitor the activities of packaged water producing company confirm that water produced by them conformed with WHO and the NAFDAC's standard. The World Health Organization (WHO) and NAFDAC should periodically check the company's purification and packaging equipment, also the inspection of their workers and company environment.

REFERENCE

Aderibigbe et, al (2008): Assessment of water quality of reservoir in Bhopal (M.P) pollution Research 15(2) pg191-193

Akunyili (2003): Externality effect of sachet water in Nigeria. Vol 40, pg75-76

Dada A. (1997): Pure water. How safe? ultimate water technology and environment 1(3) pg 8-11.

Dada A. C (2009): sachet water phenomenon in Nigeria: Assessment of the potential health impact Jan African Journal of microbiology Research 3: 15-21.

Gbadegeshin A.S (2007): Linking poverty incidence to water resources. No 7, pg 110-115

Mara D.D and Oragui J. (1985): Bacteriological methods of distinguishing between human and animal faecal pollution of water, Bulletin of WHO, No. 63, 4 PP 773-783.

Mohapatra, S.C, Misra and Bidyabati (2005): Assessment of water quality parameters of the river Brahmani at Rourketh Journal of industrial pollution control, 21(2), 265-270.

NAFDAC (2007) Nigeria standard for drinking water quality publish by sow1 pg(1-30)

Oyinloye, A.O. (2007): Geology and geochemistry of some crystalline Basement Rock in southwestern Nigeria: Implication on Provenance and Evolution. 50(4): 223-231.

Rahaman M.A. (1988): 'Geology of Nigeria', Elizabethan Publishing', Lagos, Pp.45-50'.

Rahaman M.A. (1976): Review of the Basement Geology of Southwestern Nigeria. In: C.

A. Kogbe (ed.) Geology of Nig. Elizabethan Publishing', Lagos, Pp.45-50'.

Sobsey, (2002): State the microbiology contamination of water. Vol.20, pg 225-236

Sridhar, M.K.C (2000): Groundwater of Nigeria urban center problem and option in water sanitation and health resolving conflicts between drinking water demand and pressure from society waste (1998) 24 - 28.

WHO (2009): Guidelines for drinking water quality (electronic resources), 3rd edition incorporate 1st and 2nd addenda volume 1, pg 30 – 113 Recommendations.