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Treatment of Surface Water Runoff in Igala-Mela, Kogi State Nigeria Using Local Materials

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Abstract

Purpose: Water is life and majority of the sicknesses in the world today is either contracted through water or air. There is need to reduce the spread of these diseases that spread by lack of drinkable water available to people. Some areas in Nigeria experiences scarcity of water fit for domestic use, such areas as Igala-Mella area of Kogi State and extended to environs in Nnsuka Enugu State faces this challenge of access to safe water. Most people in the study area obtain drinking water from storm water which is polluted by dust and animal droppings. In view of this, this study is geared to harvesting the storm water, fabricate mini pilot plant, and use locally available material and extract of neem tree which serves as antibacterial to kill the bacterial present in the water.

Methodology: The pilot plant was fabricated to allow the flow of water under gravity. It has the storage, aeration, chemical inject, stirrer formulated and the filter bed. All the material used were sourced locally. The raw water was fed into the storage, opened to allow to flow through the stages as arranged in the mini pilot plant with the neem extract added. At the end, the treated water was collected. The raw water was tested before treatment to determine the level of contamination. After treatment, the pure water was subjected to quality test.

Findings: The result shows that there is an improvement in the water quality characteristics as there is reduction in the color, taste, PH, other chemicals such as; Zn, Fe, Nitrate, Nitrite, Potassium, Nitrogen, Phosphate, Cadmium, Lead were reduced after test. Bacteriological test such as oxygen demand, biochemical oxygen demand, shegella, salmonella sp shows reduction in the treated water.

Unique Contribution to Theory, Policy and Practice: This shows that with mini pilot plant and the extract can be used to treat raw water at household level using this mini plant and the neem tree extract.

Key words: *Treatment of Surface Water Runoff, Water Quality Characteristic, and Reduction in the Colour, Taste, PH/ Other Chemicals.*

I. Introduction

Water is an indispensable natural resource essential for the existence of man and the ecological system. Water is a clear, colourless, odourless and tasteless and inert liquid substance essential for most plant and animal life and a mostly used solvent. Adequate portable water supply is a major challenge for most developing countries especially the Sub- Saharan African countries. Adequate potable water supply remains a major challenge for most developing countries, despite its importance in primary health care [4]. With increasing population, the demand for quality water has become even more critical [15]. The United Nations Centre for Human Settlements noted that populations in peri-urban areas in developing countries are growing twice as fast as in the formal cities [50]. Such increases have threatened water quality due to domestic and industrial wastewater discharges and by certain agricultural activities.

The problem is particularly acute in the densely populated peri-urban areas and rural areas where the large majority of the dwellers are typically low-income people. It is estimated worldwide that over half a billion urban people and over 2 billion rural people lack sanitation services [4]. Despite efforts by most developing countries in the last two decades, investment in the sanitation sector has remained inadequate while the needs have continued to grow especially with regard to surface runoff water treatment [4].

Surface runoff is the flow of water occurring on the ground surface when excess rainwater, storm water, melt water, or other sources, can no longer sufficiently rapidly infiltrate in the soil. This can occur when the soil is saturated by water to its full capacity, and that the rain arrives more quickly than the soil can absorb it. Surface runoff often occurs because impervious areas (such as roofs and pavement) do not allow water to soak into the ground. Furthermore, runoff can occur either through the natural or man-made processes [16]. Surface runoff is a major component of the water cycle. It is the primary agent of soil erosion by water [10]. Surface runoff water effluents are responsible for the degradation of several ecosystems [54]. Impacts may arise from an increase in nutrient loads leading to eutrophication, decreased levels of dissolved oxygen and releases of toxic substances, many of which can bio accumulate and bio magnify in aquatic wildlife [31]. Physical changes to the environment can also occur, including thermal enhancement, increased water flow, leading to potential flooding and erosion, increase in suspended solids, and the release of floating debris to the country's waters [13]. The problem is pronounced in areas where surface runoff water treatment systems are simple and not efficient [35].

Runoff that occurs on the ground surface before reaching a channel can be a nonpoint source of pollution, as it can carry man-made contaminants or natural forms of pollution (such as rotting leaves). Man-made contaminants in runoff include petroleum, pesticides, fertilizers and others. In addition to causing water erosion and pollution, surface runoff in urban areas is a primary cause of urban flooding, which can result in property damage, damp and mold in basements, and street flooding.

While the impact of untreated surface runoff water on local rivers and streams is clear, proper waste water treatment is also fundamental to maintaining people's health, protecting the quality of drinking water and ultimately promoting economic development. Surface runoff water running directly into the aquatic environment have both an acute and chronic impact on the environment which may be very severe and can diminish biodiversity and greatly reduce populations of sensitive species. Toxic metals and organics, where present, can lead to chronic toxin accumulation in both local and downstream populations [46]. Quality assessment of water and wastewater is, therefore, crucial to safeguarding public health and the environment [40]. According to the World Bank, the greatest challenge in the water and sanitation sector over the next two decades will be the implementation of low-cost treatment that will at the same time permit selective reuse of treated effluents for agricultural and industrial purposes [41]. It is crucial that sanitation systems have high levels of hygienic standards to prevent the spread of disease. Other treatment goals include the recovery of nutrient and water resources for reuse in agricultural production and to reduce the overall user-demand for water resources [18].

Problems concerning water and sanitation in Nigeria stem from the rise in urban migration and the practice of discharging untreated waste water. The uncontrolled growth in urban areas has made planning and expansion of water and sewage systems very difficult and expensive to carry out. In addition, many people moving to the city has low incomes, making it difficult to pay for any water system upgrades as reported by Looker, [49]. Effluents may contain organic and inorganic toxic pollutants which might flow laterally or percolate through permeable soil strata and pollute surface or ground water. The effect of such uncontrolled effluent disposal system renders surface waters and the underground water systems unsafe for human, agricultural and recreational use; destroys biotic life, poisons the natural ecosystems, poses a threat to human life and is therefore against the principles of sustainable development [12].

The objective of surface runoff water treatment process is to remove pollutants from waste water to improve the waste water quality to a point where it may be reused or disposed of without detrimental environmental impacts. The process of removing the contamination involves physical, chemical and biological processes and produces residues which must be managed by design a waste water treatment station [30]. Filtration is the purification process, whereby the water to be treated is passed through porous media. During this passage water quality improves by partial removal of suspended and colloidal matter by reduction in the number of bacteria and other organisms and by changes in its chemical constituents [7]. To help prevent the harmful effect of surface runoff on the environment and human health, Acute portable water shortage in densely populated urban, semi-urban and rural areas calls for concern in finding an acceptable science proven technique to purify available water to a portable water free for consumption and domestic use. Scarcity of portable water in Kogi State Nigeria especially in Igalamela/Odolu Local Government Area and the Axis call for concern in that out 21 Local Government Areas in Kogi State, Igalamela-Odolu and the environs in Nnsuka Enugu State there is little to none availability of streams in these area The thought of harvesting rain water which is contaminated in the air and during flowing or run off in the raining season in this area is employed to serve as the source raw water supply for treatment to portable and palatable water. Storm water runoff is precipitation (rain or dew) that flows across the land. It infiltrates into soil, discharge directly into streams, water bodies or drain inlets, or evaporates back into the atmosphere. In the natural environment, most precipitation is absorbed by trees and plants or permeates into the ground, which results in stable stream flows and good water quality. Rain that falls on a roof, driveway, patio or lawn runs off the surface more rapidly pollution. The storm water running over roofs and vegetation, pick pollution such as oil, fertilizers, pesticides, dirt/sediment, trash and animal waste. These pollutants when treated properly provides portable water for drinking and domestic use. This storm water runoff can be harvested, treated using Charcoal, Sand and Luffa spongeto solve the water need in Igalamela-Odolu and other adjoining areas in order to meet standard for reused

1.2 Statements of research problem

Urbanization increases surface runoff by creating more impervious surfaces such as pavement and buildings that do not allow percolation of the water down through the soil to the aquifer [17]. It is instead forced directly into streams or storm water runoff drains, where erosion and siltation can be major problems, even when flooding is not. Increased runoff reduces groundwater recharge, thus lowering the water table and making droughts worse, especially for agricultural farmers and others who depend on the water wells.

I.3 Aims and objectives of study

The main aim is to carry out an investigation on the need to purify the contaminated surface runoff water with available local materials, fabricate a mini pilot plant that can handle the treatment of contaminated surface runoff.

The following objectives will be achieved:

i. To determine contaminants, present in the raw storm water in Igala-mela.
ii. To treat and remove the harmful contaminants present in the raw water;
iii. To fabricate a mini pilot plant suitable for home waste water purification.
iv. To determine the suitability and portability of treated water for drinking and house reuse.

1.4 Significance of the study

The supply of freshwater is limited and threatened by indiscriminate discharge of untreated waste water effluents. In developed countries, municipal waste water systems are well organized and cover most parts of the regions but this is not the case in developing countries like Nigeria. Water is a scarce commodity and there is the need to protect the available water resources from discharges of untreated waste water.

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Various forms of waste water treatment exist in Nigeria; however, this study provides valuable information on traditional ways on treating waste water in Igala-mela area of Kogi State, Nigeria as a means of ensuring a cost-effective treatment system that meets standard requirements before discharge into surface waters.

Furthermore, the study was planned to generate information that could be used by waste water treatment plant managers and the Environmental Protection Agency of Nigeria in order to develop or review an effective policy for waste water treatment plants in meeting standard requirements for discharge of effluents into water sources.

1.5 Scope of the Study

The study is to focus on the collection of storm water or surface runoff in Igala-mela, determine the impurities, contaminants present, treat the contaminants and characterize the treated water. The scope will cover the use of traditional techniques (Charcoal, Sand and Luffah sponge) in treating surface runoff water and also evaluate the efficiency of the techniques and fabrication and of a pilot plant.

2.0 The Study Area

This study area is Igala-mela Odolu Local Government Area of Kogi state (Figure 1.1) the area is a Local Government Area is bordered by the Niger River in the West and Enugu State in the east. Its headquarters are located in the town of Ajaka in the north of the area at 70 10'16"N and 60 49'35"E. The north eastern line of equal latitude and longitude passes through the Local Government Area. It is endowed with numerous forest reserves and community forests. It has a landmass of 2,175 km2 and a population of 148,020 at the 2006 Nigeria Population Census10. The people depend mostly on the natural environment for their livelihood; they are involved in subsistence Agriculture. The climate of Igala-mela Odolu Local Government Area is divided into the tropical wet and dry climate. Government Area is divided into the tropical wet and dry climate. The rainy season lasts from April to October while the dry season lasts from November to March.

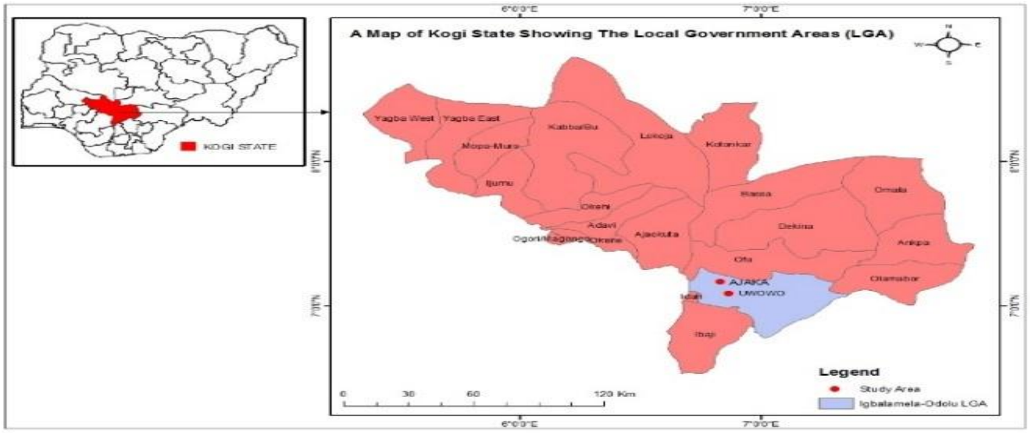

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Figure 1.1: Study Area map

3. Methodology

The materials to be used for this research work were local sponge, activated charcoal alum, spectrophotometer, colorimeter, digital PH meter, turbid meter, and fabricated mini water treatment plant and storm waste water sample. The waste storm water was collected by grabbing method at three different locations at Ajaka area of Igala-mela local government area of Kogi state, Nigeria. The physical test carried on the waste storm water includes temperature, PH, turbidity and colour. The chemical test carried on the waste storm water and the following parameters was checked Nitrate, Nitrite, Phosphate, Sodium, Potassium, Magnesium, Manganese, Iron, Zinc, Calcium, Lead, Cadmium, Nickel and Copper while the biological and the bacteriological tests includes dissolved oxygen, biochemical oxygen demand, e-coli, salmonella sp. pseudomonas sp. Shigella sp.

Procedure of Waste water treatment:

Screening is the first unit operation used at wastewater treatment plants (WWTPs). Screening removes objects such as rags, paper, plastics, and metals to prevent damage and clogging of downstream equipment, piping, and appurtenances. Some modern wastewater treatment plants use both coarse screens and fine screens.

Waste water Screening is the first unit operation in all wastewater treatment plants. Screen is the device used to retain solids found in the influent wastewater to the treatment plant. The main purpose of **screening** is to remove solid materials that could:

- Cause damage to other process equipment.
- Cause reduction in efficiency of the whole system
- Contaminate waterways

The materials that are removed using screens are called screening.

Aeration provides oxygen to bacteria for treating and stabilizing the waste water. Oxygen is needed by the bacteria to allow biodegradation to occur. The supplied oxygen is utilized by bacteria in the waste water to break down the organic matter containing carbon to form carbon dioxide and water.

The purpose of aeration is to bring water and air in close contact in order to remove dissolved gases (such as carbon dioxide) and oxidizes dissolved metals such as iron, hydrogen sulfide, and volatile organic chemicals (VOCs). Aeration is often the first major process at the treatment plant.

Aeration treatment consists of passing large amounts of air through water and then venting the air outside. The air causes the dissolved gases or volatile compounds to release from the water. The air and the contaminants released from the water are vented.

The two major ways of water aeration are surface aeration and subsurface aeration. The first kind involves placing the oxygen into the water through the surface. Usual executions of this method include using fountains and other aesthetically pleasing features to splash oxygenated water.

Mixing Wastewater is a mixture of solids, liquids, and sometimes gases. The wastewater goes through three treatment processes in order to separate substances out of the mixture in order obtain water in the purest form possible. This way it can be returned back to the watershed or even used as drinking water.

Mixing process makes it easier to trap harmful substances by increasing a contact area between a flocculants and an undesirable substance. Mechanical agitators within a few minutes perfectly mix sewage with the flocculants so that it is able to combine with a greater number of dirt particles.

Below we discuss the primary chemicals used in wastewater treatment, and their common applications.
Membrane Cleaners and Antiscalants

- Neem Tree back soaked in Alcohol. (The re-agent used in this study)
- Chlorine Dioxide.
- Muriatic Acid.
- Soda Ash.
- Algicide.
- Chlorine.
- Sodium Bicarbonate.

Flocculation is the separation of a solution, commonly the removal of sediment from a fluid. The term is derived from floc, which means flakes of material; and when a solution has been flocculated, the sediment has formed into larger aggregated flakes, making them easier to see and remove.

Sedimentation is the process of allowing particles in suspension in **water** to settle out of the suspension under the effect of gravity. The particles that settle out from the suspension become sediment, and in water treatment is known as sludge. The process used in both primary and secondary wastewater treatment, that takes place when gravity pulls particles to the bottom of a tank (also called settling).

Chlorination is the most commonly used disinfection process for wastewater treatment. Elemental chlorine is either liquid or gaseous in form. Chlorine gas can be compressed to a point where it liquefies. Waste water chlorination is widely practiced to reduce microbial contamination and potential disease risks to exposed populations.

Clarification is an essential step in a water or wastewater treatment process to remove suspended solids through gravity settling, providing a clarified liquid effluent. A secondary function of a clarifier is the removal of floating matter (scum), which has accumulated on the water surface.

Clarification consists in removing all kind of particles, sediments, oil, natural organic matter and colour from the water to make it clear. A clarification step is the first part of conventional treatment for waste and surface water treatment. It usually consists in: - Screening.

Big size Pebble stone; Pebble refers to the natural oval-shaped particles with a diameter of 60 ~ 200mm, which are formed by long-term transportation of weathered rocks by water flow.

Activated charcoal can add important minerals, such as calcium, magnesium and iron back into your water to improve the water quality. Charcoal filters not only absorb these nasty tasting chemicals, but they are also highly effective at removing odors as well, making your drinking water much more palatable

Sand filtration is used for the removal of suspended matter, as well as floating and sinkable particles. The wastewater flows vertically through a fine bed of sand and/or gravel. Particles are removed by way of absorption or physical encapsulation. If there is excessive pressure loss on the filter, it must be rinsed.

Slow sand filtration has been an effective water treatment process for preventing the spread of gastrointestinal diseases for over 150 years, having been used first in Great Britain and later in other European countries. SFFs are still used in London and were relatively common in Western Europe until recently and are still common elsewhere in the world. The move away from slow sand filtration in industrialized countries has largely been a function of rising land prices and labour costs, which increased the cost of SSF produced water. Where this is not the case, SSFs still represent a cost-effective method for water treatment (WHO n.y.). Since these conditions prevail in many developing countries, it is a very promising technique for water purification and, therefore, the development of a sustainable water system. Filtration; this process removes or reduces any contaminants that the downstream systems could not handle effectively. This increases the overall efficiency of the water treatment process and reduces overall operating & maintenance costs.

Diagram of the proposed Pilot plant (Figure 3.0).

Water quality measured before treatment includes; Chemical, physical and biological properties and can be tested or monitored based on the desired water parameters of concern

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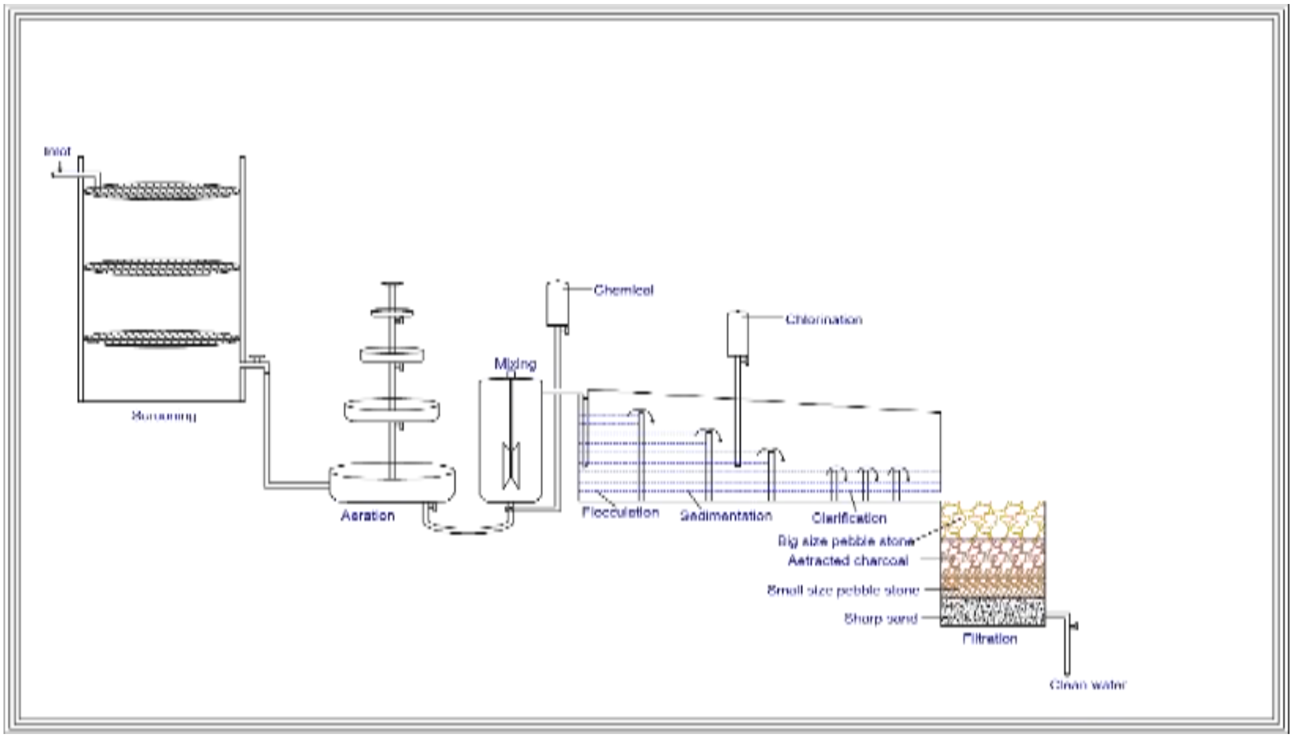

Figure 3.1: Schematic Diagram of fabricated mini water treatment pilot plant

Plate 3.2 Extract of neem tree (Antibacterial

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Plate 3.3. Assembling the pilot plant.

Plate 3.5. Picture showing samples of treated water

4. Results and Discussion

The result before treatment of waste storm water is as in table 4.1.1.and the mini pilot plant fabricated was employed and used to treat the waste storm water the result of the treated water is shown in table 4.1.2. The combination table showing pre-treatment, post treatment and comparing with the world health organisation (WHO) is shown in table 4.1.3.

Table 4.1.1 PRE - TREATMENT ANALYSIS

S/NO	PARAMETER	SAMPLE A	SAMPLE B	SAMPLE C	Average	WHO STANDARD
1	Temperature	29	31	31	30.333	-
2	Colour	Reddish-yellow	Reddish-yellow	Reddish-yellow	Reddish-yellow	Colourless
3	Turbidity	92NTU	93NTU	94NTU	93NTU	15
4	PH	7.51	7.44	7..57	7.506	6.5 – 8.5

5	Odour	Ferrous smell	Ferrous smell	ferrous smell	ferrous smell	Odourless
6	Nitrite	0.00	0.020	0.00	0.006	10mg/l
7	Nitrate	1.50	1.30	1.3	1.366	10
8	Phosphate	5.00	4.00	5.6	4.866	0.1mg/l
9	Sodium	2.4148	2.2770	2.3212	2.337	-
10	Potassium	9.2932	7.1853	7.4520	7.976	3, 400 milligrams
11	Magnesium	0.9288	0.4577	0.6213	0.669	NA
12	Iron	9.9377	7.3246	7.8731	8.378	0.3
13	Zinc	0.0406	0.0767	0.0542	0.057	5.0
14	Copper	-0.5808	0.4561	0.3232	0.066	NA
15	Manganese	0.8068	0.5417	0.4431	0.597	400mg/l
16	Lead	-0.7866	-4.6294	-5.4410	- 3.619	0.01
17	Calcium	0.6355	0.4952	0.4214	0.517	75
18	Cadmium	-0.6797	-0.4181	-0.4221	-0.506	-
19	Nickel	0.0727	0.074	0.0724	0.073	-
20	DO	4.80	8.00	5.3	6.033	-
21	BOD	3.80	4.80	4.2	4.267	100ppm
22	E-coli	25CFU	31CFU	22	26CFU	0
23	Salmonella sp.	10CFU	-	13	7.667CFU	0
24	Pseudomonas sp.	-	102CFU	-	34CFU	0

25	Shigella sp.	-	-	-	0	0

CFU = Colony Forming Unit = Negative

The results of the test are based on tests carried out on waste storm water gotten from three selected locations sample A was gotten from Opposite Community Secondary School Ajaka beside Qua-Ibo Church, sample B was gotten from Community secondary School compound and sample C was gotten from the drainage of the road between community secondary and Qua-Ibo Church, Ajaka in Igala-mela Odolu Local Government Area of Kogi State. The tests were divided into two, the Physical and bacteriological tests the water samples collected from the study area. The results of pre-treatment test before treating the waste storm water was determined and the post-treatment result after testing the waste water with the pilot plants fabricated was also determined. The two results were compared in order to determine the improvement as a result of using the local materials in the fabricated Pilot plant. The total of twenty-five (25) water contaminants was tested before treatment which gives the result in table 4.1.1.The general overview of the waste storm water shows that the physical, chemical and bacteriological properties of the water fall below the acceptable standard set out by the world health organisation (WHO) for drinking water quality. The colour and the turbidity shows reddish-brown colour and the turbidity of 99NTU this indicates that the water is coloured and have high suspended solid present in it.

The nitrate and nitrite present in the waste water were 0.001g/ml and 1.067g/ml and this shows that there is presence of dissolved solids present in the waste water. Other dissolved elements found in the waste water include phosphorous, sodium, potassium, magnesium, zinc and copper and are in very high concentration of 4.900mg/l,2.338mg/l, 8.06mg/l, 0.222mg/l, 3.232mg/l, 0.057mg/l and 0.261mg/l. Manganese, , lead, calcium, cadmium, Nickel are elements presents in the water occur as trace since the quantities are below WHO standard.

Oxygen demand and biochemical oxygen demand of the storm water are 6.033 and 4.267. This quantity is far above the range acceptable by WHO.

There is a high quantity of biological microorganisms such as e-choli, salmonella sp, pseudomonas sp and shigella present in the storm water which stands at 26CFU, 7.66CFU, 34CFU and 0. All the bacterial present in the water are above the recommended standard set by WHO except for shigella that was not found in the water samples.

The mini pilot plant water treatment was fabricated and installed with the local purification material such as pebble stoned, activated, charcoal, Loffa sponge as filter, an extract from neem tree back used as bacterial disinfectant to kill the bacterial present in the water.

The waste water was treated with the local materials in the pilot plant, the result of the treatment are presented in the Table 4.1.2.

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TABLE 4.1.2 POST ELEMENTARY TEST.

S/NO	PARAMETER	SAMPLE A	SAMPLE B	SAMPLE C	AVERAGE	WHO STANDARD
1	Temperature	31	29	29	29.667	-
2	Colour	Colourless	Colourless	colourless	Colourless	Colourless
3	Turbidity	4.5NTU	4.8NTU	4.5NTU	4.600NTU	15
4	PH	5.51	5.44	5.51	5.487	6.5 – 8.5
5	Odour	Odourless	Odourless	Odourless	Odourless	Odourless
6	Nitrite	0.001	0.003	0.00	0.001	10mg/l
7	Nitrate	0.8	1.10	1.3	1.067	10
8	Phosphate	4.70	4.40	5.6	4.900	0.1mg/l
9	Sodium	2.4148	2.2770	2.3212	2.338	-
10	Potassium	9.2932	7.4520	7.4520	8.068	3, 400 milligrams
11	Magnesium	0.017	0.029	0.6213	0.222	NA
12	Iron	0.99	0.832	7.8731	3.232	0.3
13	Zinc	0.0406	0.0767	0.0542	0.057	5.0
14	Copper	0.37	0.39	0.3232	0.361	NA
15	Manganese	0.35	0.305	0.4431	0.366	400mg/l
16	Lead	0.6355	-4.6294	-5.4410	-3.145	0.01
17	Calcium	0.6355	0.4181	0.4214	0.492	75

18	Cadmium	-0.6797	0.0740	-0.4221	-0.343	-
19	Nickel	0.009	0.012	0.0724	0.031	-
20	DO	7.20	8.30	7.40	7.633	-
21	BOD	3.20	3.30	3.30	3.267	100ppm
22	E-coli	3CFU	5CFU	0.7CFU	2.9CFU	0
23	Salmonella sp.	0.0	-	0.0	0	0
24	Pseudomonas sp.	-	11CFU	-	3.667CFU	0
25	Shigella sp.	-	-	-	0	0

CFU = Colony Forming Unit = Negative.

TABLE 4.1.3 PRE-TREATMENT, POST-TREATMENT AND WHO STANDARD TEST.

S/NO	PARAMETERS	PRE-TREATMENT TEST	POST-TREATMENT TEST	WHO STANDARD
1	Temperature	30.333	29.667	-
2	Colour	Reddish-yellow	Colourless	Colourless
3	Turbidity	93	4.600NTU	15
4	PH	7.506	5.487	6.5 – 8.5
5	Odour	Rotten smell	Odourless	Odourless
6	Nitrite	0.006	0.001	10mg/l
7	Nitrate	1.366	1.067	10

8	Phosphate	4.866	4.900	0.1mg/l
9	Sodium	2.337	2.338	-
10	Potassium	7.976	8.068	3. 400 milligrams
11	Magnesium	0.669	0.222	NA
12	Iron	8.378	3.232	0.3
13	Zinc	0.057	0.057	5.0
14	Copper	0.066	0.361	NA
15	Manganese	0.597	0.366	400mg/l
16	Lead	- 3.619	-3.145	0.01
17	Calcium	0.517	0.492	75
18	Cadmium	-0.506	-0.343	-
19	Nickel	0.073	0.031	-
20	DO	6.033	7.633	-
21	BOD	4.267	3.267	100ppm
22	E-coli	26CFU	2.9CFU	0
23	Salmonella sp.	7.667CFU	0CFU	0
24	Pseudomonas sp.	34	3.667CFU	0
25	Shigella sp.	0	0	0

The pretreatment, post-treatment and WHO Standard for domestic water is presented in table 4.1.3.

Results obtained shows that four of the physical tests conducted meet standards for drinking water quality.

The post treatment shows that turbidity of the treated water is 4.600 NTU showing lowering the turbidity of the storm water from 93NTU to 4.6NTU this shows that the suspended material in the wasted water was removed. The physical color of the water has improved and this value is lower than 15 WHO Standard.

The PH of the treated water was 5.487 lower than 7.506 of the waste water and the value falls within the WHO tolerable value.

The treated water became odourless after treatment which shows an improvement in the quality of the water.

Nitrite presents in the waste water shows pretreatment value of 0.006 and post treatment of 0.001mg/l and this value falls below 10mg/l WHO Standard.

Ten(10) out of the fourteen (14) Chemical parameters meet the standard for drinking water quality while four(4) were reduced number, it can be deduced that the mini pilot plant with local materials and neem tree extract as antibacterial eliminate totally the ten chemical substances present in the storm waste water, however the remaining four were reduced

Nitrates in the waste water have the values of 1.366 before treatment and 1.067mg/l after treatment this result shows that there is reduction in the quantity of nitrates. This value falls within standard of domestic water according to WHO.

The test for phosphate shows 4.866 and 4.900 pre and post treatment values, this value is higher than the WHO recommended value of 0.1mg/l, this shows that the plat and use of the local material used here cannot remove phosphate in the waste water.

The potassium content in the waste water was increased from 7.979mg/l to 8.068mg/l after treatment. This shows that the local material has added more of the element to the water so it is very important that check the material that caused the increase the potassium content. The value of potassium present in the water is higher than WHO Standard for domestic water of 3.400mg/l.

The values of elements iron, zinc, copper manganese shows the values of 8.378mg/l, 0.057mg/l, 0.066mg/l, 0.597mg/l in the wastewater and values of 3.232, 0.057, 0.361 and 0.366mg/l after treatment. The values show reduction in the quantities of the elements present in wastewater before treatment after treatment. The reduction in the values falls within accepted WHO Standards.

The elements such as lead, calcium, cadmium, nickel have -3.619mg/l, 0.517mg/l, -0.506mg/l and 0.073mg/l content in waste water and after treatment, the values obtained were -0.3145mg/l, 0.492mg/l, -0.343mg/l and 0.031mg/l. The values of post treatment fall within the acceptable WHO Standard for domestic water.

Table 4.1.3 shows that the Salmonella sp in the water samples after the treatment meets the standard for drinking water from an initial value of 7.667CFU which is not an acceptable value for drinking. It can be seen that the water treatment process successfully reduced the Salmonella sp to acceptable values. Other micro-biological parameters were reduced from 34CFU to 3.667CFU.

5. Conclusion

The unsuitability of the waste water quality access for drinking purpose in the study area shows that:

i. There is need for a treatment option for the improvement of the available surface water for domestic use especially where no treated water.
ii. The mini pilot water treatment plant fabricated and the use of the local materials such as washed pebble stone, clean river sand activated charcoal local sponge as screen and use of extract from the back of the neem tree as antibacterial is suitable for the treatment and purification of waste storm water to acceptable water quality standard.
iii. Results show that colour, odour and PH of the physical parameters were treated to meet international standards for drinking water quality.
iv. From the result, the pre-treatment and post-treatment values shows that there is reduction in the values of the parameters before and after using the local materials and the pilot plant and with the increase in the concentration of the neem extract will totally eradicate every bacterial present in the waste water thereby making it portable and safe for drinking
v. management.

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