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HOUSEHOLD WASTEWATER TREATMENT FACILITY APPRAISAL - CASE STUDY OF OTA ESTATE, IN OGUN STATE NIGERIA

[1]IGIBAH
[1]Department of Civil Engineering
University of Abuja, F.C.T Abuja, Nigeria

[2]EHIZEMHEN
[2]Department of Civil Engineering
University of Abuja, F.C.T Abuja, Nigeria

[3]SADIQ
[3]Department of Civil Engineering
University of Abuja, F.C.T Abuja, Nigeria

[4]ABUBAKAR
[4]Department of Civil Engineering
University of Abuja, F.C.T Abuja, Nigeria

ABSTRACT
This paper appraise the biological treatment of household wastewater generated at Ota estate in Ogun state, Nigeria. Actuated sludge technique was used as example of the biological treatment method, while wastewater from the estate septic tank, actuated sludge treatment plant cured water from the expulsion was obtained and laboratory investigation were carried out so as to determine the amount of calcium oxygen demand (COD), Biological Oxygen demand (BOD), Total dissolved solid (TDS), Ammonia (NH3), Chlorine, Sulphate, Salinity, PH and temperature of the wastewater besides the treated water. Conversely chromium and lead tally with Federal Ministry of Environment (FME) Standard. Household wastewater treatment plant of five hundred cubic meters per day per capacity (500m3/day/cap) has effectual treatment capability and every parameter treated met FME standard. This study impact is about the actuated sludge wastewater treatment plant that can be economically positioned in regions wherever there is adequate electricity supply electricity besides semi-expert workers.

Keywords: *Household, Treatment Facility, Actuated Sludge, Wastewater.*

INTRODUCTION

Nigeria, one of developing countries releases household plus industrial wastewater into the acceptance waters without appropriate management both in countryside and urban regions (Degrement et al., 2001). Water is odourless, unblemished, colourless as well tasteless liquescent substance necessary for most plant in addition animal natural life besides frequently used solvent (Silva et al., 2012). Water supply source can be contaminated with either household waste water, human plus animal faeces, agricultural

waste and industrial waste (So-ryong et al., 2015). There is currently more highlighting on improving ingestion water quality than on nontoxic as well workable wastewater management and re-utilized for instance key factors responsible for Ogunpa stream flooding in Nigeria has been attributed to waste disposal especially septic tank (Sangodotin et al.,1996). Meanwhile, World Health Organisation has Recommendations for harmless use of greywater, wastewater as well excreta that "As freshwater develops progressively infrequent due to population evolution, urbanization and perhaps, climate revolution, wastewater usage, excreta plus greywater in agricultural science plus aquaculture will upsurge" (Unicef, 2000). Likewise, the millennium improvement United Nations goals Nations target increase of the socio-economic situations of the low revenue nations through stimulation of development in regions with water supply as well hygiene (Grandy et al., 2011). In enactment of these purposes, it is obligatory to develop household wastewater treatment approaches that are specifically appropriate in developing nation (Hammer, 2004). Improved water use in addition to wastewater generation method necessitates more effectual elimination of by-products besides toxins that permit for effluent expulsion within proven environmental boundaries (Wang et al., 2013). Biological management is an essential and vital aspect of every wastewater cure plant which treats wastewater from metropolis, industry containing solvable organic impurities or combination of the double kinds of wastewater sources (Hung et al., 2010). The highlighting ought to be on low-fee, energy shortage as well low repairs but high-performance schemes that contribute to eco-friendly sustainability by generating effluents or finish products that could be without harm and gainfully reutilized (Opera et al., 2011). Apposite technology choice making will require a comprehensive survey of the predominant indigenous situations, while the skill will be applicable besides fitness if they are mounted in regions with suitable soils as well hydraulic capabilities for soil founded infrastructure (Olunyo et al., 2010). Meanwhile, the design must target treatment of the incoming waste capacity to withstand groundwater, civic healthiness plus surface water performance limits besides environmental fortification ideal, which should be fitted appropriately and sustained to guarantee long-standing performance and sustainability (Itokawe et al., 2014). Other elements for attention include social acceptance, waste water composition, know-how, land availability and funds availability (Tai et al., 2014). This research work hypothesizes an actuated sludge treatment method that was mounted for the biological management of the sewage water manufactured in the estate. The run-off from the actuated slurry treatment process having gratified the WHO and FEM limits is channeled to the sealed drain in the environs which finally evacuates into the river in Ota region of Ogun State. The case study assessed the proficiency of biological management household wastewater or sewage-water created in the estate by the actuated sludge treatment method.

MATERIALS AND METHODS

Materials

To detect the system treatment efficiency, treated and unprocessed wastewater samples were gathered and investigated at EEE Triple "E" Systems Associates Ltd, Lagos. Fresh wastewater samplings were collected from the septic chamber by means of suction pump injected from septic tank breathing fleapit, with a disinfected 500ml bottle and two 125 polystyrene basins, while the treated water samplings were obtained from the exit location of the treatment plant. Before sampling gathering rubber containers were cleaned two times before filling, then corked tight and instantly taken to the laboratory and kept in a freezer to evade extra chemical reaction. Physico-chemical properties of treated and uncured sewage water with Federal Ministry of Environment (FME) regulatory standards and Parameter analytical techniques detection limit and tools are shown in Table 1 and 2 respectively.

Table 1: Physico-chemical properties of treated and uncured sewage water with Federal Ministry of Environment (FME) regulatory standards.

Parameter	Sewage		FME regulatory standards	Removal Efficiency (%)
	treated	Untreated		
Salinity (ppm)	46	50.9	60	11
Total Dissolved Solids (TDS)(ppm)	15.5	43.5	≤ 30	45
Total suspended solids (TSS) mg/l	10.2	36.2	≤ 30	71

Biochemical Oxygen Demand (BOD) (mg/l)	1.72	21.01	≤ 10	64
Chemical Oxygen Demand (COD) (mg/l)	21	3560	≤ 40	57
Sulphate (mg/l)	300.1	452.08	≤ 500	34
Ammonia (NH3)	11.61	27.62	20	59
colour	colourless	Pale yellow	Colourless	-
odour	Odourless	Sewage odour / rotten smell	Odourless	-
Taste	Tasteless	Unhealthy to taste	Tasteless	-

Table 2: Parameter analytical techniques detection limit and tools

Parameters	Techniques	Detection Limit	Tools
Nitrate	Alpha 4500	0.01	Hach UV Spectrophcolometer
salinity	Alpha 4500	0.01	Pestestr Muiti parameter
Total dissolved solid	Alpha 2520B	1.00	Pestestr Muiti parameter
Total suspended solid	Alpha 2540D	0.00	Pestestr Muiti parameter
COD	ASTM D 1125	0.010	Hach COD Reactor
BOD	ASTM D1125	0.010	Aerobic incubator
Turbidity	ASTM D1889 ten	0.010	Hach UV Spectrophcolometer
Nitrite	Alpha 4500	0.010	Hach UV Spectrophcolometer
Sulphate	ASTM D 516	1.000	Hach UV Spectrophcolometer
phosphate	ASTM D 515	0.010	Hach UV Spectrophcolometer
Lead (Pb)	Alpha 311 A	0.040	Atomic captivation spectrophotometer
Zinc (Zn)	Alpha 311 A	0.050	Atomic captivation spectrophotometer
Chromium (Cr)	Alpha 311 A	0.040	Atomic captivation spectrophotometer

METHODS

Raw wastewater from Estate hygienic system drifts by means of a drain pipe into a chamber which in turn drifts to checkup division to check supplies, particularly inorganic materials that drift in because these supplies can compete against free movement of wastewater for additional management. From chamber, the wastewater runs inside the septic tank where solid stuff present in the influent settles as well degenerated with bacterial help while sewage from the septic tank with high nutrient and infectious suspension drifts into the airing tank. Besides the effluent wastewater plus microscopic mass is named as diversified liqueur suspended solids (DLSS) whereas the prevailing bacteria are diverse species present bacteria. Also oxygen is simmered inside the airing tank through a compressor to permit bacteria digestion. Metabolism contains thousands of simultaneous biochemical reactions that are happening any period inside the bacteria. Likewise DLSS from the airing tank is impelled into the reactor basins which comprise of screens with achievement of additional solids settlement. The DLSS oxygen level is small hence inhalation would be repressed and hereafter energy would not be accessible for microorganisms evolution. Thus, the micro-organisms that resolve in the DLSS starved because of low dissolved oxygen (DO) and as they are become starved consequently they are actuated which is the source of the word "Äctuated Sludge Method". More so, static mass of microbe are propelled back to airing tanks, where the bacteria in the waste from the septic tank find food and is a continuous process. Further flock particles settlement happens in the reactor basin which was also removed through gravity resolving, leaving a reasonably pure liquefied at the treated sewage. Furthermore, the treated effluent pours inside a chlorine well (a concrete box where after chlorination is achieved that is chlorine administration at the expiration of the management method) where the surplus settled particles are scooped out and this is attained by presenting chlorine capsules upon exhaustion of chlorine capsules in the chlorine well. Lastly, the treated effluent pours inside the public sealed drain which empties into the river ota in Ogun state. The block illustration demonstrating the flow method used for wastewater treatment plant of Ota housing are shown in Figure 1.

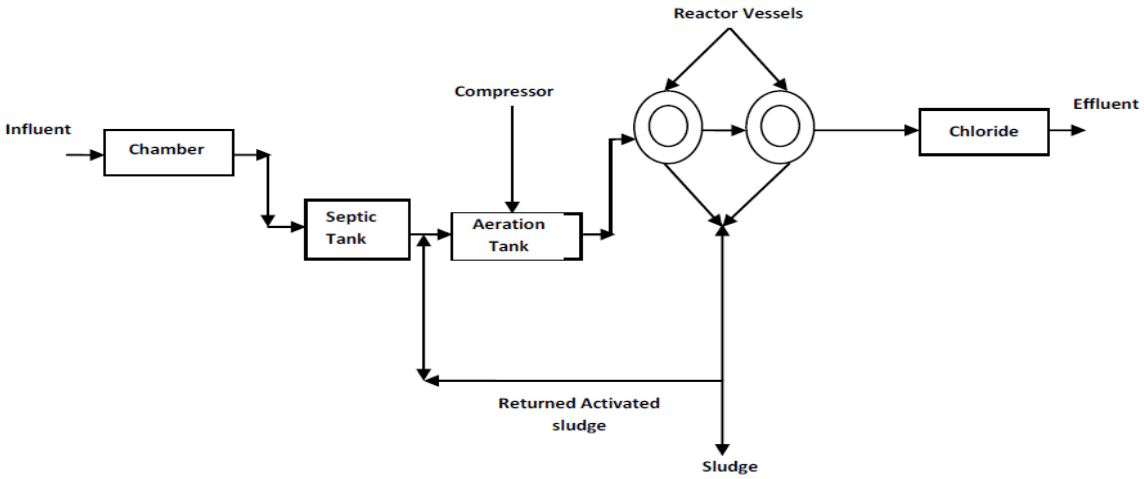

Figure 1: Block diagram representing wastewater treatment plant process in Ota housing estate, Ogun state.

SAFETY PRECAUTION

The following care were engaged throughout gathering and investigation of the waste water samplings: Hands were cleaned regularly using antiseptic cleanser with warm water; hand purifiers were utilized when there is unavailability of soap and water; eating or ingestion or smoking in work regions were disallowed; dodging of touching of mouth, eyes, face and nose except hands were freshly washed; sluicing of mouth, eyes or nose with clean water immediately wastewater squish happened; work outfits, gloves as well waders were not permitted into homes; not reusable gloves were worn throughout performance of all the tasks; hands were not permitted to be sunken below gloves top; mucky clothes were changed instantly; no permission to pick up piercing items or ruined cut-glass without hands protective through pelt gloves wearing; during lengthy expose to waste water nose covers, googles or face armors were worn; not reusable latex or artificial gloves were worn at the periods when there is anticipation of hands and sewage will be in contact and all burns, scraps and cuts were protected before contact with sewage.

RESULTS AND DISCUSSION

COD Test

The calcium oxygen demand (COD) test result of actuated sludge treatment plant using the two categories of mixing fluid (treated and untreated) with Ministry of environment standard with removal efficiency are presented in Figure 2.

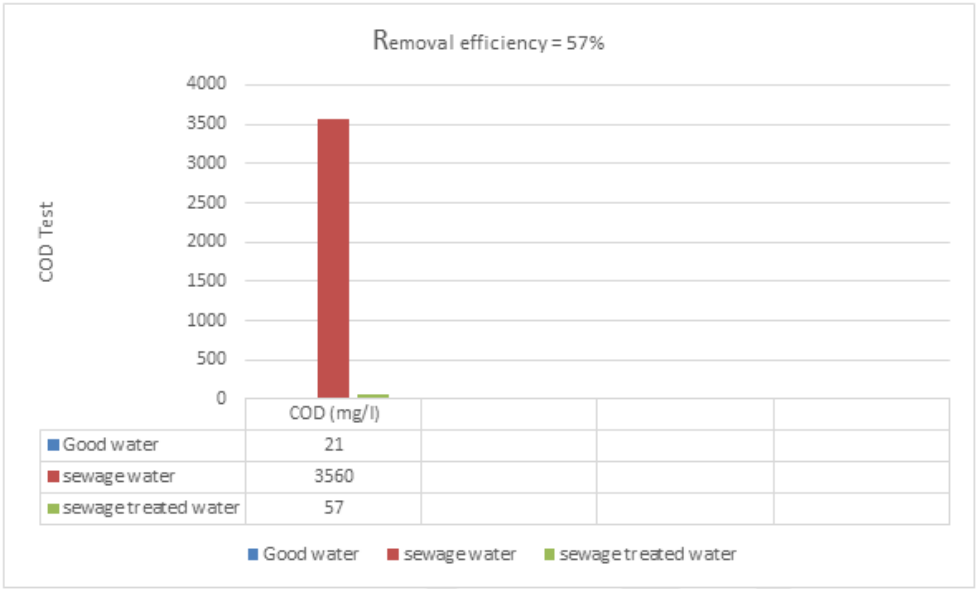

Figure 2. COD result for treated, untreated and FEM standard with removal efficiency percentage.

Figure 2 shows that treated wastewater meets the FEM COD Standard.

BOD Test

The Biological oxygen demand (BOD) test result of actuated sludge treatment plant using the two categories of mixing fluid (treated and untreated) with Ministry of environment standard with removal efficiency are presented in Figure 3.

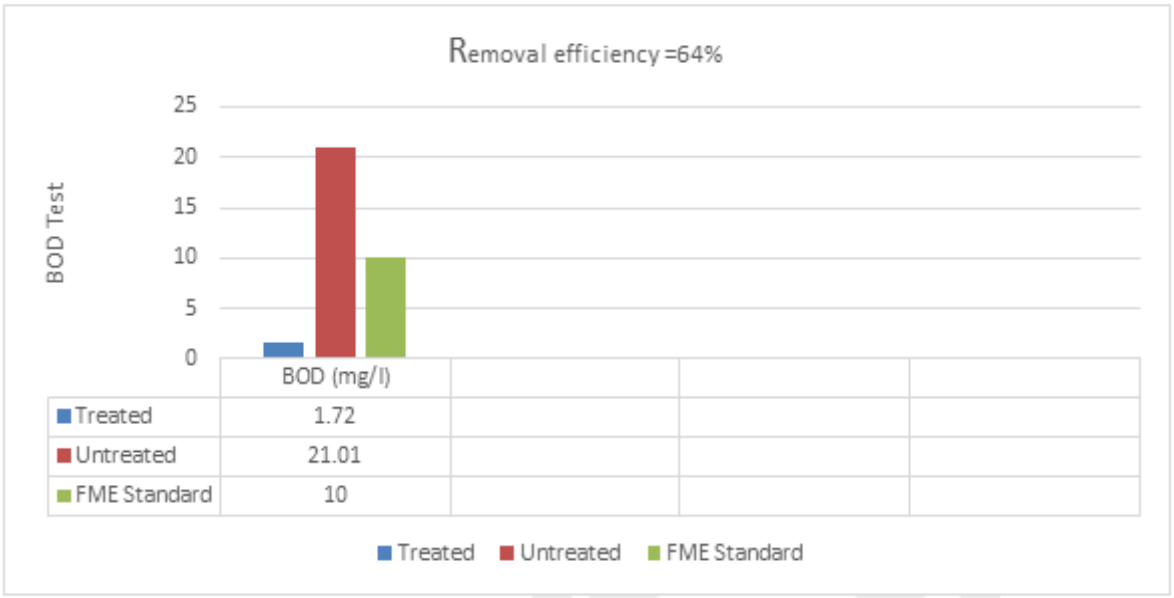

Figure 3. BOD result for treated, untreated and FEM standard with removal efficiency percentage.
Figure 3 shows that treated wastewater meets the FEM BOD Standard.

SULPHATE TEST

The sulphate test result of actuated sludge treatment plant using the two categories of mixing fluid (treated and untreated) with Ministry of environment standard with removal efficiency are presented in Figure 4.

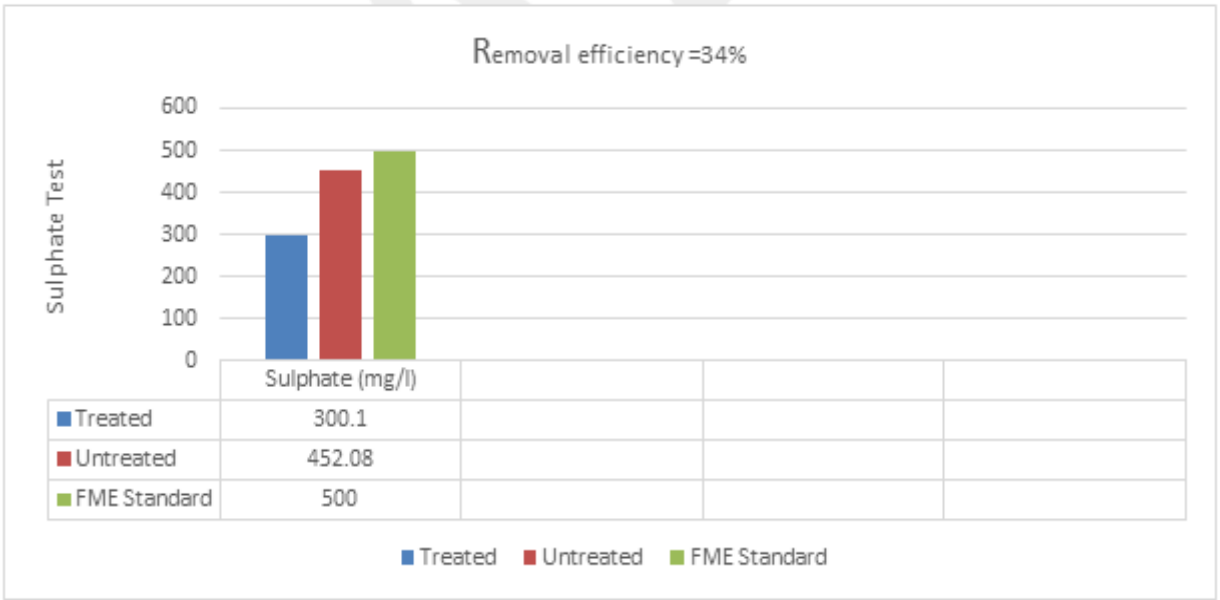

Figure 4. Sulphate result for treated, untreated and FEM standard with removal efficiency percentage.
Figure 4 demonstrations that treated wastewater meets the FEM sulphate Standard.

AMMONIA (NH_3) TEST

The ammonia test result of actuated sludge treatment plant using the two categories of mixing fluid (treated and untreated) with Ministry of environment standard with removal efficiency are presented in Figure 5.

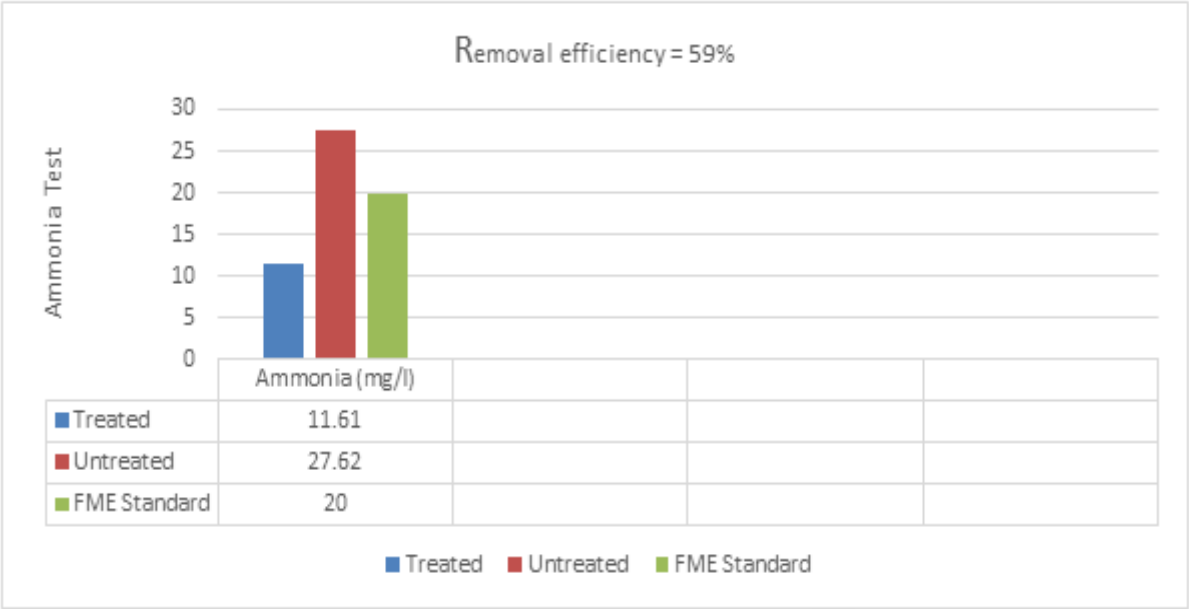

Figure 5. Ammonia result for treated, untreated and FEM standard with removal efficiency percentage.

Figure 5 indications that treated wastewater meets the FEM Ammonia Standard.

TOTAL DISSOLVES SOLID (TDS) TEST

The total dissolves solid test of actuated sludge treatment plant using the two categories of mixing fluid (treated and untreated) with Ministry of environment standard with removal efficiency are presented in Figure 6.

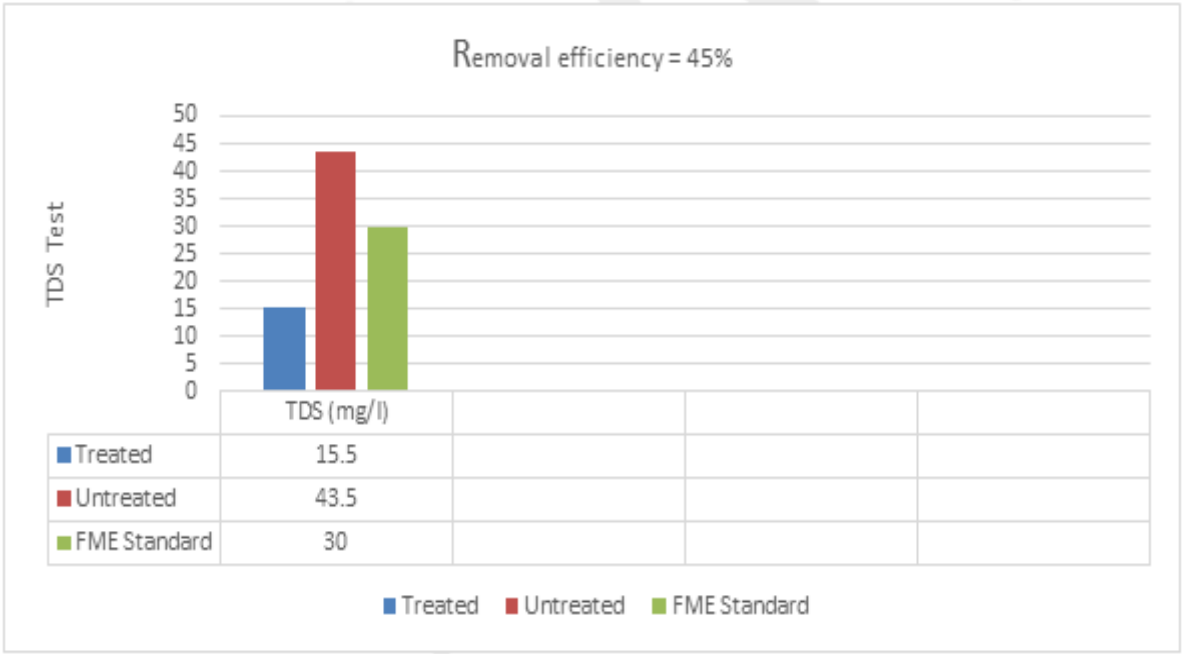

Figure 6. Total dissolves solid result for treated, untreated and FEM standard with removal efficiency percentage.

Figure 6 shows that treated wastewater meets the FEM TDS Standard.

SALINITY TEST

The salinity test result of actuated sludge treatment plant using the two categories of mixing fluid (treated and untreated) with Ministry of environment standard with removal efficiency are presented in Figure 7.

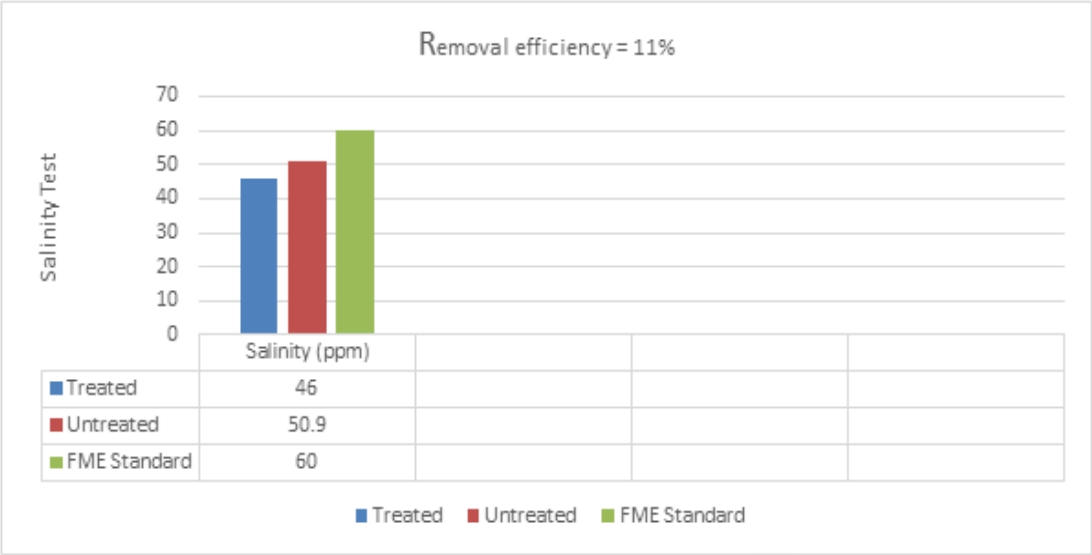

Figure 7. Total dissolves solid result for treated, untreated and FEM standard with removal efficiency percentage.

Figure 7 shows that treated wastewater meets the FEM TDS Standard.

CONCLUSION

This study scrutinized the effects of Household wastewater treatment facility in Ota housing estate, Ogun State Nigeria, using inlet (untreated) and outlet (treated) water from the septic tank. Physico-chemical properties of the untreated (effluent) water, as compared with those of treated water, showed that they have greater biological oxygen demand, sulphate, ammonia chemical oxygen demand, total dissolves solid and salinity. The household wastewater treatment plant of five hundred cubic per day per capacity (500m3/day/ cap) had a proficient treatment ability and all parameters treated meet FEM standard.

The outcomes reveals that the actuated sludge waste water management process can be efficaciously installed sludge treatment in household and industrial premises especially where there is nearly 24 hours electricity supply. Conclusively, it can also be economically used in regions were the septic tank is incapable of draining the waste water into the ground as a result of impervious layer such as clay soil.

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