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Biological and physiochemical properties of shallow wells in Ikorodu town, Lagos Nigeria

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This study examined the biological, physical and chemical quality of shallow wells in Ikorodu, Lagos state. Purposive random sampling method was employed for the collection of samples during the wet season in September, 2010 from Majidun, Ogolonto and Agric communities. A total of 24 samples, with 8 from each community, were collected and analyzed for taste, odour, colour, temperature, pH, total dissolved solids (TDS), conductivity, total hardness, total alkalinity, total acidity, chloride and nitrate, calcium, magnesium and total coliform count. The physiochemical parameters analyzed fell within the NAFDAC, SON maximum allowable limit and WHO desirable and maximum permissible limit for potable water. However, magnesium, total hardness and nitrate were higher than WHO desirable standards in most of the locations. The mostly affected were the shallow wells in Ogolonto community. The relationship between total bacterial count and total acidity was significant at the 0.05 level at Ogolonto community. The relationship between total bacterial count and conductivity, TDS and chloride was significant at the 0.05 levels, while nitrate is significant at the 0.01 level at Agric community. The implication of this result is that the shallow wells in most locations were polluted and could result in adverse health hazard

Key words: Water quality, shallow well, standard guidelines, total coliform count.

INTRODUCTION

In ancient times, water was mostly stored in tanks, pots and buckets while some people harvested rain water from the roof top of houses and kept for use during rainfall absence especially during the dry seasons (Todd, 1980). Later, the increased demand for water resulted in tapping of groundwater from springs and hand dug wells.

Groundwater is a reliable source of water supply, because it is often unpolluted due to restricted movement of pollutants in the soil profile (Lamb, 1985). However, shallow and permeable water table aquifers are most susceptible to contamination (Moody, 1996). The potential of such water to harbor microbial pathogens and cause illness is well documented for both developed and developing countries (Wright et al., 2004). Introduction of pollutants into the natural water occur directly through point source (septic tanks, disposal sites etc,) near the ground water or indirectly through non-point source when already polluted water in the area enters into the freshwater body by lateral or side movement (Hammer, 1986).

Water pollution results in transmission of infectious diseases. The implications of waterborne bacteria and virus infection include polio, hepatitis, cholera, diarrhea, typhoid etc (Kukkula et al., 1997; Nassinyama et al., 2000) but nitrate contamination is very severe. Thus, contamination of drinking water from any source is of primary importance due to the danger and risk of water diseases. In 1997, the World Health Organization (W.H.O.) reported that 40% of deaths in developing nations occur due to infections from water related diseases and an estimated 500 million cases of diarrhea, occurs every year in children below 5 years in parts of Asia, Africa and Latin America.

Water that has good drinking quality is of basic importance to human physiology and human's continued existence relies very much on its availability (Lamikanra, 1999; Nwosu and Ogueke, 2004). According to Davis and De-Wiest (1966), the standard for drinking water can be

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attributed to two main criteria, namely: The presence of objectionable taste, odour and colour and the presence of substances with adverse physiological effects. However, most of the groundwater from most sources is therefore unfit for immediate consumption without some sort of treatment. The extent of treatment needed therefore is determined by the quality of the raw water source (Macrea et al., 1993). Therefore, water has to meet up with certain physical, chemical and microbiological standards, that is, it must be free from diseases producing micro-organisms and chemical substances, perilous to health before it can be termed potable (Ihekoronye and Ngoddy, 1985).

The present study aims to (1) determe the quality of shallow well water and relates the biological, physical and water chemistry with standard guidelines for safe consumption or usage, and (2) to identify the various properties of water collected with the likely causes of the contamination and pollution in Ikorodu town of Lagos State, Nigeria.

METHODOLOGY

Study area

Ikorodu town is one of the twenty (20) local governments in Lagos State. The local government is located between longitude $4^{\circ}\ 12^{1}$ and $4^{\circ}\ 47^{1}$E and latitude $7^{\circ}\ 15^{1}$ and $7^{\circ}\ 36^{1}$N. It shares part of its boundary with Ogun State.

Ikorodu town enjoys the characteristics of West Africa Monsoon climate marked by distinct seasonal shift in the wind pattern. Between March and October, it is under the influence of moist maritime South-West winds, which blow inland from the Atlantic Ocean producing wet season. Dry season occurs from November to February when the dust laden wind blow from the Sahara desert. The annual rainfall is about 1800 mm averagely. Sunshine hours range from a minimum of 11.6 h in December to a maximum of 12.7 h in June, with maximum temperature value of 27.6°C in August. The area falls within the high forest region whereas the drier North-Western part is attributed to the vegetation growth of the Guinea savannah (World Gazeteer, 1998).

Materials

Materials used for carrying out this study include twenty four (24), 1 L plastic bottles, distilled water, ethanol, cellotape, plastic funnel, detergent, tissue paper and clean white napkin.

Methods

A total of 24 samples, with 8 from each community, were collected. Purposive random sampling method was used to carry out the research. This method was employed because it was difficult to know the total number of shallow wells in the study area. The sampling was carried out during the wet season in September, 2010. The water samples collected in 1 L bottle each was transported to University of Agriculture, Abeokuta and analyzed at the Water Laboratory in Department of Water Resources Management and Agrometeorology and the Bio-technology laboratory. While the physiochemical analysis was carried out at Water Laboratory, the biological analysis was carried out at Bio-technology Laboratory. The water samples were named water sample MJ1…..MJ8 for Majidun community, OG1 to OG8 for Ogolonto community and AG1 to AG8 for Agric community respectively.

For the physiochemical analysis, the plastic bottles used for sample collection were washed using detergent. After this, the sample bottles were rinsed with distilled water and later with a little quantity of the sample. For the bacteriological analysis however, the bottle was oven dried at 40°C for 30 min and later rinsed with ethanol so as to sterilize bottle after which the sample was added.

Physical properties such as appearance and odour used human sensory organ. The temperature was measured *in-situ* in the field with a capillary filled thermometer which was first suspended in the air to know the temperature of the environment before it was inserted in all the samples to know their various temperatures. Total dissolved solids, pH and conductivity were analyzed immediately using electrodes including pH probe and electrical conductivity meter. Titrimetric analysis was performed for chemical parameters of total hardness, alkalinity, total acidity, calcium and magnesium within 24 to 48 h after collection. Other samples which could not be analyzed immediately for nitrate and chloride due to unavailability of chemical reagent for the analysis, were kept in the refrigerator and capped and cellotaped to prevent contamination and gas dissolution that may affect the quality of the sample. Nitrate was analyzed by spectrophotometer while total coliform test was performed by bacteriological analysis.

For the biological analysis, the water samples were tested for total coliform count adopting the standard procedures. *Escherichia coli* which is a fecal coliform was identified. The principle behind the test is that except for any other coliform, only a few bacteria will ferment lactose with the simultaneous production to avoid gas. The main aim was to narrow down the identification of the coliform to *E. coli* or to disapprove it.

Mean values and Pearson moment correlation were the statistical tools employed in this study. Mean values was used for comparison of parameters in the three communities. Pearson moment correlation coefficient was employed to examine the relationship between the total bacterial count and each of the physiochemical parameters in the study area.

ANALYSES OF RESULT

The determined values of quality of the water samples are shown in Tables 1 to 3. Table 4 shows bivariate correlation between physiochemical parameters and total coliform count at Majidun, Ogolonto and Agric communities while the recommended water quality is shown respectively in Tables 5. In Table 1, the result of the physical properties of water indicated a temperature range of 27.6 to 28.3°C in the Majidun community, 27.4 to 28.0°C in Ogolonto community and 26.9 28.0°C in Agric community. The highest temperature range was recorded at Majidun while the lowest was recorded at Agric community. At Majidun community, temperature was lowest in MJ4 and highest in MJ5 with values, 27.6 and 28.3˚C, respectively. In like manner, 27.4°C in OG1 and 26.9°C in AG2 were the lowest temperature in Ogolonto and Agric communities whereas 28.0˚C in OG4 and AG8 was the highest. The appearances of all the samples were colorless. MJ2, MJ3 and MJ7 at Majidun community have foul odour while the rest were odourless. The pH value ranged from 6.55 in MJ5 to 6.99 in MJ8 at Majidun community, 6.63 in OG6 to 7.02 in OG3 at Ogolonto community and 6.49 in AG8 to 6.95 in AG1 at

Table 1. The physical properties of selected wells in Majidun, Ogolonto and Agric community.

Community	Sample	pH	Conductivity (µS/cm)	TDS (Mg/L)	Temperature (°C)
	MJ1	6.95	282	144	27.8
	MJ2	6.60	209	107	27.8
	MJ3	6.67	308	158	27.9
	MJ4	6.54	201	102	27.6
Majidun	MJ5	6.55	257	132	28.3
	MJ6	6.52	242	123	27.8
	MJ7	6.75	301	154	27.7
	MJ8	6.99	296	150	27.8
	Mean	6.65	262	133.8	27.8
	OG1	7.01	237	120	27.4
	OG2	6.96	235	120	27.6
	OG3	7.02	311	159	27.8
	OG4	6.89	233	118	28.0
Ogolonto	OG5	6.80	231	118	27.9
	OG6	6.63	187	95	27.8
	OG7	6.78	216	131	27.7
	OG8	6.84	303	154	27.7
	Mean	6.87	244.13	126.9	27.74
	AG1	6.96	315	160	27.0
	AG2	6.55	154	78	26.9
	AG3	6.75	273	139	27.0
	AG4	6.50	152	77	27.1
Agric	AG5	6.74	22	11	27.3
	AG6	6.53	24	12	27.6
	AG7	6.71	152	77	27.7
	AG8	6.49	226	115	28.0
	Mean	6.65	164.75	83.63	27.33

Agric community. The table also indicates a conductivity range of 201 to 308 µS/cm in the Majidun community, while the Ogolonto community had a conductivity amount ranging from 187 to 311 µS/cm and Agric community with 22 to 315 µS/cm. Total dissolved solids (TDS) ranged from 102 to 158 mg/L in Majidun, 95 to 159 mg/L in Ogolonto and 11 to 160 mg/L at Agric community. The lowest in these communities were MJ4, OG6 and AG5 while the highest were MJ3, OG3 and AG, 1 respectively.

From the chemical properties of water in Table 2, the amount of Total hardness (TH) ranged from 58 to 100 mg/L in Majidun community, 95 to 159 mg/L in Ogolonto and 42 to 192 mg/L in Agric community. At Majidun community, the amount of carbonate ion in the groundwater is lowest in MJ4 (58 mg/L) whereas it was highest in MJ3 and MJ7 (100 mg/L). OG4 with the value of 70 mg/L was the lowest at Ogolonto and the highest values of 132 mg/L in OG2 and OG7 respectively. At Agric community, the lowest value was recorded in AG5 while the highest was recorded in AG8.

Total acidity ranged from 0.2 to 0.5 mg/L at Majidun and Ogolonto communities, while it ranged from 0.2 to 0.4 mg/L at Agric community. Alkalinity varied from 0.4 to 1.0 mg/L at Majidun, 0.5 to 1.5 mg/L at Ogolonto and 0.3 to 0.9 mg/L at Agric. The amount of calcium ranged from 40 to 92 mg/L in Majidun community, 48 to 82 mg/L in Ogolonto community and 37.4 to 125.2 mg/L in Agric community. Chloride varied from 17 to 39 mg/L in the study area. It ranged from 26 mg/L (the lowest) in MJ4 to 35 mg/L (the highest) in MJ7 at Majidun, 22 mg/L (the lowest) in OG4 to 39 mg/L (the highest) in OG3 at Ogolonto and 6 mg/L (the lowest) in AG5 and AG6 to 26 mg/L (the highest) in AG8.

However, the result of the nitrate analysis ranged from 23.5 to 44.0 mg/L in Majidun community, 23.6 to 45. mg/L in Ogolonto community and 26.5 to 50.6 mg/L in Agric community. Magnesium ranged from 6 to 28 mg/l at Majidun, 4 to 84 mg/L at Ogolonto and 37.4 to 125.2 mg/L. In the 3 communities, the lowest values were recorded in MJ2, OG4 and AG5 while the highest values

Table 2. The chemical properties of selected wells in Majidun (MJ), Ogolonto (OG) and Agric community (AG).

Sample	Total hardness (Mg/L)	Total acidity (Mg/L)	Chloride (Mg/L)	Alkalinity (Mg/L)	Magnesium (Mg/L)	Calcium (Mg/L)	Nitrate (Mg/L)
MJ1	82	0.3	29	0.4	12	60	23.5
MJ2	62	0.4	28	0.5	6	56	28
MJ3	100	0.4	35	0.8	28	72	30.5
MJ4	58	0.5	26	0.6	18	40	44
MJ5	88	0.2	31	0.6	12	76	42.4
MJ6	68	0.2	29	0.5	10	58	26.2
MJ7	100	0.4	35	1.0	8	92	30.8
MJ8	96	0.3	33	0.6	16	80	27.5
Mean	81.79	0.34	30.75	0.63	13.75	66.75	31.61
OG1	90	0.5	32	1.5	36	54	23.6
OG2	132	0.2	29	0.7	80	52	45
OG3	90	0.3	39	0.9	12	78	31
OG4	70	0.2	22	0.5	4	66	22.5
OG5	76	0.3	31	0.6	24	52	38.5
OG6	82	0.3	28	0.7	28	54	26
OG7	132	0.4	28	0.6	84	48	30.5
OG8	98	0.2	36	0.7	16	82	41.3
Mean	96.25	0.3	30.63	0.78	33.5	60.75	32.3
AG1	106	0.4	20	0.9	35.2	80.8	26.5
AG2	74	0.3	19	0.6	21	53	28
AG3	98	0.2	20	0.7	34	64	33
AG4	58	0.3	17	0.5	16	42	31
AG5	38	0.3	6	0.6	0.6	37.4	50.6
AG6	100	0.4	6	0.6	32	68	42.5
AG7	42	0.2	19	0.3	0.4	41.6	36.5
AG8	192	0.4	26	0.4	66.8	125.2	34
Mean	88.5	0.31	16.63	0.58	25.75	64	35.26

were recorded in MJ3, OG7 and AG8, respectively

The mean value of pH, conductivity, TDS, temperature, chloride and total alkalinity were lowest at Agric community with 6.65, 164.75 µS/cm, 83.63 mg/L, 27.33℃, 16.63 and 0.58 mg/L. These parameters were highest at Majidun with the exception of pH and total alkalinity, which was highest at Ogolonto (Table 1). Total hardness, magnesium and nitrate were lowest at Majidun with 81.79, 13.75 and 31.65 mg/L but highest at Ogolonto with 96.25, 33.5 and 35.26 mg/L, respectively. Total acidity and calcium were lowest at Ogolonto with the values of 0.3 and 60.75 mg/L but highest at Majidun.

The total coliform count varied from 1.30 × 10 to 3.05 × 10 cfu/ 100 ml at Majidun, 1.50 × 10 to 3.30 × 10 cfu/ 100 ml at Ogolonto and 1.30 × 10to 3.60 × 10 cfu/ 100 ml at Agric (Table 3). The total coliform count is lowest at MJI and AG1 and highest at AG5. The average concentration was lowest at Majidun with 1.99 ×10 cfu/100ml but highest at Agric with 2.3 × 10 cfu/ 100 ml.

As shown in Table 4, correlation analysis only showed significant relationship between the total coliform count and physiochemical parameters at Ogolonto and Agric communities. At Majidun, there was no significant relationship between the total coliform count and any of the physiochemical parameters at 95 and 99% level of confidence. The bivariate correlation shows a significant negative relationship between total bacterial count and total acidity at 95% level of confidence at Ogolonto community. The relationship between total bacterial count and conductivity, TDS and chloride is also significant at the 95% confidence level and nitrate (r = 0.906) at 99% confidence level at Agric community

DISCUSSION

From the analysis of the water samples collected from the different sampling locations, the pH values ranged from 6.55 to 7.02 confirming slightly excess hydroxyl ion and more hydrogen ions indicating an acidic solution with a pit value less than 7.0 (Powell, 1964). However, the pH values in OG1 and OG3 at Ogolonto were slightly alkaline. The pH in the three communities was found to be within National Agency for Food Drug Administration

Table 3. Total coliform count (Cfu/ 100 ml) for water samples at Majidun, Ogolonto and Agric community.

Community	Sample	Total coliform count (Cfu/100 ml)
	MJ1	1.30 × 10
	MJ2	2.05 × 10
	MJ3	1.50 × 10
	MJ4	1.80 × 10
Majidun	MJ5	2.40 × 10
	MJ6	3.05 × 10
	MJ7	1.60 × 10
	MJ8	2.20 × 10
	Mean	1.99 × 10
	OG1	1.45 × 10
	OG2	3.20 × 10
	OG3	1.70 × 10
	OG4	2.30 × 10
Ogolonto	OG5	1.50 × 10
	OG6	2.05 × 10
	OG7	1.60 × 10
	OG8	3.30 × 10
	Mean	2.14 × 10
	AG1	1.30 × 10
	AG2	1.50 × 10
	AG3	2.10 × 10
	AG4	2.50 × 10
Agric	AG5	3.60 × 10
	AG6	3.10 × 10
	AG7	1.85 × 10
	AG8	2.30 × 10
	Mean	2.30 × 10

Cfu: Colonies forming unit.

and Control (NAFDAC), Standard Organization of Nigeria (SON) and World Health Organization (WHO) potable water standards (Table 5). The varied pH levels in the study areas may be partly attributed to the differential organic matter content in the soil. Richardson (2007) noted that low pH levels obtained in well waters may be traced to the acidity produced by organic waste decomposing under partially reducing conditions into organic acids.

The total dissolved solids (TDS), which are solids in water that can pass through a filter, is a measure of the amount of materials dissolved in water. In the three communities studied, TDS ranged from 11 to 160 mg/L. These values were within the 500 mg/L maximum permissible limit set by NAFDAC, SON and WHO. The materials present which determines the amount of TDS include; carbonate bicarbonate, chloride, sulphate, phosphate, nitrate, calcium, magnesium, sodium, organic ions and other ions. In this study, the possible cause of low amount of TDS was the minimal presence of these chemicals in the groundwater while, places with higher TDS value was due to high presence of the chemicals in the groundwater (Salisu, 2004).

Conductivity is the ability of water to conduct electric current signifying chemical purity of a low electrical conductance (Benain et al., 1993). Samples MJ1, MJ7 and MJ8 had poor well casing and the effect of this can be pollution of the water through rust. Although, most of the wells in the Majidun community were sited away from dump sites, the poor casing of the well, when corroded, releases reddish-brown substances (rust) into the well, and this could lead to the accumulation of heavy metals such as iron.

Temperature is the degree of coldness or hotness of a body (Ayoade, 1974). The temperature of the samples ranged from 27.6 to 28.3°C in the study area. The temperature is fairly uniform in almost all the sample locations. Temperature is important because it affects other physical phenomena such as the rate of biochemical and chemical reactions in the water body, reduction

Table 4. Bivariate correlation between physiochemical parameters and total coliform count at Majidun, Ogolonto and Agric communities, Ikorodu, Lagos State.

Parameter	Majidun	Ogolonto	Agric
pH	-0.469	0.023	-0.317
Conductivity	-0.359	0.278	-0.793*
Total dissolve solids	-0.367	0.181	-0.791*
Temperature	0.286	-0.042	0.323
Total hardness	-0.323	0.305	-0.183
Total acidity	-0.633	-0.772*	0.103
Chloride	-0.233	-0.003	-0.761*
Total alkalinity	-0.301	-0.337	-0.209
Magnesium	-0.327	0.072	-0.21
Calcium	-0.093	0.39	-0.214
Nitrate	0.057	0.603	0.906**

*Significant at 0.05 level (*α≤0.05); ** significant at 0.01 level (**α≤0.01).

Table 5. Physio-chemical characteristics of national and international potable water standards (2007).

Parameter	NAFDAC (Maximum allowed limits)	SON	WHO (Highest desirable)	WHO (Maximum permissible)
Colour	TCU	3.0 TCU	3.0 TCU	1.5 TCU
Odour	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable
pH at 25 (°C)	6.5 - 8.5	6.5 - 8.5	7.0 - 8.9	6.5 - 9.5
Conductivity (µs/cm)	1000	1000	900	1200
Total solids (mg/L)	500	500	500	500
Total hardness (mg/L)	100	100	100	500
Total alkalinity (mg/L)	100	100	100	100
Chloride (mg/L)	100	100	200	250
Nitrate (mg/L)	10	10	10	50
Magnesium (mg/L)	20	0.02	20	20
Calcium (mg/L)	75	75	NS	NS

in solubility of gases and amplifications of tastes and colours of water (Olajire and Imeokperia, 2001).

Total hardness is characterized by the formation of insoluble salts of the fatty acids found in soaps and by the deposition of scale in heated surface (Powell, 1964). Hardness is dependent upon the amount of calcium or magnesium salts or both (Olajire and Imeokparia, 2001). The presence of CO_3^{2-} in water, determines the hardness of water and this can cause scours in utensils such as kettles, pots etc. Though, the values of the total hardness of 132, 132, 106 and 192 mg/L at OG2, OG7, AG1 and AG8 were above the limit of NAFDAC and SON and the desirable limit of WHO, it is within the maximum permissible standard of 500 mg/L of WHO (Smith, 1987).

Total acidity varied from 0.2 to 0.5 mg/L in the study area. It is usually derived from inorganic and organic acidifying precursors including $S0_x$ and $N0_x$ in most industrialized regions, due to the prevailing industrial processes, which involves gaseous and particulate emission, organic waste decomposing under partially reducing conditions into organic acids as well as acidic precipitation (Ogunkoya and Efi, 2003; Richardson, 2007)). The effects of acidic precipitation include the inhibition of microbial decomposition, nitrogen fixation and the increased solubility and mobility of toxic heavy metals within the environment (McDowell, 1988). Total alkalinity ranged from 0.3 to 1.5 mg/l in the study area. Alkalinity is very low in each of the 3 communities. It fell within National and International potable water standards of NAFDAC, SON and WHO (Table 5).

The chloride level which ranged from 6 to 39 mg/L in the study area is low and falls within the National and International standards of 250 mg/L for potable water. Its increased presence in most locations might have been as a result of fecal contaminant. According to Haruna et al. (2005), the presence of nitrate and chloride in spring water is associated with fecal contamination. Besides, most of the chloride m water comes from precipitation (Hem, 1970). Magnesium is higher than 20 mg/l permissible limit for NAFDAC, SON and WHO standards in in MJ3 with 28 mg/l, OG1, OG2, OG5, OG6, and OG7 with 36, 80, 24, 28 and 84 mg/L as well as AG1, AG2 and AG3 with 35.2, 21, and 34 mg/L, respectively. The sources of magnesium in the hydrosphere are dolomite in sedimentary rocks and serpentines, and tremolites in metamorphic rock (Twort and Dickson, 1994). There is the possibility that these wells are underlined by rocks. Calcium is higher than the maximum allowable limit of 75 mg/L for NAFDAC and SON in 7 locations of MJ5, MJ7, MJ8, OG2, OG8, AG1 and AG8 with 76, 92, 80, 78, 82, 80.8 and 125.2 mg/L.

Nitrate level is higher than NAFDAC and SON allowable limit and WHO desirable limit of 10 mg/L but less than WHO maximum permissible limit of 50 mg/L in all the locations except in AG5 at Agric community, which exceeded the limit. Nitrate could have been as a result of fecal coliform in water due to closeness of septic tank to the wells in some locations. This might have been the case of AG5. In fact, excessive concentration of nitrate and or nitrite can be harmful to humans. Since the result obtained shows that the nitrate level did not go beyond the World Health Organization (WHO) permissible limit of 50 mg/L, the fear of methemoglobnemial is alleviated. Haruna et al. (2005) maintained that nitrate in water results from the production of toxic nitrogenous chemicals in water.

Bacteriological analysis showed that the selected wells at Majidun, Ogolonto and Agric community were polluted. Total coliform in water in these communities is an indication of fecal contamination. This shows that substances which are present in waste matter leaches to groundwater and are transported in it. Dillion (1997) asserted that in areas where the waste matter is not properly disposed, for example a pit latrine, the liquid soaks away through the base and sides of the pit. The presence of fecal coliform in water indicates that fecal pollution had occurred (Mara, 1997; Khazaei et al., 2004; Pritchard et al., 2007). This poses great danger to human health. Contamination of water by human waste deposit; constitute the most common mechanism for transmission of micro-organisms to humans (WHO, 1985). These pathogenic organisms are responsible for the infection of the intestinal tracts and the diseases caused include; diarrhea, cholera, bacillary dysentery, typhoid, hepatitis and so on. The incidence of water borne diseases can therefore be attributed to untreated or poorly treated groundwater that contains pathogens.

The mean value of 6, 3 and 2 parameters were lowest at Agric, Majidun and Ogolonto communities while 6 and 5 parameters were highest at Majidun and Ogolonto, respectively. Correlation analysis showed no significant relationship between the total coliform count and physiochemical parameters at Majidun. Relationship was only significant at 95% level of confidence between total bacterial count and total acidity at Ogolonto community. Also, relationship between total bacterial count and conductivity, TDS and chloride is also significant at 95% level of confidence and nitrate at 95% level of confidence at Agric community

Conclusion

This study had examined the biological and physio-chemical quality of shallow wells at Majidun, Ogolonto and Agric communities in Ikorodu town of Lagos State. The physico-chemical parameters analyzed fell within the NAFDAC, SON maximum allowable limit and WHO highest desirable and maximum permissible limit for potable water. Exceptions are magnesium in MJ3, OG1, OG2, OG5, OG6, OG7, AG1, AG2 and AG3, total hardness in OG2, OG7, AG1 and AG8 and nitrate in all the locations. Though, these samples were above WHO desirable limit, TH in these 4 locations is within WHO 500 mg/L maximum permissible limit while nitrate is above WHO 50 mg/L limit only in AG5. Shallow wells at Ogolonto community were mostly affected by these parameters. There was significant relationship between total bacterial count and total acidity at 0.05 level at Ogolonto community, total bacterial count and conductivity, TDS and chloride at the 0.05 levels, and nitrate at 0.01 level at Agric community. This is an indication that shallow wells were polluted in most locations and could result in adverse health hazard.

We hereby recommend prompt and regular well water quality assessment in order to know the extent of contamination of water used by the local communities; public alertness on the risk of sitting of waste matter points close to shallow wells; and enlightenment of the populace on the dangers of consumption of untreated water from shallow wells by the government.

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