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QUALITY OF WELL WATER IN OWO, SOUTHWESTERN NIGERIA

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ABSTRACT

In order to assess the quality of well water in Owo Local Government Area of Southwestern Nigeria, samples of water were collected from wells in five different locations of Ipele, Oke-Ogun, Iyere, Oke-Ijebu and Isuada. Analyses of physical, chemical and microbial qualities were carried out on each of the samples. The results showed that the water samples conformed withthe WHO recommended standards for both physical and chemical qualities for potable water. Samples were generallyodourless, colourless and of low turbidity (2.6-3.8), but slightly tasty in two locations; pH (5.6 - 7.2mg/l), EC (98–752mg/l), Calcium hardness (43.21 – 87.40 mg/l) and Total hardness (67.40 – 132.31 mg/l). However, microbial analysis showed the presence of E-coli in the samples collected fromIpele, Oke-Ogun, Iyere and Oke-Ijebu, an objectionable organism which indicatedfaecal contamination of wells. Since shallowwell formed the main source of water for domestic purposes in Owo, it is therefore recommended that well should be sited far away from septic tanks and other similar sources of contamination. Added to this,is the need for the treatment of water before consumptionin the area while government should intensify efforts to construct more boreholes to replace hand-dug wells which are highly prone to surface runoff from various sources of contaminants.

Keywords: Well-water, Faecal contamination, *E-coli*, Treatment

INTRODUCTION

The importance of water to human life cannot be over-emphasized. Water is important for agricultural, household, industrial, tourism and cultural purposes and sustenance of ecosystem (Mark *et al*., 2002). Apart from its use for direct human consumption, water is integrally linked to the provision and quality of ecosystem service. In homes, water is used for cooking, drinking, bathing and cleaning. However, availability of water for the afore-mentioned uses has been a subject of concern in this part of the world especially in the rural and semi-urban area of the country. Where it exists, the quality and quantity are a far cry from the internationally accepted standard. WHO/UNICEF (2006a) had stated that an important indicator of risk exposure to water related diseases is access to safe drinking water. Improved water supply is defined to include reasonable access to protected water resources which include protected spring and dug wells, boreholes, public stand pipes and house–hold connections. In addition, it involves the application of measures to protect the water source from contamination (Hulton and Haller, 2004). Reasonable access means at least 20 liters/person/day accessible within 1 km of that person dwelling (WHO/UNICEF, 2005).

Globally, about 84% of an estimated 1.1 billion people who lack access to safe drinking water are said to be living in the rural areas (Longe*et al*., 2009). Africa has the lowest total water supply coverage in the world, with only 62% of the population having access to improved water supply (WHO, 2000). Nevertheless, with over 70% of the earth's surface covered with water, people are using the water bodies' to serve as a limited dumping ground. Besides, beaches around the world are closed regularly due to the presence of high amount of bacterial from sewage disposal and marine life suffers from these phenomena (UNEP, 1993); surface waters may also contain domestic sewage and industrial waste. Groundwater from shallow wells may contain nitrogen compound and chlorides but water from deep well generally contain only dissolved minerals.

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In view of the foregoing, the Federal Republic of Nigeria (2000) considered the provision of water supply and sanitation services to be the domain of the Federal, State and Local governments. In an attempt to meet this responsibility, therefore, pipe borne water has been provided in some urban cities by the various State governments, while the Federal and Local governments mostly intervene or compliment this effort through the provision of boreholes in the rural and semi-urban areas. It should be noted that the supply of water through pipe borne system in the urban cities hardly meet up to 20% of human needs, while most of the boreholes in the rural areas have short lived life span owing to many reasons amongst which are high pressure and poor construction methods.

Akinro and Ologunagba (2009) noted that water supply services where they exist, are unreliable and of low quality and are not sustainable because of difficulties in management, operation and maintenance, pricing and failure to recover cost. Consequently, people tend to seek for water which ever source they can find it; one common source that has been widely explored is through the construction of shallow wells. However, many of the constructed wells tend to have poor water quality due to contamination from the surface or from nearby septic tanks and other sources. Thus, water from this source becomes unhygienic and unsafe for human consumption. Hence, the need to assess the quality of this water source becomes imperative. Therefore, the objective of this study is to assess the physical, chemical and microbial qualities of well water in Owo local government Area, Southwestern Nigeria with a view to ascertaining their suitability and make appropriate recommendations for treatment where necessary.

MATERIALS AND METHODS

Description of the Study Area

Owo local government area lies on the Northern Senatorial District of Ondo State, Nigeria, within Latitude 7^0 10^1N and Longitude $7^0 10^1$E; it is about 150m above sea level and enjoys abundant rainfall of over 1,500mm annually.The population of the local government area is about 250,000 and is bounded by Ikare at the north, Akure at the South, Oka and Isua at the east and Ifon at the west. The study adopted quantitative technique and made use of data collected through household interview using standard quantitative technique. This method allowed the selection of representative samples from among the population to be investigated and then provides opportunity for an analysis that generates inferences for the entire population under study. Based on this, the study area was first divided into 5 zones namely, Iyere, Ipele, Oke-Ijebu, Isuada and Oke-Ogun. The households were randomly selected based on the map of the study area and demarcation of zones. The number of questionnaires administered in the study area was determined by the size of households as well as residential density of each zone.

In order to assess the domestic water wells in the residences of the selected households, reconnaissance visits were made to them. Administration of questionnaires was done after informal interviews had been conducted with the house owners. The study questionnaires were admitted on 2nd December, 2010. Out of about 100 questionnaires administered, about 80 of them were received after a week. The method of sample collection employed was based on the WHO recommendation as in the guideline for drinking water quality (WHO, 2003). Water samples were collected once in the month of December 2010 from each well by using white specimen bottles previously sterilized. Sample collections were made at early hours of the day time when the wells were assumed to be least disturbed. Strong rope was tied on clean and sterilized water fetcher, which was used to draw water from the sample wells. Immediately after each bottle was filled, the stopper was used to cover the bottle to ensure no other external organism was admitted into the water and labeled. Observations were made as to the depths of wells, whether covered or uncovered, lined or unlined. The samples were finally taken to the Soil Laboratory of the Federal University of Technology, Akure, Ondo State, Nigeria for physical, chemical and microbial analyses.

RESULTS AND DISCUSSION

Table 1 shows the description of samples collected for the study and their respective location where they were collected for identification purposes. Samples were collected across the local government area to ensure even coverage while observations were also made as to the physical conditions of the

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wells such as depth, presence of lining and cover and distances from source of contaminants which are capable of influencing water quality were critically observed.

Table 1: Description of samples

Samples	Distance from contamination (m)	Depth of well (m)	Presence of Lining and Cover
Iyere	35. 6	21.5	Unlined but covered
Ipele	15.5	16.7	Lined but uncovered
Oke-Ijebu	18.7	17.3	Unlined and uncovered
Isuada	19.2	14.5	Unlined but covered
Oke-Ogun	42.3	19.4	Lined and covered

Physical Quality of Wells

Table 2 shows the result of the analysis of the physical qualities of the sample collected. Physical qualities examined included colour, taste, odour, turbidity and temperature. All the water samples were odourless and tasteless except samples from Ipele and Isuada that were tasty owing to salinity and hardness as a result of the presence of $CaCO_3$, a common mineral in the precambium basement rock found in the well site. The entire water samples were colourless, their temperature varied between 29.8-28.4^{0}c and with turbidity ranging from 2.6-3.8 that is less than the WHO (2003) permissible limit of 5 NTU for potable water. Important requirements for potable water as stipulated by all agencies (governments and non-governmental) include that water should be colourless, tasteless and odourless.

Table 2: Result of physical analysis of samples

Sample	Colour	Taste	Odour	Turbidity (NTU)	Temperature (^{0}C)
Iyere	colourless	tasteless	odourless	2.65	27.80
Ipele	colourless	tasty	odourless	3.63	27.90
Oke-Ijebu	colourlesss	tasteless	odourless	2.83	28.80
Isuada	colourless	tasty	odourless	3.80	27.80
Oke-Ogun	colourless	tasteless	odourless	3.24	27.80

Chemical Quality of Wells

The result of the analysis of the chemical qualities of the samples collected is shown in Table 3. Chemical analysis was carried out to determine such parameters as pH, EC, TDS, TS, TSS, Chlorine, Total hardness, Calcium hardness, SO_4, NO_3, and DO_2. The levels of pH in samples ranged between 5.6 and 7.2, indicating that the samples are relatively neutral and within the unobjectionable range. Electrical conductivity (EC) which varied between 98–752mg/l, was on the high side though within the permissible limit of 1000 mg/l, so also were the TDS, TS, TSS, Cl, SO_4^{2-}, NO_3^-. Adekunle*et al*., (2007) had observed the existence of a direct relationship between EC and the other parameters, but of significant among them were the correlation between EC and TDS (r = + 0.67), EC and TS (r = +0.87). However, none of these exceeded the defined water quality assurance limit. Total hardness defined by WHO (2003) as Calcium Carbonate in mg/l of a sample was also within the allowable limit of 500 mg/l according to APHA (1995). The result indicated that Total hardness ranged from 67.40 – 132.31 mg/l while Calcium hardness ranged from 43.21 – 87.40 mg/l. Chloride content which also varied between 11.36 – 24.32 mg/l was also permissible. The result of dissolved oxygen also showed that the water will be useful for agricultural purposes apart from its domestic uses.

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Table 3: Result of chemical analysis of samples

Sample	pH (mg/l)	EC (mg/l)	TDS (mg/l)	TS (mg/l)	TSS (mg/l)	Chloride (mg/l)	Total hardness (mg/l)	Calcium hardness (mg/l)	SO_4 (mg/l)	NO_3 (mg/l)	DO_2 (mg/l)
Iyere	7.2	296	147	227	80	22.30	82.52	68.71	3	3	3.32
Ipele	5.6	752	374	434	60	19.40	67.40	43.21	15	18	6.40
Oke-Ijebu	6.9	208	103	165	62	11.36	132.31	87.40	5	3	8.08
Isuada	6.5	166	84	120	36	20.17	74.60	58.26	7	5	5.22
Oke-Ogun	6.8	98	49	115	66	24.32	93.42	84.63	10	9	10.24

Microbial Quality of Wells

Table 4 shows the result of microbial analysis of samples to determine the presence of bacteria, yeast and *E-coli*. The result showed high presence of enteric bacteria and yeast in samples Iyere, Ipele, and Oke-Ijebu, but small quantity in Isuada and Oke-Ogun, indicating that the samples may have been somehow contaminated. High presence of yeast in the three samples might have been as a result of high microbial activities in the wells. Also, *E-coli* were present in samples from Iyere, Ipele, and Oke-Ijebu thus signifying the presence of microbial organisms which may have been caused by faecal contamination and run-off from refuse dumps. Adekunle*et al*., (2007) had said that coliform populations are indicators for pathogenic organisms. They should not be found in drinking water but are usually present in surface water, soil and faeces of humans and animals. Gatsroenteritis (GI), acute respiratory diseases (ARD), eyes, ears and skin infections are all illnesses which result from the consumption of *E-coli* infested water (Pruss, 1998; WHO, 2003). High coliform population in all the water samples is an indication of poor sanitary condition in the community. Inadequate and unhygienic handling of solid-waste could have generated high concentration of microbial organisms where samples contain *E-coli*.

Table 4: Result of Microbial Analysis of Samples

Sample	Bacteria (cfu/ml)	Yeast (sf/ml)	E-coli
Iyere	530	462	Present
Ipele	290	400	Present
Oke-Ijebu	198	136	Present
Isuada	75	100	Present
Oke-Ogun	55	16	Not present

CONCLUSION

The overall result of this study showed that the various samples collected conformed to the international standard of water quality in terms of physical characteristics. Samples were generally tasteless, odourless and of permissible turbidity. Hence, well water in Owo local government area can be said to be of good physical quality. Also, the result of the chemical analysis showed that the samples do not contain heavy metals beyond permissible limit and the acidic level fall within the unobjectionable limit, although there was relative hardness in all the samples, the proportion is not capable of making the water completely unfit for human consumption. The presence of *E-coli* in the samples from Ipele, OkeIjebu and Isuada probably makes the water in these areas objectionable. Thus, in such areas, water treatment may be necessary for the water in the well to be safe for consumption. Consequent upon this, it is recommended that the people should be enlightened on the need to follow the appropriate standard for siting wells to avoid faucal contamination. To avoid microbial contamination of well water, good sanitary measures and the treatment of well water before consumption in the area generally should be embraced by all. Also, in view of the seeming inability of the governments to provide pipe borne water in recent time, deep wells (boreholes)that are less prone to contamination from surface run off should be constructed to replace hand-dug wells.

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