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Ground Water Quality Analysis in Nigerian Institute of Leather and Science Technology, Zaria

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Abstract

The study examined the physico-chemical parameters of Nigeria Institute of Leather and Science Technology underground water. The study analyzed ground water samples from four different collection points, Hostel bore-hole, Tannery bore hole, Mosque well and Staff quarters well using Atomic Absorption Spectrophotometer (AAS). Total dissolved solid value at the hostel was found to be 1231 mg/l, while the Tannery was 703 mg/l, the mosque was 448 mg/l and the staff was 428 mg/l. Chemical Oxygen Demand, Total hardness and some heavy metals were measured to be above the permissible standard of the World Health Organization after the analysis at the National Research Institute for Chemical Technology (NARICT) and Ahmadu Bello University (ABU). Solution proffered includes, treatment of tannery wastes before being discharged into the environment because it constitutes the major industrial activity in the institute. Furthermore, the students' hostel in the institute should be provided with waste bins for dumping of waste.

Keywords: Underground Water; Samples; Analyze; Tannery; Atomic Absorption; Spectrophotometer and Result

Introduction

Water is a natural resource of fundamental importance that supports all forms of life and creates jobs and wealth, tourism, recreation and fisheries. Without water, life as it exists on our planet is impossible. Water is an important geomorphic organ playing a significant role in weathering, the most important energy regulator in the heat budget of the earth. Fresh water therefore is a renewable resource; yet the world supply of clean fresh water is steadily decreasing. The demand for fresh water has increased with the ever increasing population in the world. About half of the people that live in develop countries do not have access to safe drinking water and 73% have no sanitation and some of their waste eventually contaminates their drinking water supply leading to a high of suffering [1].

Water pollution is primary associated with domestic and industrial waste both type of waste water pose threat to water quality which may be classified into health hazard and sanitary nuisance each day some 25,000 people are said to die from their everyday use of contaminated water and many million more suffer from devastating water borne illness Remove. It occurs when unwanted materials with potentials to threatened human, some of these pollutants are decomposed by the action of microorganisms through oxidation and other processes. Throughout the world the provision of water to meet the human use standard are essential requirements.

Industries are the major sources of pollution in all environments based on the type of industry; various levels of pollutant can be discharge into the environment directly or in indirectly through public sewer lines water from industries include employee sanitary waste, processed waste from manufacturing washed water and relatively uncontaminated water from heating and cooling operation. High level of pollution in river water system causes an increased in Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Dissolved Solid (TDS), Total Suspended Solid (TSS), toxic metals such as Cadmium (Cd), Chromium (Cr), Nitrate (NO_3), Lead (Pb), and fecal coliform hence make unsuitable for drinking [2].

Many factors affect the quality of the surface and ground water. Water moving over or under the land surface can undergo physical and chemical changes these changes may be caused by either natural factors or human activities. Ground water is hidden resources at one time, its purity and availability were taken for granted now contamination and availability are serious issues. Scientists estimate groundwater accounts for more than 95% of all fresh water available for use. Infact, approximately 50% of Americans obtain all or part of their drinking water from ground water nearly 95% of rural resident rely on ground water for their drinking supply about half of irrigated crop land uses ground water.

Africa about 85% of the water is used in agriculture. Only 10% is used in household and only 5% in the industry. Growing population in the continent will place increasing demand on water usage in agriculture. Water have no limit of uses, hence it's been use often and

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all the time. Water is been use by the students, staff and the tannery located in the Nigerian Institute of Leather and Science Technology. The use of water by the student is for different purposes e. g, drinking, bathing, cooking and washing, while the tannery uses it in washing out of dirt of the hide/skin use in making of finished leather product. They conducted a research on the effects of solid waste dumpsite on ground water quality in Samaru Zaria. Ground water samples were collected from 24 different wells from three different areas that have major dumpsite in Samaru and concluded that the ground water of Samaru is not totally pure and therefore not fit for drinking without proper treatment. Furthermore, researched into water hardness within CHELTECH environment and concluded that the hardness of water at that time was within acceptable standard requirement for tannery water. He however did not look into other use of underground water [3].

Aims and Objectives

The aim of this study is to access the physico-chemical analysis of Nigerian Institute of Leather and Science Technology (NILEST) underground water. The stated aim was achieved through the following objectives;

i. To access the quality of the ground water in terms of pH, BOD, COD, DO,TDS, TSS and the concentration of selected heavy metals

ii. Compare the concentration of physico-chemical parameters in the water with the acceptable limit of World Health Organization(WHO)

iii. Access the amount of water hardness and compare with World health Organization Standards

Statement of Research Problem

NILEST underground water is natural water that is made up of non-impurities that can be used for drinking and other uses in the institution. But recently there has been complains from student about the taste, the appearance and the color of water ground water in the institute [4].

The Study Area

Nigeria Institute of Leather and Science Technology (NILEST) is located at Samaru, Sabon-Gari Zaria, Kaduna state, is an institute. It houses staff and students as well as industrial out-outlet (Tannery) which may cause the ground water contamination.

Materials and Methods

Materials

Sample Bottles, Beaker, pH Meter, Measuring Cylinder, Filter Paper, Test Tube, Conical Flask, Atomic Absorption Spectrophotometer (AAS)

Reagents

Nitric acid, Sodium Thio Sulphate, Iodine, Magnesium Sulphite, Calcium chloride, Alkalis, Sulphuric acid and Distilled water

Methodology

Underground water sample from four selected areas in NILEST which are; Hostel, Tannery, Mosque and Staff quarters were collected using four different sterilized sampling bottles which were coded to avoid mistake in identifying the bottles. The samples were then taken to the Environmental Laboratory in National Research Institute for Chemical Technology for analysis to get the physiochemical parameters of the water samples. Spectrophotometer was use to analyzed for heavy metals.

Physiochemical parameters such as COD, BOD, DO, TDS, conductivity, pH, Temperature, hardness and standard for world health organization for safe water was also obtained from the internet [5].

Sampling Techniques

The physiochemical analysis was conducted by collecting water samples from each bore hole and well, using sampling bottles. The samples were taken from four different location having either well or bore hole. Samples were collected from well using a local fetcher, while the bore hole sample were collected from the tap, from the four major different area

Discussion of Results

pH is a good indicator of whether water is hard or soft the pH of pure water is 7, in general water with a pH lower than 7 is considered acidic and a pH greater than 7 is considered basic. This gives a graphical illustration to the pH of under -ground water from the sample points. pH values for Hostel, Tannery, Mosque and Staff Quarters were found to be 07.7, 07.1, 07.6, and 07.1 respectively.

Total Dissolved Solid refers to any minerals, salts, metals cations or anions. This gives a graphical representation of obtained values. TDS result were found to be 1231mg/l for Hostel, 703mg/l Tannery, 448mg/l for mosque and 428mg/l for staff quarter well sample [6].

Temperature is the degree or intensity of heat present in a substance or object especially according to a comparative scale and shown by a thermometer, the values found were, Hostel 25.9°c, Tannery 26.1°c, mosque 25.2°c staff quarter 26.0°c as shown below

Dissolved Oxygen is the amount of Gaseous Oxygen (CO_2) in the water. The DO concentration was found in the four samples were, 5.42 mg/l for Hostel, 5.51mg/l for tannery, 6.04mg/l for mosque, 5.24 mg/l for staff quarter as seen below.

Chemical Oxygen Demand (COD) is the measure of the capacity of water to consume oxygen matter and the oxidation of inorganic chemicals, COD was found to be 190 mg/l for Hostel, 90 mg/l for Tannery, 110 mg/l for mosque and 110 mg/l for staff quarter well sample as represented [7].

Total Hardness is one of the factors that established the quality of a water supply is the degree of hardness, hardness is define as calcium and magnesium ion content since most analysis do not distinguish between Ca^{2+} and Mg^{2+}, and since most hardness is cause by carbonate minerals deposits, hardness is reported in Parts Per Millions (PPM), hard water forms scales in steam boiler and interior of pipes. High amount of hardness in drinking water also leads to hearts diseases and kidney stone formation, as shown below

Heavy Metals in concentration above World Health Standard poses a number of health challenge, the concentration of the heavy metals of cobalt, zinc and lead are represented.

The graph above shows negative concentration of cobalt in all the sample points as the bars appear below the Y- axis. From the Graph all sample points with the exception of the student Hostel is above the WHO standard of 0.3 [8].

The graph above shows negative concentration of cobalt in all the sample points as the bars appear below the Y- axis. From the graph the concentration of Cobalt in all sample points is well within the permissible limits as set by WHO.

From the above the pH value for underground water gotten from the hostel is within the WHO acceptable limit 0f 6.5-8.5 for safe drinking water, conductivity was observed to be 0.98 mS/cm from the tannery which is below the WHO standard of drinking water 600 mS/cm, while Temperature was observe to be 26.1˚c compared to be below the standard limit of WHO 30˚C, Dissolved oxygen appear to be lower than stipulated 10mg/l of WHO which agrees to. The chemical oxygen demand was found to be above the standard 40 mg/l of WHO, Total hardness was measure to be three times greater than the permissible standard of 250 mg/l of WHO while the concentration of lead in Tannery and mosque was above the permissible standard world health organization 0.3 ppm. The concentration of Cobalt was also found to be beyond the World Health Standard set limit of 0.05 [9].

Conclusion

From the foregoing it can now be conclude that most of the parameters analyzed where highest in the school hostel and tannery, likely as a result of dumpsite and tanning activities therein, most of the parameters were compared with world health Organization standard were above the acceptable limit for safe drinking water, thus the underground water in Nigeria institute of leather and science technology is not safe for consumption.

In other to meet the requirements of WHO regulatory guidelines and standard it is recommended that Nigeria Institute of leather and science technology rehabilitates and maintains the tannery waste water treatment plant so that water should be treated to reduce the concentration of pollutants before discharging it out into drainages [10].

Acknowledgement

None

Conflict of Interest

None

References

1. Egerton F N (2007) Understanding food chains and food webs, 1700-1970. Bulletin of the Ecological Society of America 88: 50-69.
2. Zanden V, M J, Shuter B J, Lester N, Rasmussen J B (1999) Patterns of food chain length in lakes, A stable isotope study. The American Naturalist 154: 406-416.
3. Odum EP, Barrett GW (2005) Brooks/Cole, a part of Cengage Learning, Fundamentals of Ecology (5th Edn.)
4. Shurin JB, Gruner DS, Hillebrand H (2005) All wet or dried up? Real differences between aquatic and terrestrial food webs. Proc R Soc B 273: 1-9.
5. Nummi P, Kattainen S, Ulander P, Hahtola A (2011) Bats benefit from beavers: A facilitative link between aquatic and terrestrial food webs. Biodivers Conserv 20: 851-859.
6. Roth BM, Kaplan IC, Sass GG, Johnson PT, Marburg AE (2007) Linking terrestrial and aquatic ecosystems: The role of woody habitat in lake food webs. Ecological Modelling 203: 439-452.
7. Potapov AM, Brose U, Scheu S, Tiunov AV (2019) Trophic Position of Consumers and Size Structure of Food Webs across Aquatic and Terrestrial Ecosystems. The American Naturalist 194: 6.
8. Nakano S, Murakami M (2000) Reciprocal subsidies: Dynamic interdependence between terrestrial and aquatic food webs. Center for Ecological Research 52-2113.
9. Nowlin WH, Vanni MJ, Yang H (2008) Comparing resource pulses in aquatic and terrestrial ecosystems. Ecology by the Ecological Society of America 89: 647-659.
10. Kautza A, Sullivan SMP (2016) The energetic contributions of aquatic primary producers to terrestrial food webs in a mid- size river system. Ecology by the Ecological Society of America 97: 694-705.