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Effects of Waste Water from Hair Dressing Salon on Soil Microrganisms

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ABSTRACT:- Microbiological studies to assess the effect of waste water from hair dressing salon on soil microorganisms was carried out. A total of twelve (12) samples of salon waste water were collected from eight (8) locations and soil sample was collected, within Makurdi metropolis. The determination of total heterotrophic bacteria count and fungi count was carried out using five-fold serial dilution using the spread plate method. The results showed Total Viable Count (TVC) to be 32.2 (± 0.28) $\times 10^5$ Cf µ/g, 18.3(± 0.42) $\times 10^5$ Cfu/ g, 25.0 (±1.41) $\times 10^5$Cfu/ g for untreated soil, treated soil and waste water. The Total Colony Count (TCC) showed 14.3 (± 0.42) × 10^5 Cfu/ g, 9.4 (± 0.56) $\times 10^5$ Cfu/ g, 24.0 (± 0.00) $\times 10^5$Cfu/ g for untreated soil, treated soil and water waste. Total Fungi Count (TFC) showed the result to be 7.2 (±0.28) $\times 10^5$Cfu/ g, 3.6 (±0.00) × 10^5Cfu/ g, 10.0 (±0.28) $\times 10^5$ Cfu/ g for untreated soil, treated soil and waste water respectively. There was a decrease in TVC, TCC, and TFC of the treated soil. The microbial isolates obtained from untreated soil includes; *Staphylococcus* spp., *Klebsiella* spp., *E. coli*, *Bacillus* spp., *Micrococcus* spp., *Proteus* spp, and *Streptococcus* spp. While *Aspergillus* spp, *Mucor* spp, *Rhizopus* spp and yeast cells constitute the fungal isolates. Treated soil revealed Bacteria isolates to be *Staphylococcus spp*, *Klebsiella* spp, *E. coli*, *Bacillus* spp, *Proteus* spp., the fungal isolates includes *Aspergillus* spp, *Rhizopus* spp. *Staphylococcus* spp., *E. coli*, *Bacillus* spp, *Klebsiella* spp., *Mucor* spp., *Rhizopus* spp and Yeast cells constitute the fungal isolates. The physiochemical properties showed the pH to be 6.82, Turbidity 8.46, Temperature 26.50^{o}C, BOD 30.8 mg/L, COD 112.00 mg/L and conductivity (µs/cm) 540. *Micrococcus* spp., *Streptococcus* spp., yeast cells and *Mucor* spp. were absent in soil treated with waste water thus, waste water from hair dressing salon has a negative effect on soil microorganisms. Waste water from hair dressing salon should be adequately treated before discharging into receiving environment.

Keywords:- Effluent, Salon, Sludge, Yeast, Bacteria, Turbidity, Temperature

I. INTRODUCTION

The ubiquity of microorganisms made it easier for them to thrive in different habitats of which waste water from hair dressing salon on soil is not exempted. Waste water from domestic, industrial sector and even farms increase on the daily basis due to increase in population (Patil *et al*., 2014). So, effluent and sludge from municipal sewage treatment plants, and that of water supplying to plants do contain micro and macro nutrients and heavy metals in high quantity which also lead to contamination of soil thereby posing threat microorganism which are of benefits to agriculture as a result of land pollution. This surface pollution come both solid and liquid waste disposal practices, spills, agricultural practices and percolation of surface pollutants through unsaturated soil (Patil *et al*., 2014).

Microorganisms are an important part of the ecological system. Although, population of microorganisms differ from one environment to another; previous studies on microbes in the environment showed that microorganisms cannot be purified and separated in the laboratory. So, it a bit challenging to get the variation in the microbial population structure under diverse or different environments (Dominati *et al.,* 2010; Medeirospm *et al.*, 2006).

Organic and inorganic nutrients comprise major part of wastewaters. The inorganic concentrations include nitrogen, phosphate, potassium and others. Therefore, waste waters do have quite large amounts of poisonous or toxic heavy

metals whose concentration differs from one environment to another (Mojiri and Amirossadat, 2011; Alshammary and Qian, 2008).

The use of water cut across all nations and continents to the extent that waste water had been defined in different ways. According to the previous study, waste water is defined as a combination of one or more domestic effluent consisting of black water like excreta, urine and feacal sludge as well as and gray water from kitchen and bathing waste water. It is also defined as the water from commercial establishments and institutions like hospitals; industrial effluent, storm and urban runoff. Another definition of waste water has it that waste water is agricultural horticultural and aquaculture effluent either dissolved or suspended matter (Corcoran *et al.,* 2010). In addition, water contaminated by either chemical or biological agent is often unfit for drinking and other uses (Rathore *et al*., 2014).

It is obvious improper management of waste water that enters river systems and agricultural fields which are the primary source for disposal of waste. This especially the effluents from industries and its environments can alter the physical, chemical and biological nature of the soil whose the water passes before entering the rivers and after entering the rivers (Fakayode, 2005).

Furthermore, industries are the primary sources of pollution in all environments. Although various levels of pollutants from different industries can be released to the environments via different means; wastewater from industries includes employees' sanitary waste, process wastes from manufacturing, wash waters and relatively uncontaminated water from heating and cooling operations (Kanu and Achi, 2011; Emongor *et al*., 2005). High levels of pollutants in river water systems causes an increase in biological oxygen demand (BOD), chemical oxygen demand (COD), total dissolved solids (TDS), total suspended solids (TSS), toxic metals such as Cd, Cr, Ni and Pb and fecal coli form and hence make such water unsuitable for drinking, irrigation and aquatic life (Kanu and Achi, 2011). Therefore, industrial wastewaters come with high biochemical oxygen demand (BOD) from biodegradable wastes from plating shops (hair dressing salon), textiles industries, slaughter houses, human sewage, tanneries, chemical industry, pulp and paper industries (Otokunefor and Obiukwu, 2005; Phiri *et al*., 2005).

Soil has been a good habitat for microbes despite the fact that its diversity in the components which could be due to organic pollution of inland water systems in continent such as Africa. In Africa extreme poverty and economic as well as social underdevelopment has caused more environmental problem to these soil microbiota (Kanu and Achi, 2011; Ritz *et al.,* 2003).

Moreover, the report of the previous researcher revealed that the soil environment is very complex and also depend on climate, organisms, land form as well as the parent materials and then provides different habitats for microorganisms. The profile of a soil reflects the organic matter that has undergone decomposition which is also known as humus (Dominati *et al.,* 2010; Ritz *et al.,* 2003).

With regards to hair dressing water from hair dressing salon, previous findings showed increased chemical and biological oxygen demand in the effluent contaminated soil of the waste water generated from hair dressing salon (Ajuzie and Osaghae, 2011). So, cosmetologists are in a way exposed their customers to high concentrations of compounds that can exposed these customers to danger of cancer. A good numbers of these products used in beauty salons are not under control could be carcinogenic. An example is volatile organic compounds (VOC) such as lithium hydroxide, calcium hydroxide and ammonium thiocyanate (Nkansah *et al.,* 2016).

Nonetheless, the problem in disposal of waste water has become one the main challenge urban settlements as a result of large populations of human beings in the settlements. This has made sewage related problems a general challenge across the globe (Tyohemba *et al*., 2017; WHO, 2003). Nkansah and Onwusah and other researchers were of the opinion that in contaminated water in the soil, oxygen becomes less available as electron acceptor and then results into reduction of available nitrate into gaseous nitrogen thereby having adverse effects in the environment. Also, chemicals in waste water can sink down into the soil and then affect the chemical composition of such soil environment resulting into land pollution, air pollution and several environmental and health impacts from insufficient waste water treatment. (Onwusah *et al.,* 2015; Nkansah *et al.,* 2016).

In addition, dated back to 1980s, Norman Pace and colleagues findings revealed that organisms could be identified in as expected in their microbial populations even without growing them. These techniques typically require the extraction and isolation of ribosomal RNA (rRNA) genes directly from cells in soil (Caporaso *et al.,* 2012). Further studies by Caporaso and others also showed the rRNA genes amplified from total community DNA using the polymerase chain reaction (PCR) with rRNA-specifi c primers. These primers can select different microbial groups at level of the domain such as in Bacteria, Eukarya, and Archaea, or in phylum ssuch as Actinobacteria or Bacteroidetes. Although different approaches can be taken to separate and sequence the rRNA genes by the means of advances in high-throughput DNA sequencing which do allow thousands of individuals to be identified in each of thousands of samples in a week (Caporaso *et al.,* 2012).

The majority of the studies on soil contaminated with waste water focused on exploring how the local microbial community interacted with the environmental factors concerned. However, a few studies made a comparison of the microbial community in a contaminated environment with that of an investigated environment in microbial communities in the environments at different distances from a pollutant (Azarbad *et al.*, 2013; Yergeau *et al.*, 2012). Contamination of soil in cultivated fields by industrial effluents loaded with toxic heavy metals has emerged as a new threat to agriculture and microbes. So, the effluent from municipal sewage treatment plants, from supplying water to plants, often contains high levels of macro and micro nutrients as well as heavy metals. Pollution on the ground surface is the major cause of soil pollution, so this surface pollution comes from solid and liquid wastes improper disposing habit (Tyohemba *et al*., 2017; Patil *et al*., 2014; Tortora *et al.*, 2007).

In general, the discharge of untreated wastewater into the soil do result into the presence of the following elements viz: iron, lead, phosphorus, calcium, and zinc which quantities usually low or not available in the soil before now and then when introduced into the environment will result to an increase in the aforementioned chemicals and also affect soil microbiota due to the change in the soil physicochemical. Some of these chemicals may be toxic to the soil microbial flora and fauna (Tyohemba *et al*., 2017; Tortora *et al*., 2007). This research is therefore sets to study the effects of waste water from hair dressing salons on soil microorganisms.

II. MATERIALS AND METHODS

Study Area

Area encompasses Makurdi which is the capital of Benue State, North Central, Nigeria. Makurdi is located on latitude 7^{o} 41N and longitude 8^{o} 37E on the Benue State map (Meterological Department Nigerian Airforce Base Makurdi). Makurdi is situated on the Banks of River Benue with total population of 297,393 in Federal Republic of Nigeria 2007.

Collection of Samples

Samples of waste water were collected from different hair dressing salons in Makurdi metropolis of Benue State. The sample locations were Wadata, Modern Market, Northbank, Gboko Road, University of Agriculture Makurdi, Wurukum Market and High Level. A total of 12 (twelve) samples were collected and mixed together to obtain a homogenous mixture. The areas were chosen due to their high number of hair dressing salons. Soil samples were collected in sterile polyethene bags at a depth of 0-5cm using a sterile spatula.

Media Preparation

All media were prepared according to manufacturers' instruction.

Nutrient Agar

14g of nutrient agar was weighed and poured into 500ml distilled water in a conical flask. The mixture was swirled to obtain a homogenous mixture and there after sealed with Aluminum foil and sterilized by autoclaving for 15mins at 121 ^{o}C and cooled at 45 ^{o}C and aseptically pour plated into petrish dishes and allow to gel.

Potatoe Dextrose Agar (PDA)

19.5g of PDA was weighed and poured into 500ml distilled water in a conical flask. The mixture was swirled to obtain a homogenous mixture and thereafter sealed with Aluminum foil and sterilized by autoclaving for 15 minutes at 121 ^{0}C and cooled at 45 ^{0}C and ascetically pour plated into petri dishes and allow to gel.

Inoculation of Medium

Serial dilution of 10^{-5} was used for soil contaminated with waste water were made. The aerobic bacteria count was carried out using 1ml of appropriate serially diluted sample in prepared nutrients agar and PDA for fungal count.

Total Heterotrophic Count

The determination of the total heterotrophic count for bacteria and fungi count was carried out using five (5) fold serial dilution method and plating on nutrient agar and Potatoes Dextrose Agar using spread plate method and incubated at 37 ^{0}C for bacteria growth and at 37 ^{0}C for 5-7 days for fungal growth.

Isolation and Identification of Bacteria and Fungi

Organisms with different cultural characteristics were sub-cultured using the same medium on which they were inoculated to obtain pure culture. For bacteria, distinct colonies were picked from each plate using a sterile wire loop and streaked on nutrient agar medium. This was incubated for 24 hours at a temperature of 35 ^{0}C after which the plate were preserved for further biochemical tests and identification of specific organisms.

Identification of Bacteria Isolates

The bacteria isolates were identified based on their cultural, biochemical properties and microscopic appearance as describe by Cheesbrough (2005).

Isolation of Fungi

For fungi, there was no sub culture since PDA is specifically meant for fungi growth, however, they were isolated based on the macroscopic and microscopic appearance of spores and shape of fungal cell. The probable identities of the moulds were determined according to the scheme of Youssuf and Kerstin (2010).

Identification of Fungi Isolates

The fungal isolates were identified based on the cultural, biochemical properties and microscopic appearance as described by Cheesbrough (2005).

Biochemical Test

Biochemical test were carried out by the method adopted by Cheesbrough (2005).

Citrate Utilization Test

Simon's citrate slant was inoculated and streaked with test organism using a sterile wire loop. The medium was inoculated at 37 ^{0}C for 48 hours positive result showed blue colour on Simon's citrate agar. (citrate utilization). A negative result retained the original colour of the medium.

Indole Test

The test organism was inoculated in 3ml of sterile peptone water in a bijou bottle and incubated aerobically at 37 ^{0}C for 45 hours. Indole production was tested by addition of 0.5ml kovac's reagent and allowed to stand for 5mins. Bright pink colour at the top layer of the broth indicated a positive result while yellow colour indicated a negative result.

Gram staining

This was carried out to distinguished gram positive and gram negative organisms. Gram positive bacteria will retain the dye iodine complex and hence will appear purple or dark blue while gram negative bacteria which is not retained by the cystal violet were counter stained with sarfranin and will appear pink to red (Prescott *et al.*, 2005).

A thin smear of colony of the test organism was made on a clean microscopic slide. It was allowed to air dry and the heat fixed by passing glass slide through the flame three (3) times. The fixed smear was then covered with 3 drops of crystal violet for 60 seconds and rinsed with clean water. It is then discolourized with 95% acetone and rinsed immediately with running water. The smear was covered with safranin for 30 seconds before it was rinsed. Then it was viewed with oil immersion by the use of x100 objective lens.

Catalase Test

A sterile wire loop was used to obtain colony from nutrient agar and dipped into test tube containing 3% H_2O_2 (Hydrogen peroxide). Effervescence of O_2 (oxygen) indicate the presence of catalase positive organism while no effervescence indicate a negative result.

Motility Test

Motility test agar was inoculated with a small portion of the test organism and stab to the bottom of the bottle of the semi-solid nutrient agar using a sterile straight wire. The straight wire is pulled out in the same line from the rest agar and incubated aerobically at 37^{o}c for 45hours. The motile bacteria spread throughout the medium (true motility) while the non motile grow only at the hive of stab.

Physiochemical Parameters

The following parameters were determined for hair salon effluent: pH, Temperature (°C), conductivity, turbidity, biochemical oxygen demand, (mg/l) chemical oxygen demand (mg/l). Effluent analysis was in accordance with standard method for examination of waste water.

Biological oxygen demand (BOD)

BOD in water was determined by the difference in the dissolve oxygen (DO) levels of water prior to incubation and after 5 days of incubation. The BOD of the collected waste water was determined by dilution method. Dilution of water was prepared by addition of 10ml of each of the reagents phosphate buffer, magnesium sulphate, calcium chloride into 10l of water to measured volume of waste water sample was topped with a dilution of 10l water mark standard flask. Two (2) 300ml amber bottles were filled with diluted water one of the bottles was incubated at 20^{o}c for 5 days $MnS0_4$ solution, alkali – lodide – azide was added to the other. At the end of five (5) days, the bottle in the incubator was brought out DO_5 was determined following procedure for DO_1

$$BOD_5\,(mg/l) = \frac{(DO_0 - DO_5) \times \text{Volume of bottle}}{\text{Volume of sample}}$$

pH

pH was determined using a pH meter (model) Jenway 3310, the pH electrode was immersed into the waste water and reading recorded.

Temperature
Temperature was determined using thermometer; the thermometer was dropped into the sample for 3 – 5 minutes. The reading was taken when the mercury level in the thermometer became stable.
Conductivity
Conductivity was determined using conductivity meter.

Statistical Analysis
Statistical package for social sciences (SPSS) version 20 was used for the statistical analysis. Descriptive statistics that is mean ± standard error values were expressed for log transformed microbial counts. A one way analysis of variance was carried out at $p \leq 0.05$.

III. RESULTS AND DISCUSSION

The result from this present study is presented as follows:
The total viable count of untreated soil, treated soil and waste water showed a microbial count of $32.2 \times 10^5 \pm 0.28 \times 10^5$ Cfu/$_g$, $18.3 \times 105 \pm 0.42 \times 10^5$ Cfu/$_g$ and $25.0 \times 10^5 \pm 1.41 \times 10^5$ respectively. As represented in Table 4.1, the untreated soil recorded the highest count
The total colony count of untreated soil, treated soil and waste water showed a count of $14.3 \times 105 \pm 0.42 \times 105$ Cfu/$_g$, $9.4 \times 10^5 \pm 0.56 \times 10^5$Cfu/$_g$, and $24 \times 10^5 \pm 0.00 \times 10^5$Cfu/$_g$, respectively with waste water having the highest count as represented in Table 4.2.
In Table 3 the total fungi count of untreated soil, treated soil and waste water is shown as $7.2 \times 10^5 \pm 0.28 \times 10^5$ Cfu/$_g$, $3.6 \times 10^5 \pm 0.00 \times 10^5$ Cfu/$_g$ and $10.0 \times 10^5 \pm 2.80 \times 10^5$ Cfu/$_g$ respectively. Waste water recorded the highest fungi count and treated soil recorded the least count.

The cultural and biochemical characteristic of bacteria isolates is shown in Table 4. The percentage prevalence of bacteria isolates is shown in Table 5. The macroscopic and microscopic characteristic of fungi, isolated from this study is shown on Table 6. In Table 7, the percentage prevalence of fungi isolates is shown, with waste water having the highest prevalence (46.31%), treated soil having the least (21.28%). Physiochemical parameters of waste water sample is shown in Table 8.

Table 1: Total Viable Count (TVC) of Isolates

Sample	Mean ± SD	Sig
Untreated soil	$32.2 \times 10^5 \pm 0.28 \times 10^5$	0.004
Treated Soil	$18.3 \times 10^5 \pm 0.42 \times 10^5$	0.010
Waste Water	$25.0 \times 10^5 \pm 1.41 \times 10^5$	0.025

Key
$p \leq 0.05$

Table 2: Total Colony Count (TCC) of Isolates

Sample	Mean ± SD	Sig
Untreated soil	$14.3 \times 10^5 \pm 0.42 \times 10^5$	0.013
Treated Soil	$9.4 \times 10^5 \pm 0.56 \times 10^5$	0.027
Waste Water	$24.0 \times 10^5 \pm 0.00 \times 10^5$	0.000

Key: $p \leq 0.05$

Table 3: Total Fungi Count (TFC) of Isolates

Sample	Mean ± SD	Sig
Untreated soil	$7.2 \times 10^5 \pm 0.28 \times 10^5$	0.018
Treated Soil	$3.6 \times 10^5 \pm 0.00 \times 10^5$	0.000
Waste Water	$10.0 \times 10^5 \pm 2.80 \times 10^5$	0.126

Key: $p \leq 0.05$

Table 4: Cultural Morphological and Biochemical Characteristics of Bacterial Isolates

S/N	Colony Colour	Colony Shape	Morphology	Gram's Rxn	Catalas	Citrate	Urease	Indole	motility	Probable Isolates
1	Cream	Circular	Cocci	+	+	+	-	-	-	*Staphyloccus spp*
2	Mucoid pink	Iregular	Rod	-	+	+	+	-	-	*Klebsiella spp*
3	Green metallic sheen	Circular	Rod	-	+	-	-	+	+	*E. Coli*
4	White	Irregular	Rod	+	+	+	+	-	+	*Bacillus spp*
5	Yellow	Circular	Cocci	+	+	+	-	-	-	*Micrococcus spp*
6	Pale	Circular	Rod	-	+	+	+	-	+	*Proteus sps*
7	Pale	Circular	Cocci	+	-	-	-	-	-	*Streptococcus spp*

Table 5: Percentage Prevalence of Isolates

Probable Isolates	Untreated Soil (%)	Treated Soil (%)	Waste Water (%)	Total (%)
Staph. Spp	3(4.50)	5 (7.00)	4(6.00)	12(17.91)
Kleb. Spp	4(6.00)	4(6.00)	2(3.00)	10(14.93)
E. Coli	4(6.00)	3(4.50)	4(6.00)	11(16.42)
Bacullus spp	5(7.50)	5(7.50)	3(4.50)	13(19.40)
Micrococcus spp	3(4.50)	0(0.00)	5(7.50)	8(11.94)
Proteus ssp	3(4.50)	2(3.00)	3(4.50)	8(11.94)
Streptococcus spp	2(3.00)	0(0.00)	3(4.50)	5(7.50)
Total (%)	**24(35.82)**	**19(28.36)**	**24(35.82)**	**67(100)**

Table 6: Macroscopic and Microscopic Characteristics of Fungi isolated

Macroscopic	Microscopic	Isolate Fungi
Velvety filament which sporulate into black powdery spores	Long septate hyphae with conidiosphore bearing brown spores and phialide at it apex	*Aspergillus sp*
Flat smooth moist and glistering colonies that grow rapidly	Multilateral budding with absence of hypae	Yeast cells
Long hypae growth which sporulated within two days to turn to black spore	Non septate branch mycelium with round shaped sporangia	*Rhizopus sp*
White and wooly aeria growth that darkens as it sporulate	Non septate hyphae with straight sporangiosphere with many spherical spores	*Mucor sp*

Table 7: Percentage Prevalence of Fungi Isolates

Fungi Isolates	Untreated Soil	Treated Soil	Waste Water
Aspergillus spp	3(27.27)	2(18.18)	15(31.25)
Mucor spp	3(6.25)	-	6(4.65)
Rhizopus spp	6(4.65)	4(3.10)	5(10.41)
Yeast cells	1(5.09)	-	-
Total	**13(43.26)**	**7(21.28)**	**24(46.31)**

Table 8: Physiochemical Parameters of Waste Water Sample

Parameters	Sample (Waste Water)
pH	6.82
Turbidity (mg/L)	8.46
Temperature (0 ^{0}C)	26.50
BOD	30.80
COD	112.00
Conductivity [µs/cm]	540.00

The study was conducted to assess the effect of waste water from hair dressing salon on soil microorganisms.

The result showed that bacterial isolates identified in untreated soil sample include; *Staphylococcus* spp., *Klebsiella* spp., *E. coli, Bacillus* spp., *Micrococcus* spp., *Proteus* spp., *Streptococcus* with the percentage occurrence of 4.50%, 6.00%, 6.00%, 7.50%, 4.50%, 4.50%, 3.00%. *Bacillus* spp. having the highest percentage occurrence; this present study agrees with the study of Borneman *et al*. (1996) who reported and proposed extensive microbial diversity including specie richness and evenness per gram of soil for uncontaminated soil.

The microbial isolates from treated soil showed; *Staphylococcus* spp, *Klebsiella* spp, *E. coli, Bacillus* spp., *Proteus* spp., with the percentage prevalence of 7.00%, 6.00%, 4.50%, 7.50% 3.00%. *Micrococcus* spp, and *Streptococcus* spp. were absent in the treated soil.

Microbial isolates from waste water revealed; *Staphylococcus* spp., *Klebsiella* spp., *E. coli, Bacillus* spp., *Micrococcus* spp., *Proteus* spp., *Streptococcus.* With the percentage prevalence of 6.00%, 3.00%, 6.00%, 4.50%, 7.50%, 4.50%, 4.50%, Micrococcus having the highest occurrence of 7.50%, with *Klebsiella* having the least 3.00%. The low occurrence of the *Klebsiella* can be attributed to the high Chlorine content of salon waste water as Chlorine is bactericidal to enteric bacteria (Ajuzie and Osaghae 2011). The fungi isolates found in untreated soil include; *Aspergillus* spp., *Mucor* spp., *Rhizopus* spp., yeast cells with the percentage occurrence of 27.27%, 6.25%, 4.65%, 5.09% with *Aspergillus* having the highest percentage occurrence and yeast cells having the least occurrence of 5.09%. The fungi isolates in waste water include; *Aspergillus* spp., *Mucor* spp., *Rhizopus* with the percentage occurrence of 31.25%, 4.65%, 10.41% with *Aspergillus* having the highest contamination. The fungi isolates from treated soil shows; *Aspergillus* and *Rhizopus* with the percentage occurrence of 18.18% and 3.10% respectively. *Mucor* spp and yeast cells were absent in the treated soil. This shows consistency with the research of Ge *et al.* (2009), who stated that the number of fungi shows a descending trend after long term irrigation with waste water.

The physiochemical parameters of waste water sample; the physiochemical analysis shows the pH to be 6.82. The result indicates that the pH value varies from weakly acidic. This could be attributed to the presence of chemicals like sodium hydroxide in hair relaxers and dyes used in hair conditioners (Dias, 2015). The pH value is however within the World Health Organization (WHO) and Federal Environmental Protection Agency (FEPA) acceptable limits of 6.0 – 9.0 for drinking water and waste water discharge into the surrounding (WHO, 2004; FEPA, 1991).

The turbidity was 8.46 which is high compare to the WHO acceptable value which is 5 (five) and this may be as a result of colour. This is an indicative of large number of microorganisms. Turbidity influences the penetration of light. The temperature of the samples differs slightly within the range of 26.50 ^{0}C which is compliance with FEPA acceptable effluent permissible limit of ($\leq$ 40 ^{0}C). The biological oxygen demand (BOD) value was 30.80mg/l. which is above acceptable limit of FEPA which is 30mg/l. this can be as a result of low biodegradable species in the waste water.

The Chemical Oxygen Demand (COD) value obtained was 112.00 which exceed the acceptable value of FEPA. The COD is the measure of the capacity of water to consume oxygen during the decomposition of inorganic chemicals such as nitrate and ammonia. A high COD value suggests more waste products or pollutants presence in the effluent such as sodium, dimethylphthalates and bis (2 ethylhexyl) and ammonium nitrogen. Since COD indirectly measures the amount of organic compound present in water. It therefore means the water was heavily polluted.

IV. CONCLUSION

This study shows that the use waste water effluent in Agriculture provides an alternative to disposal by utilizing the recyclable constituents in sludge and waste water because sewage is capable of providing the essential nutrients for crop in the course of growth when applied as manure. But, when salon waste is not controlled, it may

have adverse effect on the soil microbiota in the premises where the salon is situated. This study have shown that *Micrococcus* spp. and *Streptococcus* spp. and *Mucor* spp. were absent in soil treated with salon waste water. Therefore, an attempt should be made to treat salon effluents before disposal into salon premises.

Recommendations

Based on the findings of this study, the following recommendations are made to proffer solutions to effects of waste water from hair dressing salon on soil microorganisms.

i. Seminars and workshops should be organized by public health officers to enlighten the salon operators on the need to treat waste water from salon before disposal into the receiving environment.
ii. Attempts should be made to treat salon effluents before disposal as it would help reduce organic and inorganic substance present.
iii. There should be routine inspection of hair dressing salons with a given locality by public health officers to check for hygienic standard and level of sanitation

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