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Physicochemical Profile of some Selected Borehole Water from Lokuwa in Mubi North Local Government Area, Adamawa State, Nigeria.

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ABSTRACT

Analysis of borehole water form Lokuwa was conducted with the aim of determining its physico-chemical parameters. Samples of water were collected from Boreholes in Lokuwa along river YadzaramMubi North Local Government Area, Adamawa State Nigeria, three sampling points (Behind Hambal filing station, Yan Zana and Opposite lokuwa water board) were identified and analyzed for nine (9) physico - chemical parameters, (pH, Conductivity. Total dissolved solid (T D.S), Turbidity, Dissolve Oxygen (DO) were determined by the use of Henna instrument [Meter No: H198907], (Alkalinity, Total Hardness, Chloride) were determined by titrimetric method, while Temperature was measured using a thermometer. Some of the physico-chemical parameters analyzed comply with the requirement of WHO, NAFDAC and NSDWQ. Which include the pH (6.95), Alkalinity (95.4mgl/), Conductivity (778.1µs/cm) and Total Hardness (188.3mg/l).While other parameters of the water samples does not comply with the standard recommended by WHO, NAFDAC and NSDWQ. Which include total dissolved solid (T.D.S) (571 ppm). Turbidity (8. 16ONTU), Chloride (281.4 mg/I) and Dissolve Oxygen (D OX 6 82 mg/l of the water sample also exceeded the standard Permitted level by NAFDAC and WHO. It is therefore concluded that water from Lokuwa boreholes along river Yadzaram does not meet the qualities of a portable water for consumption, hence monitoring of such water bodies from other sources should be conducted to provide information on their physicochemical parameters.

Keywords: Physico-Chemical, Borehole Water, Lokuwa and Mubi North

INTRODUCTION

In July 2016, the United Nations General Assembly declared access to clean and safe drinking water a human right [1]. Given that climate change and anthropogenic activities are causing significant changes in the hydrological cycle, water quality degradation has emerged as a critical global issue for human development. Pollution caused by human intervention and inappropriate agricultural drainage from rivers endangers water resources.Anthropogenic sources such as untreated industrial effluents, improperly disposed domestic waste, and agricultural runoff are major contributors to surface water pollution and water quality degradation [2]. Water is one of nature's most important and valuable resources. It is required for the survival of all living organisms [3,4]. Although water covers roughly 70% of the earth's total surface, only 0.3 percent of it is of high quality and drinkable to humans [5]. Drinking water quality is a significant environmental determinant of health. However, studies showed that lack of good quality water causes more than 80% of diseases in developing countries, including Nigeria [6]. Water quality is defined by its been colorless, transparent, odorless, and tasteless in accordance with specific physical, chemical, and microbiological standards, pH of 7.0, freezing at0°C, and boiling points of 100°C at 760 mmHg [7,8].

Contaminants such as bacteria, viruses, heavy metals, nitratesand salt have also polluted water supplies as a result of inadequate treatment and disposal of waste from humans. There are a number

of reported cases of typhoid, diarrhea and other water borne diseases arising from the consumption of contaminated water. Several works have also been reported by many researchers on water quality assessment. Today, contaminated water kills more people than cancer, AIDS, wars, terrorism or accidents [9,10,11]. Physico-chemical properties of the water gets varied season wise and in addition, anthropogenic activities such as agriculture, urbanization, domestic sewage, etc (as earlier stated) in the catchment area resultin the deteriorationof water quality [12,13]. Temperature, turbidity, nutrients, hardness, alkalinity and dissolved oxygen are some of the important factors that play a vital role for the growth of living organisms in the water body. Water quality indicates the relation of all hydrological properties including physical, chemical and biological properties of the water body. Hence, water quality assessment involves analysis of Physico- chemical, biological and microbiological parameters that reflects the biotic and abiotic status of ecosystem [14]. Water quality index (WQI) provides a nominal number that represent overall water quality at a certain location and time, based on several water quality parameters.This values ensures the quality and safety of portable water. The World Health Organization (WHO), Food and Agriculture Organization (FAO). United States Environment Protection Agency (USEPA), as well as the Nigerian Industrial Standard for drinking water (NIS), have set up standard for heavy metal contamination for different sources of water. These standards are based on the physical, chemical constituents of the water from their sources [15,16,17]. Water can be obtained from a number of sources, among which are streams, lakes, rivers, ponds, rain, springs, and boreholes. In Nigeria, majority of the rural populace do not have access to portable water and therefore, depend on well, stream, boreholes water for domestic uses. In line with the non-availability of portable water in many Nigerian rural communities, people of Mubi metropolis obtained their domestic water from hand dug wells, streams and Boreholes. These sources are complimented in the dry season by hawkers (maimoya) who fetch water mostly in boreholes along the course of river yadzaramto meet up with their daily needs. However, numerous studies have shown that Borehole water is contaminated by domestic sewage, household wastes and livestock manure especially if there is a puncture in the soil layer [9,10,11]. These waste and sewage when deposited near the boreholes (as seen in the study area) may leach with percolating rain water directly into the boreholes or may travel along the well-wall or surrounding material of the drill-holes. There are several variants of fecal-oral pathway of water borne disease transmission. These include contamination of drinking water catchments (example, human or animal faces). Water within the distribution system (such as leaky pipe or obsolete infrastructure) or of stored household water as a result of unhygienic handling. Consequent upon consumption of contaminated water, water- borne diseases such as cholera and typhoid often ensure especially during dry season [18]. [19], found that diseases due to consumption of contaminated water leads to the death of five million children annually and make 1/6 of the World Population sick. Water contaminated with toxic inorganic chemicals causes either acute or chronic health effect. Acute effects include nausea, lung irritation, skin rash, vomiting and dizziness, sometimes death usually occurred. Chronic effect, like cancer, birth defects, organ damage, disorder of the nervous system and damage to the immune system are usually more common [19]. In addition, borehole water have excessive contaminants from microbial and chemical reactions [20]. It is against this background that this study seeks to determine the physical and chemical parameters of some selected borehole water in Lokuwaalong river YadzaramMubi North LGA of Adamawa

state which is one of the major sources of water supply in Mubiwith the view to ascertaining the water portability for the community.

Materials and Methods

Samples collection/treatment

Sampling and preservation of samples were carried out as prescribed by APHA method [8].Water samples were collected from three different locations (Behind Hambal filing station, Yan Zana and Opposite lokuwa water board) at Lokuwa along river Yadzaram in Mubi North LGA of Adamawa state. The samples were collected in sterilized polythene bottles of one litter capacity. Monitoring was done in the months of July and August 2021. For unstable parameters such as temperature, electrical conductivity (EC), pH, and dissolved oxygen (DO) were measured at the sampling site. Samples were brought to the Chemistry laboratory, Federal polytechnic, MubiAdamawa state for analysis of other physico-chemical parameters like chlorides, total alkalinity, and biochemical oxygen demand (BOD). The parameters were compared according to the standard methods described by [12].

Physico-Chemical Analysis

Water samples were analyzed using both classical and automated instrumental methods prescribed by standard water analysis methods and the United States Environmental Protection Agency. Standard solutions were used to calibrate a digital Jeanway 3505 pH meter (pH 4 and 10.0). The water surface temperature was determined by lowering the probe to about 1cm below the water's surface for about five (5) minutes until it stabilized, at which point the temperature was immediately recorded. Henna instrument [Meter No: H198907] Conductivity meter was used to measure conductivity, total dissolved solids, and turbidity. The results of various tests on the physicochemical properties of water samples and their comparison with World Health Organization (WHO) drinking and waste water standards [17].

RESULTS

According to the findings of the physico-chemical analysis of borehole water from Lokuwa along the river YadzaramMubi North LGA, the water samples analyzed have objections in some physical and chemical parameters when compared to the standard values, these include Turbidity, Total Dissolve Solute (T.D.S), Chloride, Dissolve Oxygen (D.O). Also the colour of the water is not in agreement with the standard colour due to the high turbidity which affect the physical appearance of the water sample (i.e. colour). While some of the parameter were found within the standard range required these include,pH. Alkalinity, Total Hardness, and Conductivity. The result is depicted in the Table 1 below.

Table 1: Results of the physio-chemical parameter of Lokuwa borehole water of Mubi local government and their means values

S/N	Parameters	Week 1	Week 2	Week 3	Week 4	mean
1	T.D.S (PPM)	530	630	553	571	571
2	Turbidity (NTU)	9.40	8.50	6.60	8.14	8.16
3	Temperature (^{o}C)	34.0	30.2	33.0	32.4	32.4
4	PH	7.25	7.09	6.52	6.94	6.95
5	Total hardness (mg/l)	197.6	189	183	184	188.3
6	Conductivity (µs/cm)	799.2	841.0	695.6	776.6	778.1
7	DO (m/l)	6.80	5.80	7.92	7.30	6.82
8	Alkalinity (mg/l)	99.9	87.5	98.8	94.6	95.4
9	Chloride (mg/l)	268.9	290.4	285.7	280.6	281.4

Key:
NTU = NephelometricTurbidity Unit. PPM = Part Per Million, Ambient: No Standard Value.

Table: 2 World Health Organization (WHO) Nigerian Standard Drinking Water Quality (NSDWQ) and National Agency for Food Drug Administration and Control (NAFDAC) standard values

S/N	Parameters	NSDWQ	NAFDAC	WHO	LOKUWA
1	T.D.S (PPM)	500		500	571
2	Turbidity (NTU)	5.0 - 5.25	5.0		8.16
3	Temperature (^{o}C)	ambient		12 - 30	32.4
4	pH	6.5 - 8.5	6.5 - 8.5	6.5-8.5	6.95
5	Total hardness (mg/l)	61 - 12	500	250	188.3
6	Conductivity (µs/cm)	1000	100	NS	778.6
7	D.0 (mg/l)			5.0	6.82
8	Alkalinity (mg/l)	98 - 278	98 – 275	400	95.4
9	Chloride (mg/l)	250	250	250	281.4

KEY: NSDWQ = Nigerian standard drinking water quality NTU = Nephelometric turbidity unit, PPM = part per million , AMBIENT = no standard value. Table 1: depict thephysico-chemical parameters of Lokuwa Borehole water obtained and their mean, in order to analyze the quality of the water sample in relation to the standard quality. The Total hardness, chloride and Alkalinity of the water sample were found to be from 188.3 mg/l. 281.4 mg/l and 95.4 mg/I respectively. The temperature of the water samples at the time of the analysis was calculated as 32.4 ˚C, while the found to be 8.16 NTU. The samples had objectionable colour. The pH of the water samples has an average of 6.95, while the total dissolved solid 571 mg/l and conductivity measured 778.1 µs/cm and lastly D.O was 6.82 mg/l

DISCUSSION

Water quality is neither a static condition of a system, nor can it be defined by the measurement of only one parameter. There is a range of chemical, physical and biological components that affect water quality. These variables provide general indication of water pollution, whereas others enable a direct tracking of pollution sources [20]. The average pH of the water samples collected from the main source (Lokuwa Borehole water) was (6.95) slightly below neutral level (Table 1) and this value fall within the accepted range of 6.5-8.5 indicative of good water quality. The result is in agreement with the findings of [20] in Umuahia, Abia State, Nigeria. Temperature values of the water sample analyzed was (32.4˚C) and also fall within the normal temperature range since the temperature standard is

ambient(No standard depend on the environment where the samples are collected). This is in consistence with the result of [11] in Bayelsa state, Nigeria. Significantly high total dissolved solids (TDS) (571 ppm) of the water is implicative of a high level of pollution of the sewage and pit latrines when compared to the WHO standard limit for good water quality which is 1,000 mg/l, which fall in consistence with the findings of [9] in India.

High TDS content values of the water show significant direct relationships to the high bacterial population obtained from the water samples. The turbidity of water sample obtained in this study (8.16 NTU) is not in agreement with the standard of both WHO and NWDSQ (5.0-5.25).Which is in consistence with the findings of [19] in Kano State. Water turbidity is very important because high turbidity is often associated with higher level of disease causing microorganism, such as bacteria and other parasites [8]. The total alkalinity of water sample is in agreement (95.4 mg/l) with both WHO and NAFDAC (100 mg/l) standard. This is also in agreement with the findings of [4] analysis of Borehole water in Nafada, Gombe state, Nigeria. Conductivity of (778.6 us/cm) was observed in the water sample collected from Lokuwa borehole which does not exceeds the required range of WHO and NSDWQ, although there is no disease or disorder associated with conductivity of drinking water. The total Hardness of the water was (188.3 mg/l) is also in agreement with the requirement of WHO and NSDWQ. Dissolve oxygen (D.O) was (6.84 mg/l) which is above the standard requirement of WHO and NSDWQ (which is 5 mg/l). So also the chloride of the water sample (281.4 mg/l) is not in agreement with that of both WHO and NSDWQ (1000). The water sample analyzed in this study have objectionable colour which is not in agreement with the standard colour due to the high turbidity which affect the physical appearance of the water sample (i.e. colour). This finding is not surprising considering the high population and close proximity of the wash borehole to dump sites and pit latrines, the sewage could leech slowly into underground water, there by polluting them.

CONCLUSION

This study concluded that the quality of drinking water from boreholes in Lokuwa along the Yadzaram River in Mubi local government area is not safe for human consumption and thus requires significant effort. According to recent WHO and USEPA news and reports, borehole water used for drinking is unsafe due to heavy industrial and environmental pollution. Toxic chemicals and heavy metals make people sick and expose them to long-term health problems. Water quality should be controlled in order to reduce the acute problem of water-related disease that is endemic to human health. In order to maintain good water quality, these water bodies should be given an effective and thorough sanitary condition.

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