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ANALYZING THE QUALITY OF GROUND WATER IN KADUNA SOUTH LOCAL GOVERNMENT AREA, KADUNA STATE, NIGERIA

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ABSTRACT

The study examines the groundwater quality of Kaduna south Local government area. The physio-chemical analysis of PH, sulphate, Phosphate, chloride, Iron, Electrical conductivity, Turbidity, Nitrates, Total suspended solid and Total hardness were carried out, the result obtained were compared with World Health Organization (WHO) recommended standards for drinking water. pH, sulphate, electrical conductivity, chloride, nitrate, total suspended solids, and total hardness in all location were within the acceptable standards of WHO. The collected data from the laboratory analysis were analyzed using simple tables, graphs and charts and the result reveals that turbidity and iron in all location were above the acceptable standards of WHO. Turbidity which is above the WHO with a significant value at all the eight sampling points with 25.3,22.6,28.7,11.6,9.05,9.05,10.4,14.3 NTU respectively, Iron concentration in all the sampling points is high with 35.0, 30.0,26.0 15.0,12.0,10.0, 15.0,11.0 mg/l respectively. Large amounts of Iron in drinking water can give it an unpleasant metallic taste. Iron is an essential element in human nutrition, and the health effects of iron in drinking water may include warding off, fatigue and anaemia (metaglobinaemia).Groundwater exploitation especially boreholes should be regulated by government in order to reduce the negative effect of water pollution to humans. This research reveals there is great need to analyze any ground water before drinking.

Keywords: Analysis, Quality, Ground, Water, Kaduna.

INTRODUCTION

Water quality analyses remain a focal point in the underground water investigation, therefore monitoring of levels and trends of quality parameters that are influenced by formations and various anthropogenic activities become more feasible (A.O. Majalagbe et al., 2012). The depth and rock structure determines how easily or fast water can be contaminated by pollutants (Jacob, John, and Umaru, 2010). 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, 2016; Nwosu and Ogueke, 2018).

Groundwater has been naturally very clean because of its filtering effect; however, it can become polluted with nutrients and toxic chemicals when surface water carrying these substances drains into the groundwater environment (United States Environmental Protection Agency, 2017). A ground water aquifer may be as little as 30 m from the surface or as much as 300 m. Although, it costs more to pump water from deeper aquifer, the water quality in deeper ones are better than the shallow ones since contaminants which the water may be carrying are removed as the water moves through the rock (United States Environmental Protection Agency, 2017). There are various ways as groundwater is contaminated such as use of fertilizer in farming. Altman and Parizek,(2018), seepage from effluent bearing water body (Adekunle, 2009). Groundwater is not as susceptible to pollution as surface water but once polluted restoration is difficult and long term (Henry and Heinke, 2018). According to Pandey and Tiwari, (2009) over burden of the population pressure, unplanned urbanization, unrestricted exploration and dumping of the polluted water at inappropriate place enhance the infiltration of harmful compounds to the ground water. Residential areas contaminate groundwater through improper storage and disposal of household chemicals and wastes into landfills, dump sites, latrines and graveyards where they decay and are moved into aquifers by rainwater (Harter, 2017; Sandhyarami, 2010). Shallow aquifers are most susceptible to such high risks of groundwater contamination from the overlaying unsaturated zones (David, 2016). The fact that groundwater can be contaminated in the aquifer is no longer in doubt because water can dissolve and transport large amounts of organic, soluble and solid substances within it (Press and Siever, 2017). Therefore, the presence of various chemicals, organism and solid particles in groundwater only stresses the need to monitor and control potable water supply from ground sources regularly, using the national and international standards so as to guide against unwholesomeness consumption of poor quality water and its attendant health hazards (WHO,2017).Point pollution areas includes, municipal landfills, leaky sewer lines, spills from industrial waste, underground injection wells, latrines and grave yards. The non-point sources of pollution include, spray of fertilizers, pesticides and herbicides on agricultural land and through acid rain (Press and Siever, 2017). In rural areas the percentage is even higher more than half of all drinking water worldwide is supplied from ground water (Harter, 2017). According to World Health Organization about 80% of all the diseases in human beings are caused by water (Al-Hadithi, 2012) Two and a half billion people have no access to improved sanitation, and more than 1.5 million children die each year from diarrheal diseases (Fenwick, 2013. Potable water, also called drinking water in reference to its intended use, is defined as water which is fit for consumption by humans and other animals (Tchobanoglous, Burton and Stensel, 2017). The usual source of drinking water is the streams, rivers, wells and boreholes which are mostly untreated and associated with various health risks (Agbaire and Obi, 2009) Potable water is the water that is free from disease producing microorganisms and chemical substances that are dangerous to health (Lamikanra, 2014). Usually the groundwater is considered less polluted as compare to the surface water due to less exposure to the external environment (Iqbal and Gupta, 2016). The consumption of water worldwide increases yearly while most of the world's water resources continue to dwindle due to improper environmental management practices (UNEP, 2016). Globally, more than twenty-five thousand people die daily as a result of water related diseases (WHO, 2017). The pollution of groundwater through mismanagement of solid waste or other mechanisms such as human and animal faecal material deposited directly in water or rising from inadequate sewage works is the major form of water pollution in Kaduna State (Anonymous, 2016). Water pollution contributes towards more scarcity as the water may be polluted to levels where it becomes very expensive to treat.

METHODOLOGY

Study area

Kaduna South Local Government Area is located at latitude N7 0 44′ 28″ North of the equator and longitude 100 31′ 23″ East of the Greenwich meridian. It is bounded in the North and North-East by Kaduna North LGA, in the North-West by Igabi LGA, in the South by Chikun LGA. Its headquarters is in the town of Makera. Kaduna South Local Government Area has an area of 59km square, with an estimated population of 402,731 people according to the 2006 census. It had a population of 391,575 according to the 1991 census; the area experienced a tremendous population increase in May 1992 and late 2002 during and after the religious crisis. So many people moved from different parts of the state to the southern part of the state because the state was segregated into two with most of the Christians in the South and Muslims in the North.

The population has 204,969 males and 197, 762 females or 50.9% males and 49.1% females. 166,975 are aged between 0-14years, 226,952 are aged between 15-64 years and 8,804 are aged 65years and above (NPC 2006). The projected population by the year 2016 is 543,600.

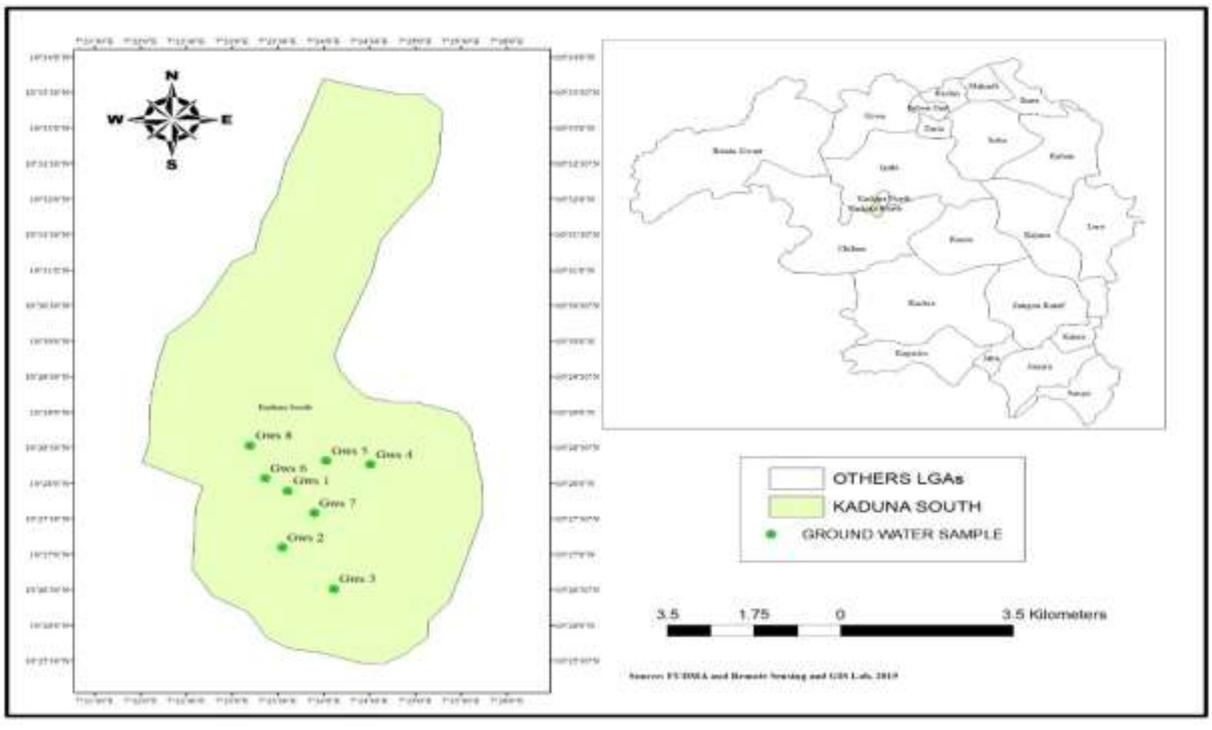

Figure 1. Map showing location of collected sample

Methods

The research areas are: Unguwan Sanusi, Sabon Gari south and north, Tudun Nupawa and Tudun Wada north and south communities of Kaduna south local government in Kaduna state. Two samples each were collected from those study areas

The samples were collected in bottles which were properly washed. Coordinates of the water samples location were taking using Global Positioning System and digitize into the study area map to show the spatial distribution of the samples.

The collected samples were analysed for different physicochemical parameters such as turbidity, electrical conductivity, PH, total suspended solids, nitrate, iron content, chloride, total hardness, sulphate, and phosphates. The test was carried out at federal university Dutsin-ma, in the soil and water laboratory, department of geography and regional planning, Katsina state and ABU Zaria

MATERIALS

Chloride free distilled water; standard silver nitrate (0.01N);potassium chromate indicator; acid or alkali for adjusting pH, water sample(s)EDTA solution; standard solution of EBT indicator; Ammonium buffer for adjusting pH, pipettes, measuring cylinder, hot plate, beaker, and spectrophotometer, volumetric flask, beaker, measuring cylinder, filter paper, weighing balance, thermostat oven and funnel. pH meter, Global Positioning System.

RESULTS AND DISCUSSION

GWS 1 to GWS 8 is the **Ground Water Samples**. The research focuses on Unguwan Sanusi, Sabon Gari south and north, Tudun Nupawa and Tudun Wada north and south communities of Kaduna south Local Government Area Kaduna state. Two samples were collected from each study area.The time frame for the collection of samples was three weeks.

Table 3.1 Result of Water Quality of Collected Samples

Parameters	*GWS1*	*GWS2*	*GWS3*	*GWS4*	*GWS5*	*GWS6*	*GWS7*	*GWS8*
pH(NS)	***7.8***	***7.9***	***8.2***	***8.2***	***7.5***	***8.0***	***8.0***	***7.8***
Sulphate(mg/l)	***0.02***	***0.02***	***4.80***	***3.20***	***8.00***	***3.20***	***0.01***	***0.02***
Phosphate(mg/l)	***0.09***	***0.11***	***0.05***	***0.18***	***5.69***	***1.42***	***0.13***	***3.36***
Electrical Conductivityσ	***1.94***	***1.63***	***0.17***	***0.39***	***1.17***	***0.78***	***0.90***	***1.35***
Chloride (mg/l)	***24.8***	***26.9***	***3.5***	***2.01***	***21.3***	***20.6***	***14.9***	***28.4***
Nitrate(g)	***0.08***	***0.06***	***0.12***	***0.03***	***0.05***	***0.05***	***0.04***	***0.02***
TSS(mg/)	***0.03***	***0.01***	***0.03***	***0.00***	***0.02***	***0.01***	***0.02***	***0.02***
Turbidity (NTU)	***25.3***	***22.6***	***28.7***	***11.6***	***9.05***	***9.05***	***10.4***	***14.3***
Iron(mg/)	***35.0***	***30.0***	***26.0***	***15.0***	***12.0***	***10.0***	***15.0***	***11.0***
Total Hardness(mg/l)	***260***	***285***	***55***	***120***	***215***	***35***	***85***	***155***

Source: field survey (2019)

The (WHO, 2017) standard for drinking and domestic uses for, PH: 6.5 – 8.5, Sulphate: 250 mg/l, Nitrate: 10mg/l, Electrical conductivity: 1000σ, Total suspended solids: 3mg/l, chloride: 250mg/l , Total hardness:500 mg/l

From the result obtained in the table above, it is observed that chloride, total hardness, pH, Sulphate, Nitrate, electrical conductivity, total suspended solids all fall within the recommended standard set by WHO for drinking and other domestic uses, phosphate in location one, two, three, four, six, seven, eight all fall within the WHO standard while in location five phosphate content is above the WHO standard.

Turbidity has no adverse health effects but can interfere with disinfection and provide a medium for microbial growth. Turbidity may indicate the presence of disease causing organisms. These organisms include bacteria, virus, parasites that can cause symptoms such as nausea, cramps, diarrhoea and associated headaches. Therefore, the entire sample analyzed do not fall within the WHO standard of 5.00 NTU hence can impose health issues in the study area as shown in figure 3.1.

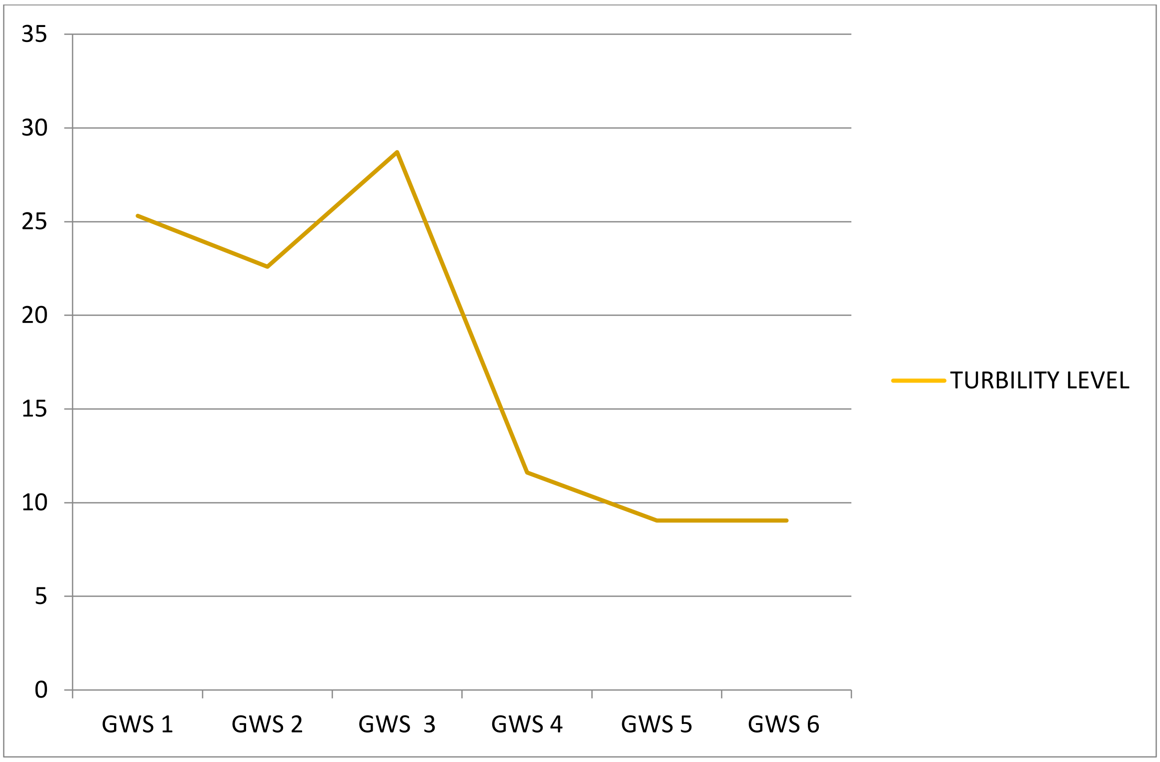

Figure: 3.1 Turbidity Level of water Samples Collected in the study Area.

Most minerals from ground water including Iron will be absorbed by water (WHO, 2017). Large amounts of Iron in drinking water can give it an unpleasant metallic taste (WHO, 2003). The average lethal dose of iron is 200 – 250 mg/kg of body weight, but death has occurred following the ingestion of doses as low as 40 mg/kg of body weight. (WHO, 2003) From the result obtained, it showed that all the samples in the study area are above the WHO of standard of 0.3 Mg/l which imposes health issues as shown in Figure 3.2 below.

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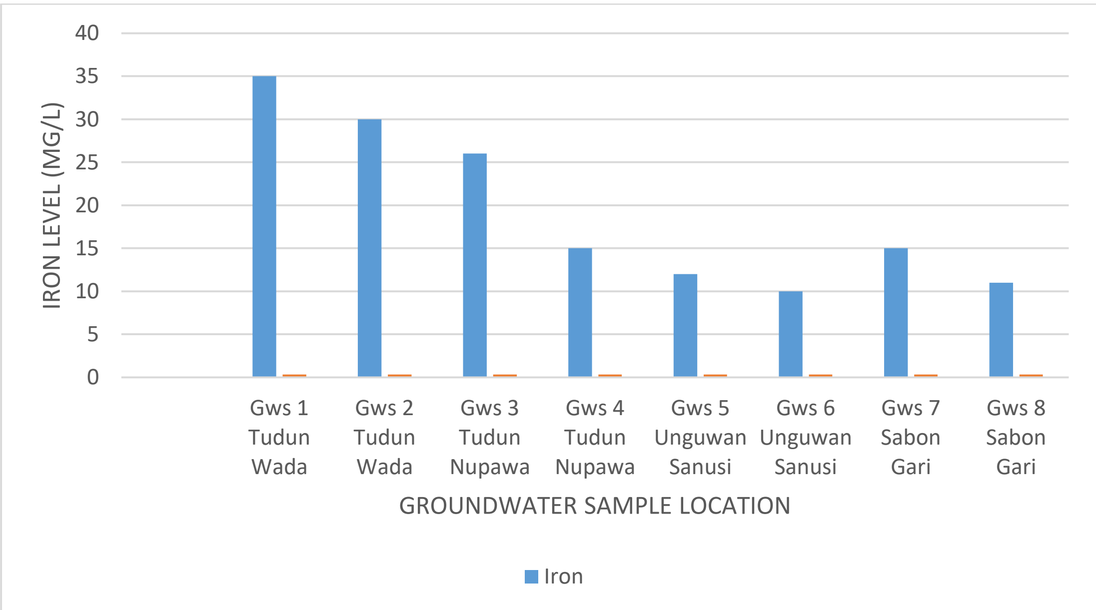

Figure: 3.2**Ion (Fe) Level of water Samples Collected in the study Area.**

CONCLUSION

The research examines the groundwater quality of Kaduna south Local government area. The physio-chemical analysis of PH, sulphate, Phosphate, chloride, Iron, Electrical conductivity, Turbidity, Nitrates, Total suspended solid and Total hardness were carried out, the result obtained were compared with World Health Organization (WHO) recommended standards for drinking water. pH, sulphate, electrical conductivity, chloride, nitrate, total suspended solids, and total hardness in all location were within the acceptable standards of WHO.

The collected data from the laboratory analysis were analyzed using simple tables, graphs and charts and the result reveals that turbidity and iron in all location were above the acceptable standards of WHO.

RECOMMENDATIONS

Based on the findings of the study, the following recommendations can be proffered

1. Frequent studies should be carried out on physicochemical characteristics of the groundwater as the concentration of some of the parameters tends to change over time.
2. It is hopeful that the research will further contribute towards achieving the Millennium Development Goal 7 by determining water quality parameters and recommending for suitable action or creating awareness about water quality and water borne diseases.
3. The information from this research will represent an important guide and reference to government agencies, researchers and other development organization and Non-Governmental Organization for the development of strategies, policies and institutional infrastructures to enable the provision of quality and accessible water resources to the communities.
4. The government and relevant authorities like KADSWAC (Kaduna State Water Corporation) should enlighten the public on the importance of sustainable use of groundwater resources.
5. The government should regulate groundwater exploitation especially boreholes by better moderation of the number, permits and general activities of borehole drillers, as most them are perceived to be unqualified and also water quality should be analyzed before drilling.

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