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Effective Wastewater Management for Health and Sustainable Environment in Afe Babalola University (Abuad)

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Abstract

Ethically, the aesthetic view of a particular atmosphere, surrounding or environment depends on its decent hygienic state. This is so for the reason that, when an environment, surrounding, or atmosphere is hygienic the lives of those in that community are not threatened by pollution, illness and disease, in that way creating a sustainable environment. If wastewater is not appropriately managed it might turn out to be a point source of pollution will be a threat for the health of human populations and the environment. This research was carried out with the aim which probably of assessing the quality and quantity of wastewater released to the environment, to determine the constituents of wastewater through experimental laboratory analysis. Laboratory analysis was taken from different point in ABUAD, Various laboratory test such as DO, PH, BOD, COD, Turbidity, total hardness, calcium carbonate hardness, alkalinity, and ammonia, which was properly carried out following due procedure and analysed properly. These results shows that majority of the test carried out for was unsatisfactory according to standards. From the laboratory experiments carried out, it can be concluded from the result that Bakery: - the appearance, turbidity, total hardness, odour, TDS, and BOD are unsatisfactory. Laundry: - the appearance, turbidity, total harness, ph., odour, BOD, are unsatisfactory. Kitchen: - the appearance, turbidity, total harness, ph., odour, ammonia, BOD are unsatisfactory. Effluent: - the appearance, turbidity odour, are unsatisfactory.

Keywords: Waste water • wastewater management

Introduction

Wastewater can mean diverse things to dissimilar people with an enormous number of definitions. The foremost objective of wastewater treatment is generally to tolerate human and industrial effluents to be disposed of without jeopardy to human health or unacceptable danger to the natural environment. Wastewater is any water that has been poorly affected in quality due to human actions, can be regarded to as wastewater. Nevertheless, according to Raschid-Sally L and Jayakody P, [1] wastewater as "a combination of one or more of: domestic effluent consisting of black water (excreta, urine and faecal sludge) and grey water (kitchen and bathing wastewater); water from commercial establishments and institutions, including hospitals; industrial effluent, storm water and other urban run-off; agricultural, horticultural and aquaculture effluent, either dissolved or as suspended matter"

Effective wastewater management for health and sustainable environment in ado-Ekiti is research that is embarked upon to reduce the rate of water related disease and also to create a sustainable and conducive environment for habitants. Pollutants must be removed and treated from water before disposal to protect the environment and public health. When water is used by our society, the water becomes contaminated with pollutants. If left untreated, these pollutants would negatively affect our water and environment. For example, organic matter can cause oxygen depletion in lakes, rivers, and streams. This biological decomposition of organics could result in fish kills and or foul odours. Nutrients in wastewater, such as phosphorus, can cause premature aging of our lakes, called Eutrophication. Waterborne diseases are also eliminated through proper wastewater treatment. Additionally, there are many pollutants that could exhibit toxic effects on aquatic life and the public.

Furthermore, numerous approaches for wastewater treatment have persistently been explored in the last few decades nevertheless their use is restrained by several limitations as well as use of chemicals, formation of disinfection by-products (DBPs), time consumption and cost effectiveness. Nanotechnology, manipulation of matter at a molecular or an atomic level to craft new structures, devices and systems having superior electronic, optical, magnetic, conductive and mechanical properties, is evolving as an auspicious technology, which has proved remarkable feats in numerous fields including wastewater treatment. Nanomaterial's encompass a high surface to volume ratio, a high sensitivity and reactivity, a high adsorption capacity, and ease of functionalization which makes them suitable for application in wastewater treatment [2].

The world is facing a global water quality catastrophe, population growth and urbanisation, rapid industrialisation, expanding and intensifying food production are all setting burden on water resources and escalating the unregulated or illegal disposal of contaminated water within and beyond national borders. Furthermore, this presents a global threat to human health and wellbeing, with both instantaneous and long-term consequences for struggles to moderate poverty whereas supporting the reliability of some of our most industrious environments. There are numerous grounds motivating this crisis, but it is convincing that freshwater and coastal environments through the world, upon which people depended for ages, are increasingly vulnerable. It is similarly clear that the need for water for the future cannot be met except wastewater management is effectively managed.

According to National Research Council [3] investigation the method we produce our food uses 70–90 percent of the available fresh water, returning much of this water to the system with extra nutrients and contaminants. It is a series of related event as downstream agricultural pollution is joined by human and industrial waste. This wastewater contaminates freshwater and coastal ecosystems, threatening food security, access to safe drinking and bathing water and providing a major health and environmental management challenge. Now all these can be tackled by making new policies, approaches and financing new mechanisms, from a healthier water quality regulation and generous agreements, to market-based instruments and partnership-based financing and management models bringing Together the public and

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private sectors, not forgetting the vital role of education. Wise investments in wastewater management will generate significant returns, as addressing wastewater is a key step in reducing poverty and sustaining ecosystem services. Instead of being a source of problems, well-managed wastewater will be a positive addition to the environment which in turn will lead to improved food security, health and therefore economy. One fifth of the world's population, or 1.2 billion people, lives in areas of water scarcity, and this is projected to increase to 3 billion by 2025 as water stress and populations increase. There is no option but to consider wastewater as part of the solution. To be successful and sustainable, wastewater management must be an integral part of rural and urban development planning, across all sectors, and where feasible transcending political, administrative and jurisdictional borders. There are few, if any, areas where investments in integrated planning can sustainably provide greater returns across multiple sectors than the development of water infrastructure and the promotion of improved wastewater management.

This research is targeted at enlightening the public on how to properly dispose wastewater and as well treating the wastewater appropriately before reusing. On the other hand there is so much of pollution due to lack of awareness in environment and human life relation. At the moment people might not be aware about pollution consequence on the environment and how crucial to treat the waste water, before it is disposed of into environment.

Stages in sewage treatment

Primary treatment: It consists of temporarily holding the sewage in a quiescent basin where heavy solids can settle to the bottom while oil, grease and lighter solid float to the surface.

Secondary treatment: It removes dissolved and suspended biological matter. Secondary treatment may require a separation process to remove the micro-organism from the treated water prior to discharge or tertiary treatment.

Tertiary treatment: It can be sometimes defined as anything more than primary and secondary treatment in order to allow rejection into a highly sensitive or fragile eco-system (estuaries, low flow river, canal reef etc).

Pre-treatment: This removes materials that can be easily collected from the raw sewage before they damage or clog the pump and sewage lines.

Objective of Abuad sewage treatment plant

The objective of sewage treatment is to produce a disposable effluent without causing harm to the surrounding environment and prevent pollution

History of wastewater treatment

Wastewater treatment is a fairly new practice although drainage systems were built long before the nineteenth century. Before this time, "night soil" was placed in buckets along streets and workers emptied them into "honey wagon" tanks. This was sent to rural areas and disposed of over agricultural lands. In the nineteenth century, flush toilets led to an increase in the volume of waste for these agricultural lands. Due to this transporting challenge, cities began to use drainage and storm sewers to convey wastewater into water bodies against the recommendation of Edwin Chadwick in 1842 that "rain to the river and sewage to the soil". The discharge of waste into water courses led to gross pollution and health problems for downstream users [4].

In 1842, an English engineer named Lindley built the first "modern" sewerage system for wastewater carriage in Hamburg, Germany. The improvement of the Lindley system is basically in improved materials and the inclusion of manholes and sewer appurtenances— the Lindley principles are still upheld today. Treatment of wastewater became apparent only after the assimilative capacity of the water bodies was exceeded and health problems became intolerable. Its design was however empirical until mid-century. Centralized wastewater systems were designed and encouraged. The cost of wastewater treatment is borne by communities discharging into the plant (Figure 1).

Today there have been great advances to make potable water from wastewater. In recent times, regardless of the capacity of the receiving stream, a minimum treatment level is required before discharge permits are granted [5]. Also presently, the focus is shifting from centralized systems to more sustainable decentralized wastewater treatment (DEWATS) especially for developing countries like Ghana, Nigeria, Mali, Chad, etc. Where wastewater infrastructure is poor and conventional methods are difficult to manage [6].

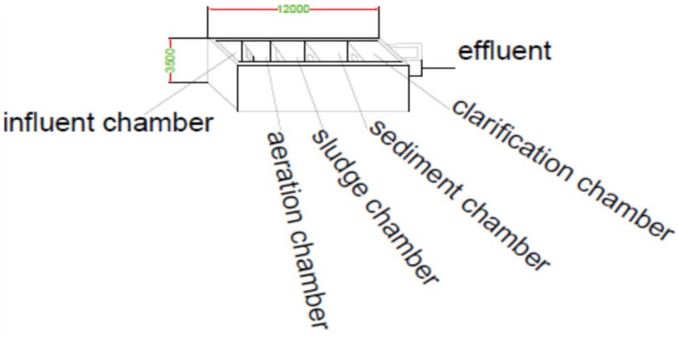

Figure 1. ABUAD sewage treatment plant.

Objectives of wastewater treatment

Wastewater treatment is very necessary for the above-mentioned reasons. It is more vital for the:

i. Reduction of biodegradable organic substances in the environment: organic substances such as carbon, nitrogen, phosphorus, sulphur in organic matter needs to be broken down by oxidation into gases which is either released or remains in solution.

ii. Reduction of nutrient concentration in the environment: nutrients such as nitrogen and phosphorous from wastewater in the environment enrich water bodies or render it eutrophic leading to the growth of algae and other aquatic plants. These plants deplete oxygen in water bodies and this hampers aquatic life.

iii. Elimination of pathogens: organisms that cause disease in plants, animals and humans are called pathogens. They are also known as micro-organisms because they are very small to be seen with the naked eye. Examples of micro-organisms include bacteria (e.g. *Vibro cholerae*), viruses (e.g. Enterovirus, Hepatits A & E virus), fungi (e.g. *Candida albicans*), protozoa (e.g., *Entamoeba hystolitica, Giardia lamblia*) and helminthes (e.g. *Schistosoma mansoni, Asaris lumbricoides*). These micro-organisms are excreted in large quantities in faeces of infected animals and humans [7].

iv. Recycling and Reuse of water: Water is a scarce and finite resource which is often taken for granted. In the last half of the 20th century, population has increased resulting in pressure on the already scarce water resources. Urbanization has also changed the agrarian nature of many areas. Population increase means more food has to be cultivated for the growing population and agriculture as we know is by far the largest user of available water which means that economic growth is placing new demands on available water supplies. The temporal and spatial distribution of water is also a major challenge with groundwater resources being overdrawn [8]. It is for these reasons that recycling and reuse is crucial for sustainability.

Types of wastewater

Wastewater can be described as in Figure 2.

Types of collection system

Surface-water: drainage that collects rainwater run-off from roads and urban areas and discharge direct to local waters

Combined sewerage: that collects rainwater run-off and waste water from domestic, industrial, commercial and other premises; and

Foul drainage: that collects domestic waste water from premises (no rainwater is collected). Both surface water and foul drainage may eventually connect to combined sewerage where there are no Local environmental waters to which surface water drainage can discharge.

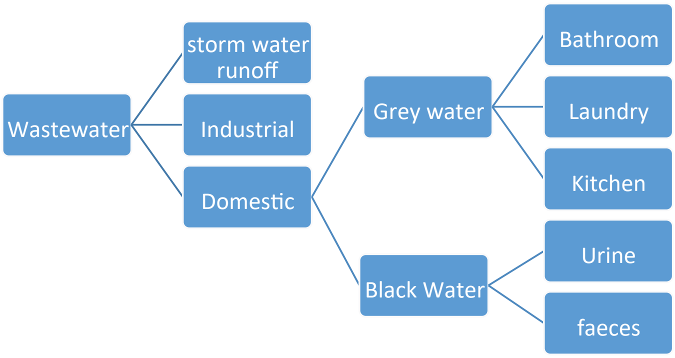

Figure 2. Types of wastewater.

Combined sewerage systems are not uncommon in the UK and elsewhere in Europe. A basic requirement of combined sewerage systems is that they need to cater for all normal local climatic conditions. In other words, they need to be large enough to receive and effectively manage storm water from peak seasonal wet weather. However, even when designed to deal with such weather, there may be times when heavy continuous rainfall will temporarily exceed the capacity of combined sewerage systems. To deal with such situations 'combined sewer overflows' are designed and built as an integral part of combined sewerage systems. The purpose of combined sewer overflows is to allow excess waste water to be discharged to local waters to avoid sewers being overwhelmed and waste water 'backing up' along sewers and flooding streets and properties, or overwhelming waste water treatment plants. The backflow of wastewater to properties and streets would present human health hazards and flooded and overflowing treatment plants would disrupt treatment processes and have the potential to cause more environmental Damage than can be caused by discharges from combined sewer overflows.

Sewage sludge utilisation and disposal

The treatment of waste water has the objective of returning much cleaner waste water to the environment. A consequence of sewage treatment is that significant quantities of sewage sludge are generated. Sewage sludge is the residual organic matter and dead bacteria used in the treatment process or bio-solids removed from the waste water being treated. In the past around a quarter of sewage sludge was either discharged to surface waters through pipes or disposed from ships at sea. Use of sewage sludge as a soil enhancer and fertiliser on agricultural land remains the environmentally favoured option, with around 80% being applied to agricultural land. The reutilisation of sewage sludge to land is regulated under the Sludge (Use in Agriculture) Regulations 1989 (as amended). A voluntary agreement known as the 'Safe Sludge Matrix' ensures that sludge is only recycled to certain crops and vegetation to avoid human health impacts from ingestion of pathogen-contaminated salad crops. Increasingly the sewage sludge generated from treatment processes has undergone anaerobic digestion with around 75% of sewage sludge currently processed this way. Anaerobic digestion reduces the residual sewage solids that needs to be disposed of and generates the by-product of biogas, a renewable energy source. For smaller sewage sludge processing facilities the biogas collected is typically used to heat the digesters to improve the digestion process. At larger facilities, economies of scale mean biogas can be conveyed off-site for use in Combined Heat and Power plants to generate electricity for general use by export to the national grid. Technological developments also mean biomethane (processed biogas) can be injected into the national gas grid or used as a fuel for vehicles. Even when incinerated, sewage sludge can be used as fuel to generate energy.

Levels of wastewater treatment

There are three broad levels of treatment: primary, secondary and tertiary. Sometimes, preliminary treatment precedes primary treatment.

Preliminary treatment: Removes coarse suspended and grits. These can be removed by screening, and grit chambers respectively. This enhances the operation and maintenance of subsequent treatment units. Flow measurement devices, often standing-wave flumes, are necessary at this treatment stage [9].

Primary treatment: Removes settle-able organic and inorganic solids by sedimentation and floating materials (scum) by skimming. Up to 50% of BOD5, 70% of suspended solids and 65% of grease and oil can be removed at this stage. Some organic nitrogen, organic phosphorus, and heavy metals are also removed. Colloidal and dissolved constituents are however not removed at this stage. The effluent from primary sedimentation units is referred to as primary effluent [9].

Secondary treatment: The further treatment of primary effluent to remove residual organics and suspended solids. Also biodegradable dissolved and colloidal organic matter is removed using aerobic biological treatment processes. The removal of organic matter is when nitrogen compounds and phosphorus compounds and pathogenic microorganisms are removed. The treatment can be done mechanically like in trickling filters, activated sludge methods rotating biological contactors (RBC) or non-mechanically like in anaerobic treatment, oxidation ditches, stabilization ponds etc.

Tertiary treatment: Or advance treatment is employed when specific wastewater constituents which cannot be removed by secondary treatment must be removed. Advance treatment removes significant amounts of nitrogen, phosphorus, heavy metals, biodegradable organics, bacteria and viruses. Two methods can be used effectively to filter secondary effluent— traditional sand (or similar media) filter and the newer membrane materials. Some filters have been improved, and both filters and membranes also remove helminthes. The latest method is disk filtration which utilizes large disks of cloth media attached to rotating drums for filtration (Food and Agriculture Organization, 2006). At this stage, disinfection by the injection of Chlorine, Ozone and Ultra Violet (UV) irradiation can be done to make water meet current international standards for agricultural and urban re-use.

Methodology

In this chapter method involved in carrying out this research, therefore assessment of wastewater quality based on standards provided by different water bodied agency using Afe Babalola University Ado Ekiti as a case study.

Sampling

The purpose of sampling is to take samples in the study area and taken to the laboratory for further testing. Many factors have been taken into consideration to obtain accurate readings. Among all the factors taken into consideration time and duration of samples, the weather, equipment used as well as methods used and the materials to be found in the laboratory.

Preservation

Preservation of samples was carried out to protect and ensure the samples to be tested in the laboratory has a quality of originality in any case very similar to the site for a period of time specified by standard

Laboratory test

Series of test was conducted in the laboratory following due and necessary procedures and necessary precautions to avoid hazards these tests are turbidity, hardness, DO, PH, BOD, and TDS.

Dissolve Oxygen (DO): The DO meter was turned on, and allowed for 15-20 minutes for it to warm to prevent errors thereafter the instrument was properly calibrated using the instruction manual of the meter and then dispensed my sample in 300-mL bottle, and inserted the laboratory electrode in 300-ml bottle as well as ensuring that It did not enclose air against the membrane, and then Turned the meter button to temperature mode, as well as noting down the readings of the temperature and detailed my values, afterward the DO meter button was switched on to Dissolve Oxygen mode, and allowed the meter reading to stabilize before taking any values in mg/L from the meter, and recorded the results (Figure 3).

Temporary and permanent hardness: Measure 20ml of water sample of each and then add 1ml of buffer solution to the water sample after which add 3 drops of erichrome black T. using the pipette and pipet the tetra accetic acid into the burette and take down the readings of the initial volume from the burette. Furthermore titrate the already mixed water sample using the acid. When d mixture turns blue, take note of the volume of the acid. and take another measurement of 20ml of each sample and boil it using the water heating mantle then allow it to cool to room temperature and add I ml of buffer solution and 3 drops of erichrome black T. and titrate with acetic acid and taking note of the volume of EDTA when the mixture turned blue (Figure 4).

Calcium hardness: Measure 20ml of each of my samples and added a drop of normal hydrochloric acid (HCL) to the each of the sample to have decomposed bicarbonate. Thereafter heat each of the water samples to expel CO_2 and allow it to cool. Add 2ml of normal sodium hydroxide (NaOH) to produce a pH between 11 and 13. Likewise added ammonium purpurate indicator to the cooled sample which will make it turn pink. Titrate the sample using standard EDTA solution, and ensured that I take initial and final titration value when you notice a change in colour (purple) (Figure 5).

Alkalinity: Prepare 20 ml of each of the samples into the conical flask and add 2 drops of methyl orange indicator and stir thoroughly. Then pour the acid into the burette while taking note of the initial value on the burette and titrate till you get the end point and then take the final reading.

Total suspended solid: Take a filter paper as well as the mass and record it and then place it on a measuring cylinder and rinse properly with distil water and dry, ensure that the damped filter paper with little amount of distil water to sealed the filter paper to the measuring cylinder, then fill the burette with the sample and make sure that there is no leakage from the burette tap. and open the tap gradually to pass through the filter paper till the burette becomes empty and also ensure that there is no liquid in the filter paper and thereafter support the filter paper with a pan to dry it in an oven for 1 hour at 103˚C and then put the samples in a desiccator to cool to cool to room temperature and reweigh the filter paper and take the reading (Figure 6).

This experiment is carried out using the electronic method, prior to use, remove the electrodes from storage solutions (silicon) and rinse properly with the distilled water. Then allow the electrode to dry. And standardise the instrument by immersing the electrode in the buffer solutions provided, thereafter remove the electrode from the buffer solution, and rinse thoroughly with distilled water and allow drying. Then insert the electrode in the samples and stir the beaker gently to create equilibrium between electrodes and sample to ensure homogeneity and take the values from the meter. And also ensured that the electrode rinsed with distilled water each time it is used for measuring different samples (Figures 7 and 8).

Turbidity: This experiment is carried out using the Hach 2100Q turbidity meter. Prior to use calibrate the instrument by using the standards provided by the manufacturer. start by ensuring that the battery is fully charged then continue with the 3 standards 20 NTU, 100 NTU and 800 NTU by agitating them gently that is turing it upside down 3 times to avoid bubbles as it would affect the calibration. Insert the standards following due procedures from the instruction manual provided by the manufacturer. Then fill the empty bottles with the samples and insert the sample into the chamber and press the read key which will take about 10 sec to give the values. Repeat this procedure after calibration for the remaining samples (Figures 9 and 10).

Biochemical Oxygen Demand: Fill four clean bottles before pouring the

Figure 3. Plate: Taking DO reading.

(a) (b)

Figure 4. (a) Plate: Heating the sample and (b) Plate: Titrating.

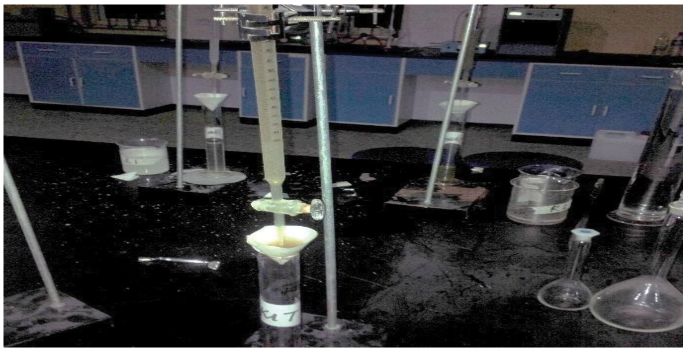

Figure 5. Samples during experiment.

Figure 6. Samples after drying in the desiccator.

Figure 7. Inserting the probe in the samples.

samples and test for dissolved oxygen (DO) thereafter ensured that the sample is closed and then Incubate for 5 days at 20°C and after five complete days take another Test for DO and record the values to get the BOD subtract the 1st day DO from the 5th day DO.

Chemical Oxygen Demand: This method is carried out using the experimental method where the lovi bond MD100 machine is used start by ensuring that the battery has enough current and well covered and well screwed and then calibrate the machine following the instruction manual then

Figure 8. The turbidity and the highly turbid sample.

Figure 9. Ensuring that there was no bubble and inserting the sample in the COD bottle.

Figure 10. Taking readings from the Photometer and samples before the readings are taken.

take the sulphuric acid container and fill it with 2 ml of the sample and shake then heat the sample for two hours at 148˚C then allowed it to cool to room temperature and used the lovi bond MD 100 to take the value.

Ammonia (NH_3): This experiment is carried out using the spectrometer. start by adding 2 ml of Nessler reagent and mix it well then wait patiently for 10 minutes for the colour to change then prepare a blank sample using the distil water to calibrate the spectrometer. Thereafter read the transmission at 410 mm. obtained the final result from the graph using the values got from the spectrometer.

Results and Discussion

This chapter analysis and interprets the data were done and the water sample was tested in the laboratory. Based on the methodology of the study described from the previous chapter, findings from the laboratory testing were plotted into graphical form in order to interpret the data and show differences between them and the recommended standards, these samples are effluent from the sewage treatment plant, bakery, kitchen (cafeteria 1) and laundry (Table 1).

Dissolve Oxygen (DO)

With the tables and the graph representation that clearly shows the amount of calcium carbonate present in these samples. This means that the sample gotten from the bakery has the highest calcium carbonate of 468 which means that the sample is very hard. The kitchen sample also has a calcium carbonate of 350 which is also very hard. The laundry sample is also moderately soft with a calcium carbonate of 80 and the effluent has the least amount of calcium carbonate of 75 which is classified as soft (Figure 11).

From this graphical representation above it can be clearly seen that the bakery sample is hardest that is has the highest calcium present followed by the kitchen and effluent sample, the laundry sample is the softest of the four sample which means it has less calcium present in it (Figures 12 and 13).

Table 1. Elevation, longitude and latitude of the study area.

Sampling Station	Longitude and Latitude
Bakery	7°36'19" N 5°18'33"E
Effluent	7°36'17" N 5°18'34"E
Kitchen	7°36'17" N 5° 18'33"E
Laundry	7°36'20" N 5°18'33"E

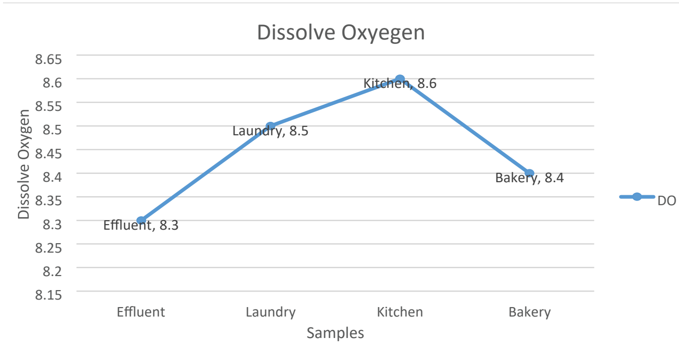

Figure 11. Dissolve oxygen graph.

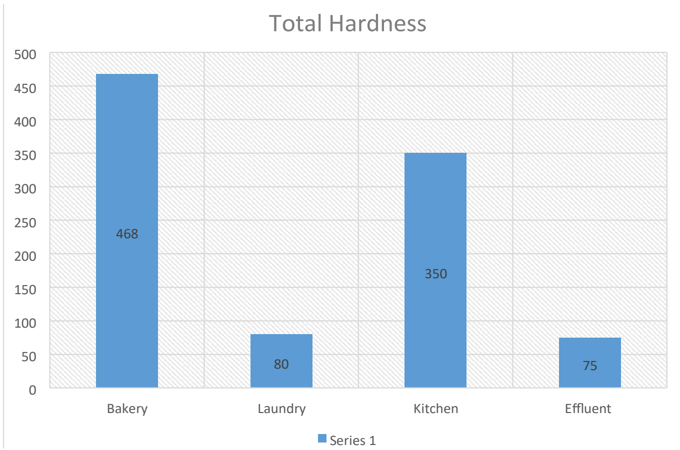

Figure 12. A graph displaying total hardness result.

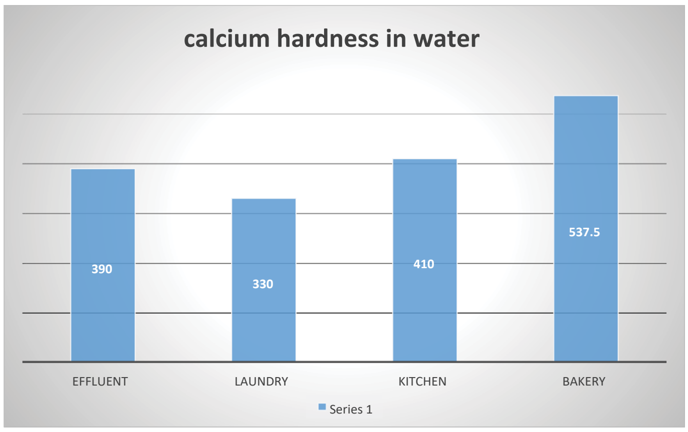

Figure 13. A chart showing calcium harness representation.

From the graph above it can be concluded that the kitchen sample is most acidic with a pH of 4.43, the bakery sample is also acidic but less acidic than the kitchen sample with a pH of 6.15, and the effluent is also acidic. The laundry sample is the only alkaline sample (Figure 14).

From the above graphical representation is can be seen that the kitchen sample is the highest followed by the laundry sample and then effluent and bakery samples and we know that the higher the alkalinity level, the greater the capacity of the water to neutralize acids; equally, the lower the alkalinity level, the less the neutralizing capacity of water to neutralize acid (Figure 15).

From the experiment carried out it was noted that the bakery sample was over ranged this occurs when turbidity is very high and a significant amount of light is blocked or absorbed by the particle and only a small amount of light reaches the detector. This also means the sample is highly turbid and comprise of a lot of dissolve solid, the laundry sample also has a high amount of suspended solid in it but not as thick as the bakery sample, followed by the kitchen and the effluent which means that the effluent has the lowest amount of undissolved solid or suspended solid (Figure 16).

From the graphical comparison shown above, it simply gives the entire detail of which of the sample has the highest and lowest BOD level. It is noted that the kitchen sample is within the highest BOD level exceeding the standard with 0.68mg/l and then we can see that the effluent sample is 9.88 which is ok. The bakery and laundry exceed the standard value with 0.02 and 0.09 respectively (Figure 17).

From the chart it clearly displayed that the bakery sample has the highest percentage of suspended solids and the effluent sample has the lowest percentage of dissolved solids. Laundry and kitchen has the percentage of 25% and 18% respectively (Figure 18).

From the above representation it can be seen that the bakery sample has the highest total dissolve solid sample followed by the kitchen, effluent and laundry samples respectively (Figure 19).

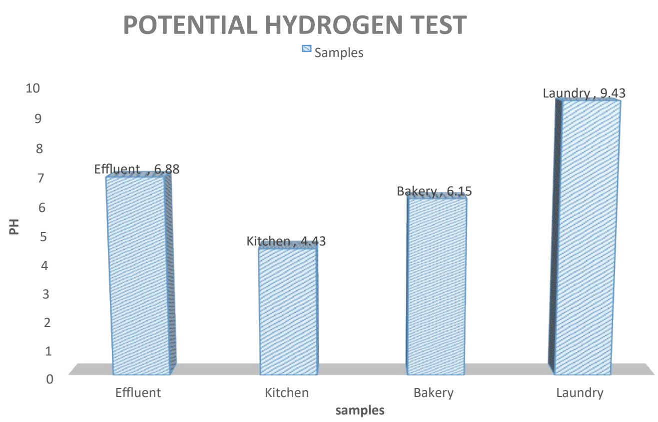

Figure 14. A chart showing pH representation.

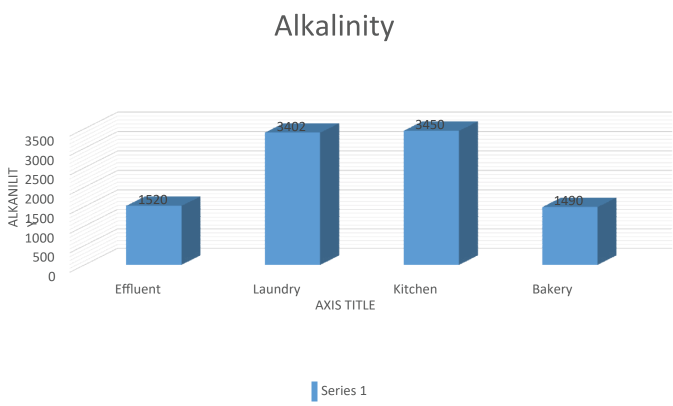

Figure 15. A chart showing alkalinity representation.

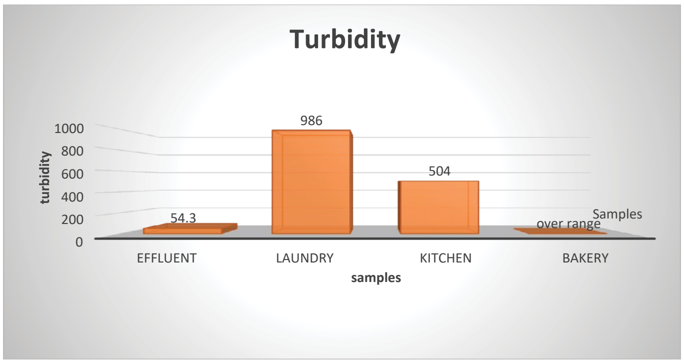

Figure 16. A chart turbidity representation.

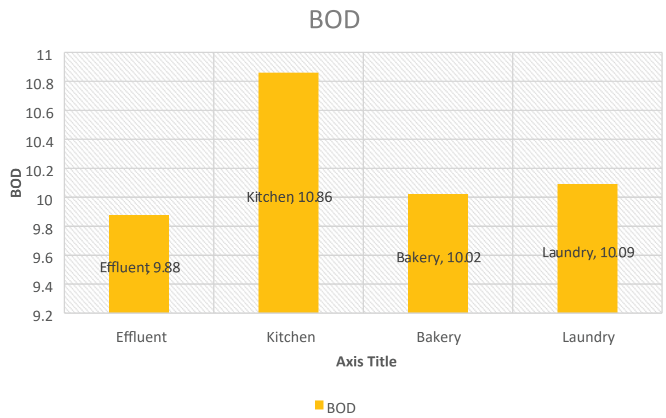

Figure 17. A chart showing BOD representation.

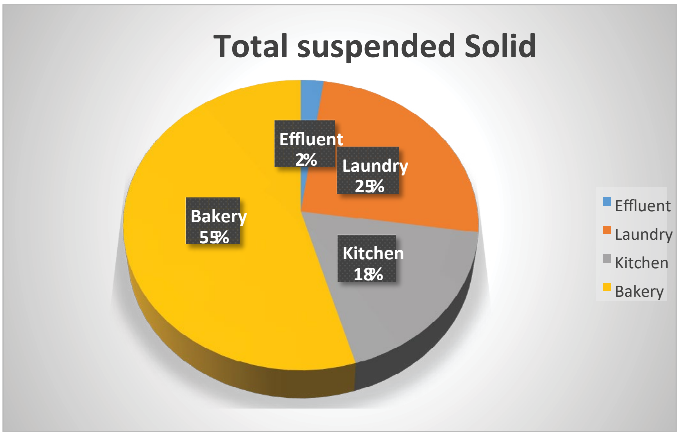

Figure 18. A chart showing TSS representation.

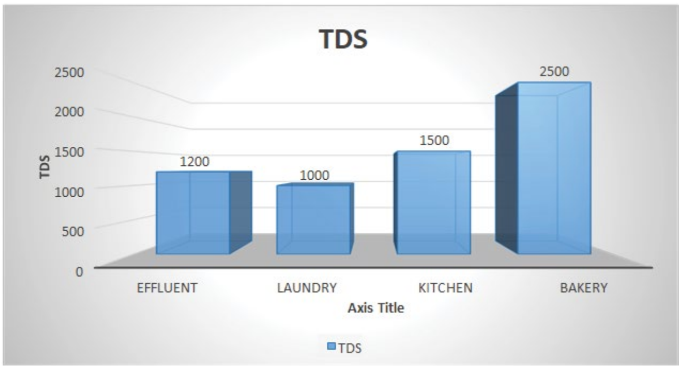

Figure 19. A chart showing TDS representation.

It can be seen that the kitchen sample has the highest ammonia concentration which has exceeded that standard but the bakery, kitchen, and laundry sample are still with the range (Figure 20).

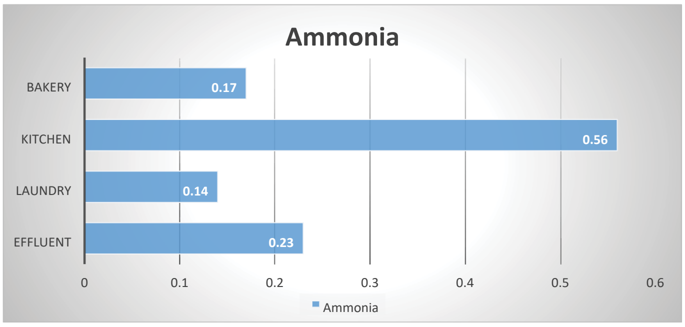

Figure 20. A chart showing ammonia representation.

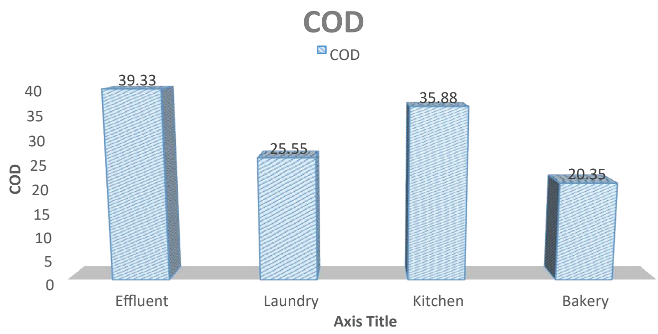

Figure 21. COD representation.

From the laboratory experiment carried out and with the result represented above it can be said that all the sample are ok because they fall within the standard range for effluent (Figure 21).

Conclusion

Based on the field study, investigations and physical assessment conducted during the research, the following conclusions have been drawn.

1. From the laboratory experiments carried out, it can be concluded that:

For the Bakery: The appearance, turbidity, total hardness, odour, TDS and BOD are unsatisfactory.

Laundry: The appearance, turbidity, total harness, pH, odour and BOD, are unsatisfactory.

Kitchen: The appearance, turbidity, total harness, pH, odour, ammonia and BOD are unsatisfactory.

Effluent: The appearance and turbidity odour are unsatisfactory.

2. There is no proper system of sludge and solid extracted from the preliminary stage disposal. This makes the whole sites unsanitary, unsightly and environmentally unsustainable

3. Not all the buildings in ABUAD are connected to the ABUAD central sewage plant. Therefore, a better transportation and collection system should be put in place.

4. The central sewage treatment plant should be sited far away from lectures' and residential rooms to avoid pollution.

5. Majority of the workers should be provided with safety equipment and proper sanitizing materials and with proper training as regards hygienic handling and protection of their body.

Recommendation

In view of the above-mentioned, it is essential to offer the following recommendations so as to improve the best possible ways of managing wastewater in ABUAD

1. A better and an efficient wastewater treatment plant that would be suitable for the community.
2. Provide enough safety materials for workers for health and to encourage them
3. Provide some better means of disposing the grit or recycling the grit to avoid nuisance to the environment.
4. Provide a central sewage plant away from residential or working environment.
5. Provide a better transportation means of wastewater from source to the treatment plant

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