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Assessment of Effect of Sewage Intrusion from Septic Tanks into the Consumable Hand Dug Wells in Lagos State, Nigeria

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Abstract - Access to a regular supply of safe water is a basic human right but many people are denied. This study investigated the physical, chemical and microbiological properties of well water installed close to septic tank in some location in Lagos metropolis. Samples were collected from five (5) wells from each location (Ikorodu, Mushin, Shomolu, Itire and Ilasamaja) during the rainy season when ground water intrusion is high. The well water were analyzed for pH, temperature, Total Solid, Dissolved Solid, Suspended Solid, Alkalinity, Acidity, Total Hardness, Dissolved Oxygen, Biological Oxygen Demand, Chemical Oxygen Demand, Sulphate, Manganese, Cadmium, Zinc (Zn), Total coliform count and Total Bacteria count. pH, temperature, TS were determined immediately in the sample. Analysis of the heavy metals was done using Flame Atomic Absorption Spectrophotometer. Data obtained were subjected to descriptive statistics. All the physical, chemical and microbial properties investigated except pH, Total Solid, DO, BOD and the coliform and bacteria count in the sampled well water were within the specified limit of WHO and hence, not suitable for domestic purposes for which they are presently used for in some of the residential area in the study area. Contamination from intrusion from septic tanks and runoff from storm water could account for these differences in sampled water and WHO Limits. Where affordable, water must be treated before consumption and Public enlightenment on water quality should be encouraged to foretell the looming danger from water contamination/pollution.

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I. Introduction

The importance of safe water in social economic development cannot be overemphasized. Water is essential to all forms of life. It is second in ranking, next to air in the list of human daily needs (NEST, 1991). Without water, humans cannot live for more than a few days. Water is in great demand (Aderogba, 2005) as it represents a unique feature in every settlement: for drinking, sanitation, washing, fishing, recreation and industrial processes. Assess to clean and regular water supply is a basic human right as is access to unadulterated food. A lot of people especially the less affluent however miss out on this as with other human rights Worldwide, about 2 billion people struggle daily for access to clean and sufficient water (Adepoju-Bello and Alabi, 2005) and Africa suffers most from inadequate access to water supply with only 62% of the population having access to potable water supply. In Nigeria in particular, more than 55% of population does not have access to safe drinking water and consequently leading to high rate of infant mortality. In order to meet this huge shortfall in the daily water demand, groundwater is considered a better complementary source as a result of modest cost. However, the problem associate with groundwater exploration is that intrusion of polluted water from solid waste landfills, on-site excreta disposal system and agricultural waste that recharges the wells used by household (Mendie, 2005). These as led to health risks which is synonymous with the study area. Therefore, it becomes imperative to investigate the effect of sewage intrusion from septic tank into the nearby consumable hand dug wells in some areas of Lagos metropolis.

II. Study Area

The Ikorodu, Mushin, Shomolu, Itire and Ilasamaja are among the major urban centre in Lagos metropolis. The Lagos metropolis is located in Lagos State, Southwest Nigeria. Lagos The study area has a typical tropical climate, which is marked by two prominent seasons. The rainy season extends generally from March to November with intermittent dry spells. This is the period when the southwesterly wind prevails. The dry season usually occurs from December and March when the area is under the influence of the northeasterly wind. The Lagos metropolis and its environs are typical of the country's Southern zone with relatively moderate temperature and fairly excessive humidity particularly during the rainy season. The average annual rainfall in Study Area is about 1500 mm. The average slope of natural drainage lines in the present undeveloped regions of the study area is about 1:10,000. Unfortunately, some of these natural drainage lines have been blocked by development in the eastern coastal areas, resulting in the creation of large swamps and a rise in the groundwater table in the neighboring undeveloped areas. The study area consists of outcrops

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coastal areas, resulting in the creation of large swamps and a rise in the groundwater table in the neighboring undeveloped areas. The study area consists of outcrops of two main geological formations. The coastal plain sands which form the low, gently sloping dissected uplands, reaching in places a height of 6 to about 30 meters, and the recent coastal deposits which form the extensive and swampy alluvial plains of the major rivers and creeks along the coast overlying the coastal plain sands.

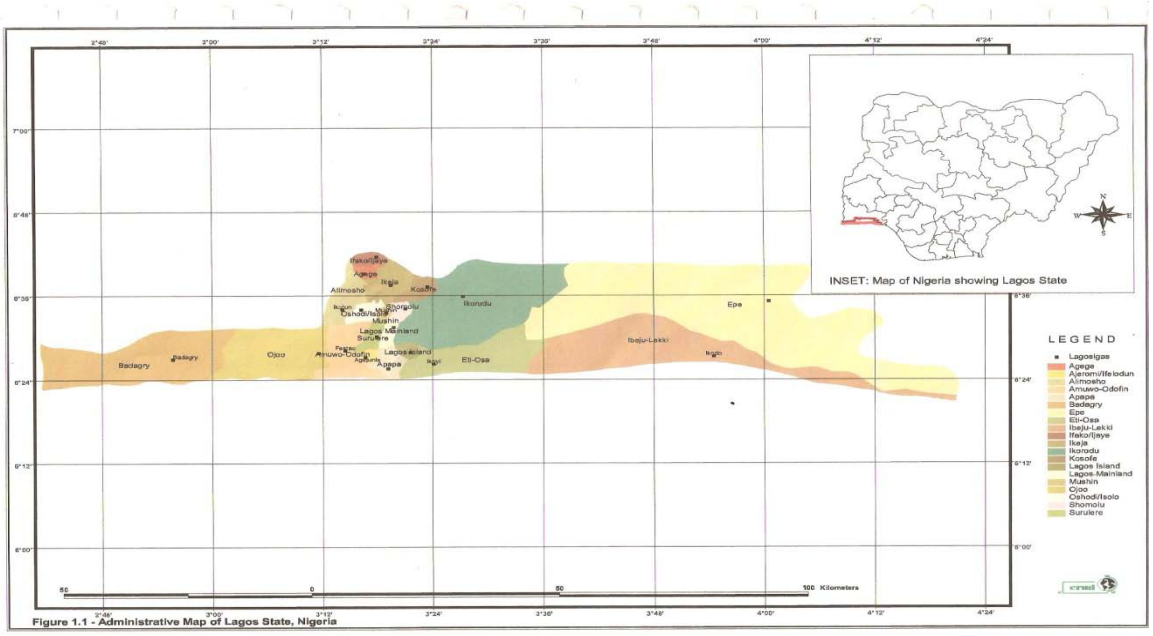


Figure 1 : Map of Lagos State Showing Project Site Location

III. Material and Method

Five water samples each randomly selected in study areas were analyzed for physical, chemical and microbiological parameters from hand dug wells from the five selected locations during the rainy season when ground water intrusion is high. The well water samples were collected following standard procedure for sampling. The choice of the sampling points was based on closeness to septic tanks and the choice of the sampling locations was based on population density of area. The samples were transported in ice chests to the different laboratories where they were either analyzed immediately or stored at 40°C or less to monitor the present status of source pollution indicative parameters. Standard laboratory methods and descriptive statistics were employed for the analysis.

IV. Results and Discussion

The physical, chemical and microbiological properties of hand dug wells in the some selected locations in Lagos metropolis were presented in Tables 1. Values obtained in this study were compared with the World Health organization standard.

Table 1 : Water physical, chemical and microbiological analysis of hand dug wells in the some selected locations in Lagos metropolis

Parameters	Ikorodu Mean	Mushin Mean	Shomolu Mean	Itire Mean	Ilasamaja Mean	WHO Limit
Appearance insitu	Clear	Clear	Clear	Clear	Clear	Clear
Temperature °C	27.5	27	27	27.5	27	20-33
pH	4.59	5.76	6.48	3.92	6.70	6.5-8.5
Dissolved solid	804.0	360.0	322.0	723.0	630.0	2000
Total Solid (mg/l)	990.0	440.0	430.0	810.0	700.0	200.0
SuspendedSolid (mg/l)	186.0	80.0	108.0	78.0	70.0	200.0
Alkalinity (mg/l)	27.0	54.0	18.0	9.0	48.0	NS
Acidity (mg/l)	32.0	44.8	41.6	51.2	25.6	NS
Total Hardness (mg/l)	98.0	112.0	220.0	106.0	326.0	NS
DO (mg/l)	8.3	3.96	3.02	7.16	2.50	<2.0

BOD (mg/l)	24.5	13.0	71.6	52.8	82.9	15
COD (mg/l)	41.8	35.6	65.0	57.4	75.3	80
Sulphate (mg/l)	25.3	90.9	26.8	107.0	49.4	500
Manganese (mg/l)	0.286	0.213	0.300	0.313	0.148	50
Cadmium (mg/l)	0.1	0.07	0.08	0.1	0.2	<1
Zinc (mg/l)	0.1	0.1	0.2	0.2	0.1	<1
Total coliform count (ml)	80	60	45	50	50	0 per 100ml
Total bacteria count (ml)	$5.0 * 10^3$	$4.5 * 10^3$	$2.4 * 10^3$	$4.0 * 10^3$	$2.6 * 10^3$	0 per 100ml

The results of the analysis indicate clear water in all well water sampled, though some level of contamination were identified in some parameters sampled. Results showed that all parameters except pH, Total Solid, DO, BOD and the coliform and bacteria count in the sampled well water were within the specified limit of WHO (Fig.2) and hence, not suitable for domestic purposes for which they are presently used for in some of the residential area in the study area. Contamination from intrusion from septic tanks and runoff from storm water could account for these differences in sampled water and WHO Limits. More than 92% of tested samples contain detectable amount of pH, Total Solid, DO, BOD and the coliform and bacteria count with concentration above the maximum contaminant level suggested by WHO.

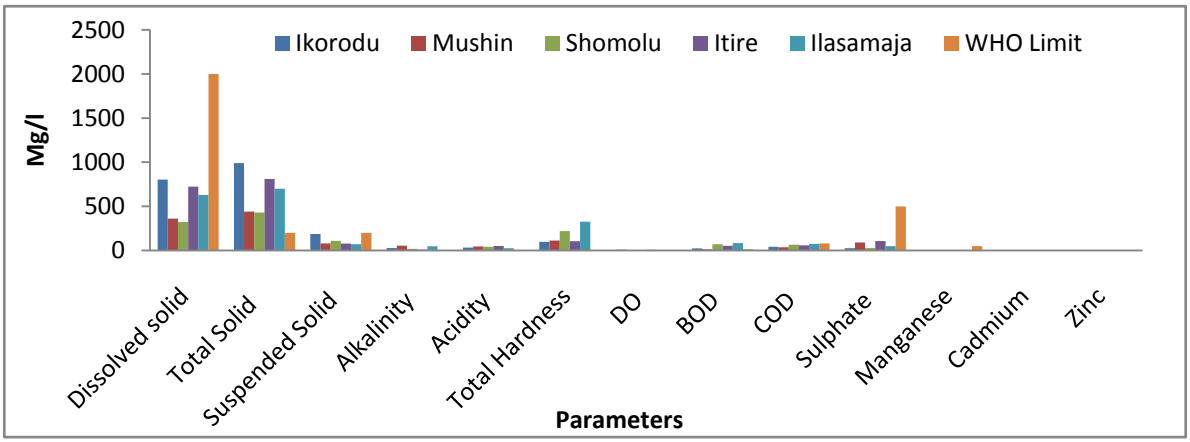


Figure 2 : Graph showing the some physical and chemical parameters levels in well water samples

Temperature of well water followed a distinct pattern reflecting no variability of the atmospheric temperature. The temperature range is between 27 and 27.5^{O}C which fall in the limit of 20-33^{O}C of WHO as shown in Fig.3.

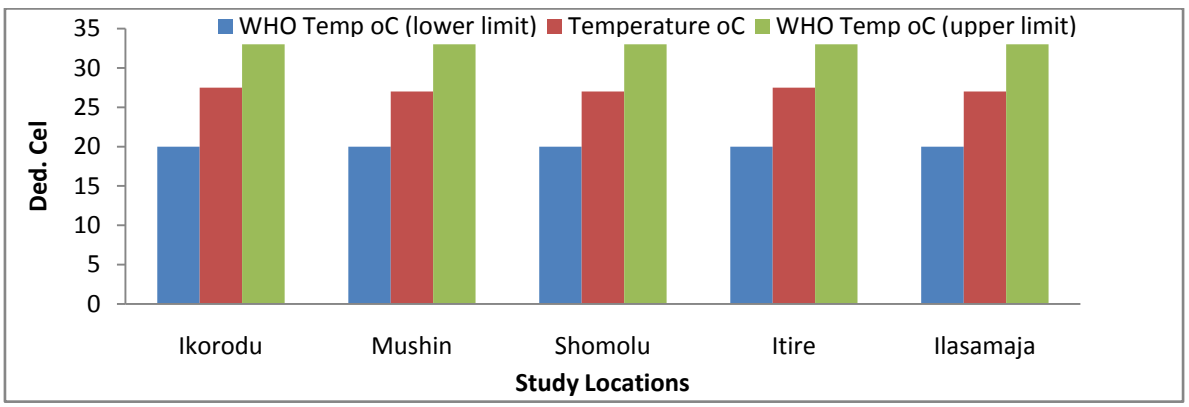


Figure 3 : Temperature levels in well water samples

The pH of sampled well water varied considerably from that of the WHO Limits and did not follow any pattern (Fig. 4) while some of the values fell within the range (6.5 – 8.5) stipulated by the WHO for drinking water quality, others did not. These were not accepted as they fall below 5.7 and rendering them

acidic. The effects of acidic water on human health and the environment have been widely reported. For example, acidic water has been known to be aggressive and enhance the dissolution of iron and manganese, causes unpleasant taste in water (Hammer and Hammer, 2004).

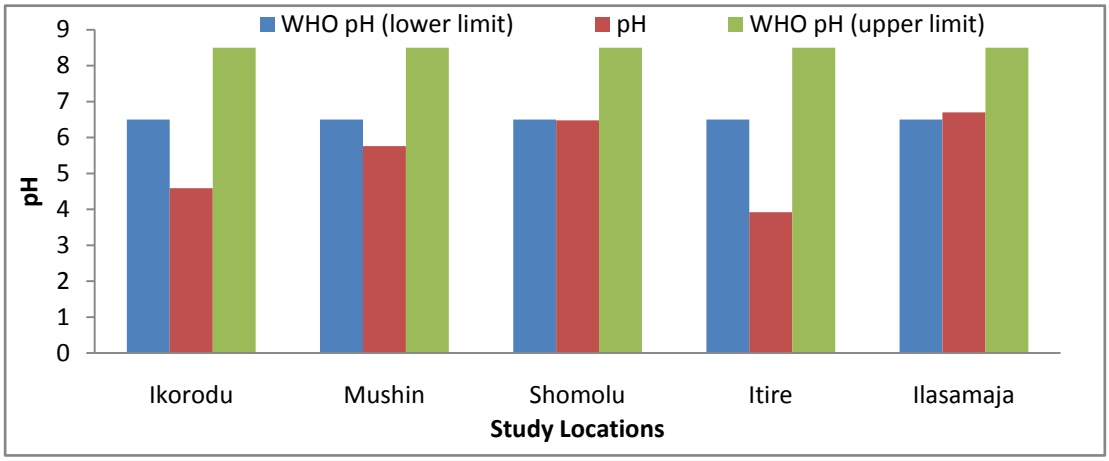


Figure 4 : pH levels in well water samples

The Total solid of well water sampled ranges from 430 mg/l-990 mg/l (Fig. 5). This is of concern because the total solid measures the amount of dissolved salts in the water (Salinity) which is a good indication of contamination or low quality of water. According to most authors, these are strongly associated with particles in runoffs (Akhter *et al.*, 2002). The values generally are more than the MCL of 500ppm, but it implication is that it impair the water quality and affect the clarity of water. High concentration of total solid could result to salty and unpalatable taste in water. High concentration of total solid could also result to gastrointestinal irritation.

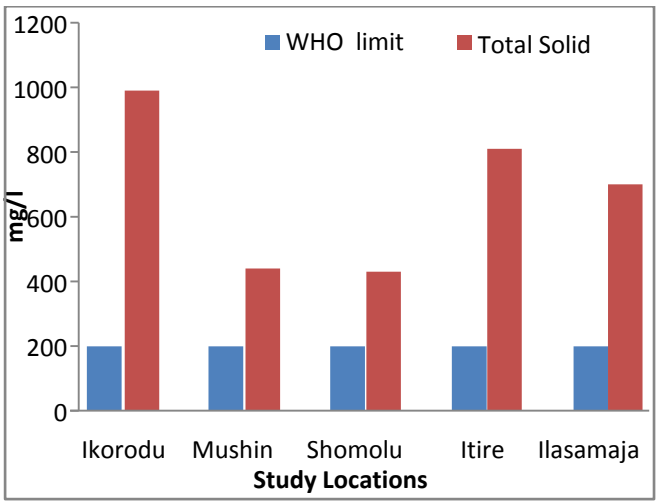
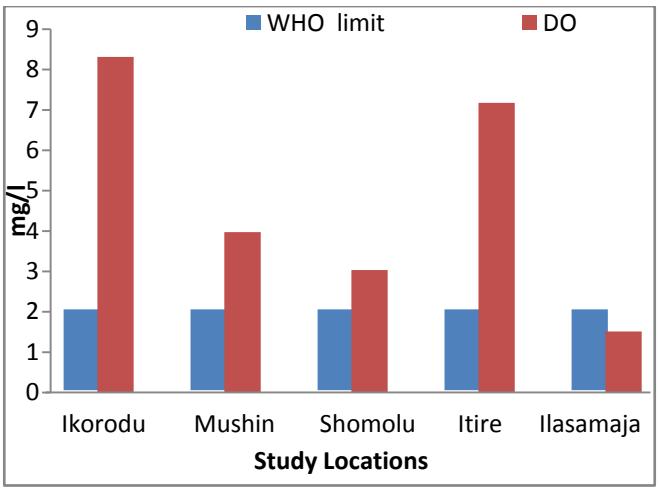


Figure 5 : Total solid levels in well water samples

Furthermore, the result showed that all well water sampled contained high organic pollutants such as Dissolved oxygen (DO) and Biological oxygen demand (BOD). They ranged from of 2.5 mg/l- 8.3 mg/l and 13.0 mg/l- 82.9 mg/l, respectively as against 2 and 15mg/l specified by WHO (Fig. 6).



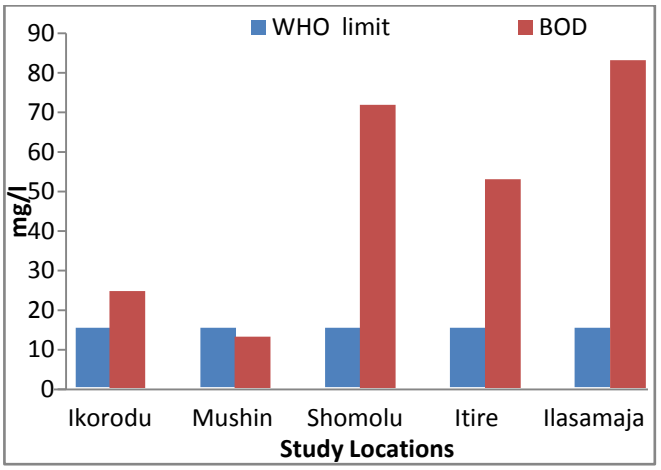


Figure 6 : Organic pollutants (DO and BOD) levels in well water samples

The Total coliform and bacteria count of sampled well water were more than the WHO specified limits. Total coliform count in the sampled locations ranged between 45 ml – 80 ml compared to a count range of 2.4 x 10^3 ml– 5.0 x 10^3 ml in the total bacteria cunt. The highest Total coliform and bacteria count was observed in Ikorodu (Fig. 7). This could be as a result of closeness of location to water bodies.

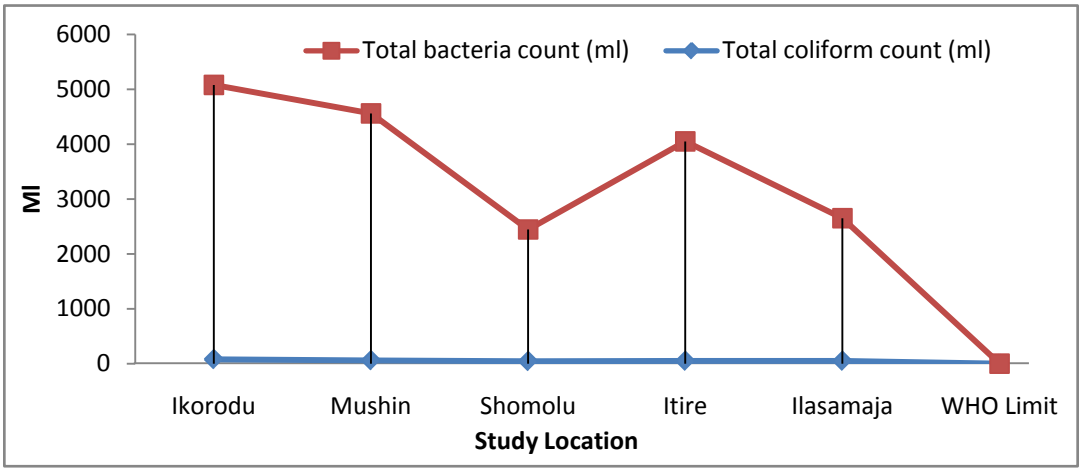


Figure 7 : Microbial (Total coliform and bacteria count) levels in well water samples

V. Conclusion

A preliminary and periodic assessment of well water located close to sewage tanks is essential as they could contain substance that may be harmful. In this study, sewages tank closeness to wells were observed to impact more on the pH, Total Solid, DO, BOD and the coliform and bacteria count content of water, where affordable, water must be treated before consumption and Public enlightenment on water quality should be encourage to foretell the looming danger from water contamination/pollution.

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