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Ecotoxicological Effects on *Apporectoda longa* (Earthworm) and *Telfairia occidsentalis* (Pumpkin Plant) by Hair Dressing Salon Effluents from shops in Azu Owa, Ika Northeast Local Government Area, Delta State, Nigeria

***[1]OSHILONYAH, LU; [1]OYEM, IM; [1]IGBORGBOR, JC; [2]ATUANYA, EI**

[1]Department of Biological sciences, Faculty of Sciences, University of Delta, Agbor
[2]Department of Microbiology, Faculty of Life Sciences, University of Benin, P.M.B 1154, Benin City, Edo State.

**Corresponding Author Email: oshilonyahl@gmail.com; lucy.oshilonyah@unidel.edu.ng*
**ORCID: https://orcid.org/0009-0007-6225-2624*
**Tel: +234 8037159115*

**Co Authors Email: mirian.oyem@unidel.edu.ng; jude.igborgbor@unidel.edu.ng; ernest.atuanya@uniben.edu*

ABSTRACT: The hairdressing salon industry produces waste containing various alkalis, relaxers, dyes, and chemicals, resulting in significant environmental concerns due to the uncontrollable nature of salon wastewater. Hence the objective of this paper was to evaluate the ecotoxicological effects on *Apporectoda longa* (Earthworm) and *Telfairia occidentalis* (pumpkin plant) by hair dressing salon effluents from shops Azu Owa community in Ika northeast local government area of Delta State, Nigeria using standard methods. Physicochemical analyses of soil samples showed pH levels ranging from 3.3 to 3.6 and clay content between 3% to 5%, both below WHO limits. The total solids of the effluent ranged from 3012 - 6443.8 mg/l, indicating high significance ($p<0.05$), while other parameters were not statistically significant. Heterotrophic bacteria count showed no significant differences ($p>0.05$), while soil fungal counts (4.67 + 1.70 -11.33 + 1.25 x 10^3 cfu/g) were significantly different ($p<0.05$) compared to the effluent. Acute toxicity assessments revealed no significant effects on earthworm length and weight across concentrations of 50 mg/ml to 200 mg/ml ($p>0.05$). *Telfairia occidentalis* exhibited significant differences in growth during weeks one and two ($p<0.05$), with no notable effects observed in week three. The results demonstrate a dose-dependent relationship between effluent concentration and earthworm mortality, with higher concentrations leading to increased lethality and observable behavioral alterations. These findings highlight the ecological risks associated with improper salon waste disposal. Earthworms, as bioindicators of soil health, underscore the need for effective waste management practices in the beauty industry. Further research is necessary to explore sub-lethal effects and long-term impacts on soil ecosystems from chronic exposure to these pollutants.

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Ecotoxicology studies the interface between ecology and toxicology. Concisely, ecotoxicology is concerned with toxic molecules, hereafter called contaminants, either of artificial origin (including drugs and endocrine disruptors) or natural agents (metals and arsenic) of which human beings alter the distribution and/or cycle in the different compartments of the biosphere from a fundamental point of view, ecotoxicology studies the fate and consequences of contaminants on biological systems,

**Corresponding Author Email: oshilonyahl@gmail.com; lucy.oshilonyah@unidel.edu.ng*
**ORCID: https://orcid.org/0009-0007-6225-2624*
**Tel: +234 8037159115*

from the ecosystems to individual organisms. From an applied point of view, it is increasingly asked of ecotoxicologist`s to develop tools that allows for the determination of the intensity and duration of contamination events and to assess associated ecological risks, through the prediction of potential effects of contaminant exposure in nature. One approach to meet this social demand for bio monitoring methods is the development of biomarkers. This approach considers that the best method to detect the biological impact of contaminant exposure is to investigate the effects of contaminants on biological systems (Vilaplana *et al*., 2008; Weeks *et al*., 1996). Indeed, compared to traditional methods focusing on physical and chemical properties of soils, biomarkers are assumed to focus on the effects of the bioavailable (i.e. transmitted to living organisms) fraction of environmental chemicals and to integrate the putative interactive effects of complex mixtures of chemicals in the Ecological Risk Assessment (ERA).

Various environmental pollution problems have been attributed to salon wastewater discharges. Organic matter and nutrients from salon wastewater cause an increase in aerobic algae and depletes oxygen from the water column; this causes suffocation of fish and other aquatic organisms. Salon wastewater contains oil and grease which stick to the bodies and feathers of sea bird and this make them unable to fly. Oils do not dissolve in water and form a thick layer on water surface, and this causes suffocation of fish and other aquatic organisms. Salon wastewater may also contain heavy metals such as nickel, chromium, arsenic and mercury which are poisonous to most of the aquatic life and may eventually result to death. Water from such sources is obviously unfit for consumption. These chemicals can also be washed down the soil and can change the chemistry of the soil. It may also contain some poisonous volatile organic compounds which can cause air pollution (Nkansah *et al*., 2016; Onwusah *et al*., 2015). Hairdressing salons generate waste in the range of various alkalis, relaxers, dyes, and other chemicals which can greatly influence the physicochemical properties of receiving water resources. Discharging into water bodies is a major problem due to the uncontrollable nature of some of the contaminants in the beauty salons wastewater (Bowers *et al*., 2002). Cosmetologists, beauticians, and to some extent customers are exposed to high concentrations of several compounds that are included in the various chemical products used in the work or treatments. Many products used in the beauty industry in developing countries are unregulated and may release carcinogens and volatile organic compounds (VOCs) such as lithium hydroxide, calcium hydroxide, guanidine carbonate and ammonium thiocyanate (Nkansah *et al*., 2016). These chemical constituents could change the; Odour appearance, and taste of water sources. Occupational skin and respiratory disorders and disputable reproductive and genotoxic effects have been linked to chemical exposure to beauty workers (Galiotte *et al*., 2008). Today's salons offer a wide range of services from skin treatments and hair styling to manicure, makeup, and tanning application. In providing these services, waste is generated. The trend of constant usage of hair beauty products that contains toxic chemicals have increased overtime, due to non-regulation of products and its effluents by government agencies concerned. However, there is paucity of information on effects of hair dressing salon effluent and its chemical component to the soil environment. Though, few metals like cadmium and lead have been implicated to cause endocrine defects in marine lives. Since the effluents are consistently discarded into the soil environment, therefore, there is an urgent need and apt to evaluate the effects of salon effluents on soil and soil biological sentinels. Hence the objective of this paper was to evaluate the ecotoxicological effects on *Apporectoda longa* (Earthworm) and *Telfairia occidentalis* (pumpkin plant) by hair dressing salon effluents from shops in Azu Owa community in Ika northeast local government area of Delta State, Nigeria. (Oshilonyah *et al*., 2025)

MATERIALS AND METHODS

Collection of Soil Samples: Soil samples (500g each) were collected from five Hair Dressing Salon shops in Azu Owa community in Ika northeast local government area of Delta State, Nigeria. A one non-contaminated soil was also be collected from the community which will serve as the control for the experiment. All soil samples were collected at a depth of 0-10cm with a standard soil auger in polyethylene bags and kept on the laboratory bench to air dry (Nathalia *et al.,* 2014). The waste soil sample collected from the landfill site will be used to enumerate total heterotrophic bacteria and isolate nitrifying bacterial while a portion of the garden soil was used to formulate specific concentrations of hair dressing saloon effluent-enriched composted soil for earthworm and plant toxicity analysis.

Collection of Plant Seeds: Seeds of *Telfairia occidentalis* (fruited pumpkin) were collected from Department of Crop Science, University of Benin, and Edo State, Nigeria.

Preparation of Winograsky Media: Media preparations were carried out for Winograsky broth

for serial dilution of samples of soil suspension. Winograsky broth were prepared using the following composition (g/l) in sterile 1000 ml of distill water: $(NH_4)_2SO_4$, 2.0 g; K_2HPO_4, 1.0 g; $MgSO_4 \cdot 7H_2O$, 0.5 g; NaCl, 2.0 g; $FeSO_4 \cdot 7H_2O$, 0.4 g; $CaCO_3$, 0.01 g. ten tubes were each filled with 9ml of Winograsky medium, autoclaved at 121^{o}C for 15 min at 15 psi and allowed to cool. The Winograsky broth were used for the isolation of *Nitrosomonas* sp. Another Winograsky broth used for the isolation of *Nitrobacter* sp. was prepared with the following composition (g/l): KNO_2, 0.1 g; Na_2CO_3, 1 g; NaCl 0.5 g; $FeSO_4 \cdot 7H_2O$, 0.4 g; in 1000 ml of distilled water. Another set of ten test tubes were filled with 9ml of Winograsky broth and sterilized at 121^{0}C for 15 min. at 15 psi and allowed to cool.

Isolation of Nitrosomonas sp. and Nitrobacter sp: The various Winograsky plates were aseptically inoculated with 0.1ml of the appropriate dilution of the soil suspension using spread plate technique. The inoculums were spread over the entire surface of the solid agar with sterile glass rod. All the inoculated Petri dishes were incubated aerobically at room temperature (28^{o}C) for 72h (Burkhard *et al*., 2001).

Preparation and standardization of inoculums: Viable cell counts were carried out on serially diluted cultures of the isolates inoculated on sterile Winograsky agar plate method. The plates were incubated aerobically at room temperature for 72h. The concentrations of the viable cells in the original culture of the isolates (expressed in colony forming unit per ml or cfu/ml) were calculated from the plate counts on the pour plate to produce standard inoculums size of each of the isolates that were used for the experiment (Burkhard *et al*., 2001).

Collection of Earthworm (Aporrectoda longa): The earthworms were collected from a farmland in Ugbowo Benin-City, Edo State. The worms were collected according to the method described by Spurgeon, (2000) They were collected by digging and hand sorting from substances liters and were taken to the laboratory for identification. They were washed with water to remove soil particles and were left on moist filter paper for voiding. Earthworms were selected based on their maturity (shown by the presence of clitellum) and liveliness (active response when anterior segment is prodded). The physicochemical parameters of the native soil will be determined prior to the test (Atuanya and Tudararo-Aherobo, 2014).

Isolation and Enumeration of Heterotrophic Bacteria: Serial dilution of each of both soil samples were made to form 10^{-4}, 10^{-5} and 10-^{6} dilutions. Total viable heterotrophic bacterial counts were determined using pour plate technique. Then the molten nutrient agar at 45^{o}C were poured into the Petri dishes containing 1 ml of the appropriate dilution for the isolation of the total heterotrophic bacteria. They were swirled to mix and allowed to solidify. The nutrient agar plates were incubated at 37^{o}C for 24 hrs. Colony counts were taken after incubation, then recorded in colony forming unit per milliliter and preserved by subculturing the bacterial isolates into nutrient agar slants which were used for biochemical tests (Burkhard *et al*., 2001).

*Soil Analysis: Determination of pH***:** The pH reading was obtained with the aid of a Hanna microprocessor pH meter which were standardized with buffer 4.0, 7.0 and 9.0. Twenty (20) grams of the fresh soil sample were weighed into a 100 ml glass beaker. Twenty (20) milliliters of sterile distilled water will be added, and the suspension were stirred continuously for 30 minutes. The mixture was allowed to stand for another 30minutes undisturbed. A Hanna microprocessor pH meter was dipped into the solution and steady readings noted (Kalra and Maynard, 1991).

*Moisture Content***:** An aluminum dish was pre weighed (W_1) using a sensitive weigh balance (State Model). Ten (10) grams of the fresh soil sample were transferred to the dish and weight of both the dish and soil were noted (W_2). The dish containing the soil sample was placed in a hot air oven (State Model) at 130^{0}C and dry to obtain a constant weight for 24 hours. The dish was immediately transferred to a desiccator and allowed to cool for 30 minutes. The resultant weight was taken (W_3). The moisture content was calculated and recorded as a percentage by weight of the respective soil sample (Kalra and Maynard, 1991).

$$Oven\ dry\ soil\ (g) = W_{3-}W_1 \quad (1)$$

$$Moisture\ (g) = W_{2-}W_3 \quad (2)$$

$$WC\ (\%\ by\ weight) = \frac{Moisture\ X\ 100\%}{Oven\ dried\ soil\ (g)} \quad (3)$$

Where WC = water content

*Particle Size Distribution***:** Fifty (50) grams of fine textured air-dried soil sample were transferred into a one L dispersion cup. One hundred (100) milliliters of freshly 0.1M Sodium hydroxide solutions were added to the dispersion cup. After thorough mixing, the mixtures were placed on a mechanical shaker for

4hrs. The mixture will be transferred to a one L measuring cylinder and the volume of the mixture were made up to 1 liter with distilled water. The mixture inside the cylinder was shaken by inversion and the time will be noted. After 40seconds, a hydrometer was inserted into the cylinder and at 5 minutes, the hydrometer scale was read the temperature of the mixture was also noted. The hydrometer was withdrawn, and the process repeated 3 hours later.

Calculation: For every 1°C above 20°C, a 0.36 graduation is added to the hydrometer reading and for every 1°C below 20°C, a 0.36 graduation is subtracted. The correct hydrometer readings are obtained by correcting for temperature and subtracting the blank reading (Onyeonwu, 2000).

$$\text{Silt} + \text{Clay}\ (\%) = \frac{\text{HR}_C \text{ at 40 seconds} \times 100\%}{\text{SW (g)}} \quad (4)$$

SW = sample weight; HR_C = corrected hydrometer reading

$$\text{Clay}\ (\%) = \frac{\text{HR}_C \text{ at 5 hours} \times 100\%}{\text{SW (g)}} \quad (5)$$

SW = sample weight; HR_C = corrected hydrometer reading

$$\text{Silt}\ (\%) = (a) - (b) \quad (6)$$

$$\text{Sand}\ (\%) = 100 - (a) \quad (7)$$

Total Organic Carbon Content (TOC): Air dried soil was passed through a 2 mm sieve in other to remove large particles, roots, organic debris and ensure for consistency. This soil samples were used for both carbon and nitrogen analyses. A weighed amount (1.0g) of prepared soil sample was dispensed into a 250 ml conical flask. Ten (10) ml of Normal Potassium dichromate was added to the flask followed by the addition of 20 ml of concentrated tetraoxosulphate (VI) acid. The flask was shaken for 1 minute and allowed to cool.

Distilled water was then added to the cold solution to make the volume up to 150 ml. Shake the solution and allow to cool. Ten (10) ml of phosphoric acid were added to the solution followed by the pipetting of 1ml of 1% diphenylamine solution (indicator). Titration with 0.5 ferrous ammonium sulphate solution were carried out until there was color change from dark violet to green. A blank determination was carried out for each soil sample (Onyeonwu, 2000).

$$\text{TOC}\left(\frac{\text{mg}}{\text{kg}}\right) = \text{Blank} - \frac{\text{S} \times \text{N}_{FAS} \times 0.03 \times 1.3 \times 100}{\text{Weight of Sample}} \quad (8)$$

Where S = sample; N = normality; FAS = ferrous ammonium sulpate

*Determination of Total Nitrogen***:** The total nitrogen content of the soil samples was determined using micro Kjeldahl digestion and colorimetric method. One gram (1g) soil sample were placed into 30ml Kjeldahl digestion flask. One tablet of a catalyst (Kjeldahl) and 10 ml concentrated H_2SO_4 will be added, and the mixture will be hand shaken to ensure mixing. At completion of digestion, the mixture will be clear and upon removal from the digestion chamber, it was allowed to cool. Then, 10 ml distilled water was added, and the solution was decanted through a filter paper into a 100ml volumetric flask.

The Kjeldahl flask was washed with 2 to 3 small aliquots of distilled water and all the washings was added into the volumetric flask via the filter paper and made up to volume. The nitrogen content of the filtrate was then determined calorimetrically. For colorimetric analysis, a standard nitrogen stock solution was prepared using dry ammonium sulphate and from the resultant 100 ppm nitrogen stock solution, 5, 10, 15, 20 and 25 ppm nitrogen standards will be prepared and, in each standard, 4 ml concentrated H_2SO_4 and 0.95g anhydrous sodium sulphate was added. A blank solution containing no nitrogen standard but having the same quantity of acid and anhydrous sodium sulphate was also prepared. Then, 5 ml of the digested filtrate was pipetted into 25 ml glass flask and 2.5ml alkaline phenol, 1 ml sodium potassium, titrated and 2.5 ml of sodium hypochlorite was added. The mixture was hand shaken, made to 25ml mark with distilled water. The solution was read calorimetrically at 630 nm, using a spectrophotometer.

Available Phosphorus Content: Five (5) grams of the soil sample was weighed and dispensed into plastic bottle. Forty (40) milliliters of the extracting solution (0.03M NH_4F in 0.025 M HCl) was added and shaken the bottle for 1 minute. The solutions were filtered with the aid of a filter paper. The clear supernatant was used for determining the phosphorus content of the respective soil samples. Five (5) milliliters of the supernatant were pipetted into a 100 ml flask. The pH of the supernatant was adjusted to 5 respectively by the addition of 3 drops of p-nitrophenol upon the development of yellow color some drops of 2 M NH_4OH was added until a deep yellow color was developed. Also, 2 M HCl will be added drop wise until the supernatant becomes

colorless, the resultant pH was between 3 and 5. Thirty (30) milliliters of water was added, followed by the addition of 10 ml of ascorbic acid reagent. The absorbance of the solution was read at 660 nm using a spectrophotometer (Model) (Onyeonwu, 2000) and calculated by equation 9.

$$P\left(\frac{mg}{kg}\right) = \frac{\mathrm{I}_R \times \mathrm{CV} \times \text{Extract volume}}{\text{Weight of sample} \times \mathrm{AT}} \quad (9)$$

Where I_R = instrument reading; CV = colour volume; EV = extract volume; AT = Aliquot taken

Determination of Total Hydrocarbon Content **(**THC): Two point five grams (2.5 grams) of the airdried soil sample was dissolved in 10ml of hexane and shaken for ten minutes using a mechanical shaker. The solution was filtered using a filter paper. The absorbance of this solution was read at 460nm with a spectrophotometer using n-hexane as blank. The THC (mg/kg) of the sample was calculated with reading obtained from the spectrophotometer (Akpoveta *et al*., 2011), using the formula below:

$$\mathrm{THC}\left(\frac{\mathrm{mg}}{\mathrm{kg}}\right) = \frac{\text{OD Reading} \times \text{Volume of Solvent Used}}{\text{Weight of soil sample (Kg)}} \quad (10)$$

Minerals (Metals) Analyses: The soil sample were spread on a clean plastic sheet placed on a flat surface and air dried under room condition for 72hrs. The soil was sieved and 5g sample was taken from the sieved soil and put in a beaker. Ten (10) ml of nitric per chloric acid, ratio 2:1 was added to the sample. The sample was digested at 105^{o}C. Five milliliters (5ml) of HCl were added to the digester again and digested for 30mins. The digest was then removed from the digester and allowed to cool to room temperature. The cooled digest was washed into a 100ml standard volumetric flask and were made up to 100ml mark with distilled water. Determination of Iron (Fe), Chromium (Cr), Manganese (Mn), Zinc (Zn), Vanadium (V), Arsenic (As), Mercury (Hg), Lead (Pb), Copper (Cu), Cadmium (Cd) and Nickel (Ni) were carried by aspirating the solution for analysis into the Atomic Absorption Spectrometer (ASS) PG 550 model (Adelekan and Abegunde, 2011).

Extraction of Nitrate, Sulphate and Ammonium Nitrogen from Soil: Ten (10) grams of airdried soil was weighed into a plastic bottle. Fifty (50) extraction solutions (100g of sodium acetate and 30ml of acetic acid in one L of distilled water) were added and the mixture was then shaken with the aid of a mechanical shaker for 30 minutes. The mixture was filtered using a filter paper into a 100 ml volumetric flask. The filtrate was then made up to mark with the distilled water and preserved for nitrate, sulphate, and ammonium nitrogen determination.

Nitrate Determination: Ten milliliters of digest were transferred into fifty milliliter flask; two milliliter of brucine and ten milliliters of concentrated sulphuric acid was added. The mixtures were mixed and allow standing for ten minutes. Stock working standards of 0, 2, 4, 6, 8 and 10 ppm were prepared and treated in similar way. The optical density (OD) of the samples and standard was taken at 470nm (Onyeonwu, 2000) equation 11.

$$\mathrm{NO_{3}}^{-}\left(\frac{\mathrm{mg}}{\mathrm{kg}}\right) = \frac{\text{OD x SR x Color Vol x Ext. vol}}{\text{Weight of sample x Vol. taken}} \quad (11)$$

Sulphate Determination: Ten milliliters of digest were transferred into fifty milliliter flask, five milliliter of water, one milliliter of barium chloride gelatin reagents was added, and the solution was allowed to stand for thirty minutes, and ten milliliter of concentrated sulphuric acid was added. The mixtures were mixed and allow standing for ten minutes. Stock working standards 0, 2,4,6,8 and 10 ppm were prepared and treated in similar way. The optical density (OD) of the samples and standard were taken spectrophotometrically at 420nm.

Calculation:

$$\mathrm{SO_4^{2-}} - \mathrm{S}\left(\frac{\mathrm{mg}}{\mathrm{kg}}\right) = \frac{\text{OD x SR x color Vol x Ext. vol}}{\text{Weight of sample x Vol. taken}} \quad (12)$$

Ammonium Nitrogen Determination: Five milliliters of digest were transferred into fifty milliliter flasks, two and half (2.5ml) milliliter of alkaline phenate, one milliliter of sodium potassium titrate reagent, and two and half (2.5ml) milliliter of sodium hypochlorite (para zone) was added. The solution was shaken. Stock working standards of 0, 2,4,6,8 and 10 ppm were prepared and treated in similar way. The optical density (OD) of the samples and standard were taken spectrophotometrically at 636nm.

$$\mathrm{NH_{4}^{+}} - \mathrm{N}\left(\frac{\mathrm{mg}}{\mathrm{kg}}\right) = \frac{\text{OD x SR x Colour Vol x Ext. vol}}{\text{Weight of sample x Vol. taken}} \quad (13)$$

Potassium, Calcium, Sodium and Magnesium Determination: One gram of oven dried ground soils samples in each case 100cm^3 placed in kjedahl digestion flask, which has been previously washed with nitric acid and distilled water, the samples was subjected to wet digestion (AOAC, 1990) reacted with 2cm^3 of 60% perchloric acid ($HClO_4$), 10cm^3 concentrated nitric acid (HNO_3) and 1.0 cm^3

concentrated sulphuric acid (H_2SO_4), the mixture was swirled gently and slowly at moderate heat on the digester, under a fume hood. It was heated continuously until a dense white fume appears. It was then digest for 15 min, set aside to cool and diluted with distilled water. The mixture will be filtered through the Whatman filter paper into a 100 cm^3 volumetric flask (Sahrawat *et al*., 2002). The blank and the samples were digested in the same way. The concentrations of the metals (Ca, Na, k and Mg) present in the soil were obtained from the calibration plot made with various concentrations of the standard (Sahrawat *et al.,* 2002) and calculated using the equation below:

$$\text{A}\left(\frac{\text{mg}}{\text{kg}}\right) = \frac{\text{Instrument Reading X 100}}{\text{Weight of the Sample}} \quad (14)$$

$$\text{Where A} = \text{any of these metals (Ca, Na, k and Mg)}$$

Soil Samples analysis and analysis of the leaves of Telfairia occidentalis: The individual chemicals and constituents of Hair dressing salon effluent used gas chromatogram with mass spectrometry (GC-MS). The leaves of *Telfairia occidentalis* was also analyzed for the presence of constituents of Hair dressing saloon effluent using hi*g*h performance liquid chromatography (HPLC) This analysis was carried out using the method describe by (Burkhard *et al*., 2001).

Instrumentation and Conditions: Hewlett Packard HP 5890 series II Gas chromatograph equipped with an Agilent 7683B injector (Agilent Technologies Santa Clara, CA, USA), A 30 m, 0.25 mm i.e. HP-5MS capillary column (Hewlett – Packard, Palo Alto, CA, USA) coated with 5% phenyl-methyl siloxane (film thickness 0.25 m) and an Agilent 5975 mass selective detector (MSD) was used to separate and quantify the BPA compounds. The samples were injected in the split less mode at an injection temperature of 300ºC. The transfer line and ion source temperature were 280ºC and 200ºC. The column temperature was initially held at 40ºC for 1min, raised to 120ºC at the rate of 25ºC/min, then to 160ºC at the rate of 10ºC/min and finally to 300ºC at 5ºC/min, held at final temperature for 15 min. Detector temperature was kept at 280ºC. Helium was used as a carries gas at a constant flow rate of ml/min. Mass spectrometry was acquired using the electron ionization (EI) and selective ion monitoring (SIM) mode. A PerkinElmer Gas Chromatograph Model Auto system XL, with Flame Ionization Detector will be used for identification of BPA, phthalate, organotin, alkyl phenol and other cosmetic chemicals by comparison between the retention times of the BPA sample peak and the standard compound. The quantification carried out done by the internal normalization method. An Elite-5 fused silica capillary column (30 m x 0.25 mm i.d. cross bond 5% diphenyl – 95% dimethyl polysiloxane, 0.25 µm film thickness) was used for the GC separation using the following oven temperature program: 150ºC (5 min hold) heating to 250ºC at 3ºC/min and heating to 300ºC at 10ºC/min (5 min hold). The injector temperature was 250ºC. The injection volume was 1.0 µL (n=3) in the split mode (1:50) (Burkhard *et al*., 2001).

Acute Toxicity of Hair dressing saloon effluent on Nitrifying Bacteria: *Preparation of Hair dressing saloon effluent concentration for Toxicity Test:* For the determination of the median lethal concentration (LC_{50}), hair dressing saloon effluent concentrations of 100, 200, 300, 400 and 500 ml/l were formulated by adding (100, 200,300,400 and 500 g) in 1000 ml of Winograsky medium respectively (Ibiene and Okpokwasili, 2011). For the median effective concentration, the following hair dressing saloon effluent concentrations (20, 40, 60, 80 and 100 ml/l.) was formulated by adding (20, 40, 60, 80 and 100 g) in 1000 ml of Winograsky medium respectively. A control experiment consisting of Winograsky medium only was set up (Ibiene and Okpokwasili, 2011).

Nitrifying Bacteria Acute Toxicity Test: Winograsky medium which was fortified by several milliliters of hair dressing saloon effluent (100, 200, 300, 400 and 500 ml/l) and (20, 40, 60, 80 and 100 ml/l) respectively was inoculated with ten milliliters of bacteria (*Nitrobacter* sp.) standard inoculum. They were allowed to stand for an hour for growth, 1 ml of the suspension thereafter were plated from mineral salt media composted with different volumes of hair dressing salon effluent on a non-hair dressing salon effluent composted winograsky agar plate. This was carried out for all the concentrations and repeated for 2, 3 and 4 h interval (Okpokwasili and Odokuma, 1996). This was followed by nitrite determination from the various hair dressing saloon effluent composted mineral salt media after 1, 2, 3 and 4h incubated at room temperature (28+/- 2^{o}C) for 24h. Percentage nitrite utilization for *Nitrobacter* sp. was plotted against the effluent concentration and the median effective concentration (EC_{50}) was determined using the probit analysis. The percentage inhibition of bacteria growth (log survival) will be plotted against test concentration and the median lethal concentration (LC_{50}) value will be determined using the probit analysis. All results were subjected

to the analysis of variance (ANOVA) as reported by (Ferrara *et al.,* 2006).

Acute Toxicity of Hair dressing salon effluent on the Growth and Survival of Earthworms: Four concentrations (50, 100, 150, and 200 ml/4kg) of hair dressing saloon effluent composting soil were prepared using the hair dressing saloon effluent and 20 g of cellulose will be added to the soil as food for the earthworms. A blank (control) containing cellulose, water and a non-hair dressing salon effluent composted soil was also prepared. The distribution of individual earthworms among the test chambers was randomized. Death, weight loss and behavioral symptoms were the criteria used in this test guideline to evaluate the toxicity of hair dressing salon effluent on the earthworms. Each test and control chamber were checked for dead or affected earthworms and observations recorded on 7, 14, 21 and 28 days after the beginning of the test (Bonnard *et al.,* 2009).

Effects of Hair Dressing Saloon Effluent on the Growth and Survival of the Plants: Block design with three replicates was used to assess the impact of hair dressing saloon effluent on the growth and survival of *Telfairia occidentalis*. Garden soil samples was collected from a farm land and will be divided into four (A, B, C, D) 4 kg each and three of them (B, C, D) will be further fortified with different concentrations of (100, 150 and 200 ml/4 kg) of hair dressing saloon effluent to form the hair dressing saloon effluent composting soil, while soil sample A served as the control without hair dressing saloon effluent. The experiment consisted of four (4) treatment, amounting to an aggregate of 4 experimental buckets. Each bucket is of 4 liters capacity and perforated at the base and set out on the field. The treatments were

A = Untreated 4kg composite soil sample (Control), B = 100 ml of hair dressing saloon effluent to 4 kg of soil sample, C = 150 ml of hair dressing saloon effluent to 4 kg of soil sample, D = g200 ml of hair dressing saloon effluent to 4 kg of soil sample.

Each treatment was thoroughly mixed in its allotted bucket at the beginning of the experiment. Percentage germination was observed, the height and Stem growth of the plants was measured using a meter rule for eight weeks.

Plant Growth Analysis: Seed viability test was be carried out prior to planting of the *Telfairia occidentalis* seeds by flotation method. The seeds were grown on the three different concentrations of the hair dressing salon effluent (100, 150 and 200 ml/4 kg) which was formulated using hair dressing salon effluent and on the control garden soil sample which are non-hair dressing salon effluent. Plant growth was determined by monitoring the various growth parameters which are germination, height of the plants per week, number of leaves produced by each plant per week, stem growth which is the size or diameter of the stem per week and the weight of the plant per week also. The leaves of *Telfaira occidentalis* grown was harvested after six months, dried for two weeks and then was used for the determination of the proximate and phytochemical constituent of the plant (Udochukwu *et al.,* 2014a).

Proximate and Phytochemical Screening of Telfairia occidentalis: The three sets of leaves of *Telfairia occidentalis* were collected from the three different concentration (100, 150 and 200 ml/kg) of hair dressing saloon effluent composted soil and one from the control soil sample was air-dried for two weeks, mashed into powder and sieved with mesh of size 0.50 mm. Each of the leaves were dispensed 50 g in 500 ml of distilled water in a liter conical flask. The mixture was vigorously stirred intermittently with a magnetic stirrer and then allowed to stand for 48 hours. It was stirred the second time and filtered through a Whatman filter paper-lined funnel into a conical flask. The filtrate was evaporated at 40^{o}C with a water bath to obtain the solid crude extract. The same procedure was carried out for ethanol extraction except that the crude solid extract was obtained by concentrating the filtrate with a rotary evaporator. All extracts obtained will be stored in a refrigerator until required for use. The extracts of both leaves were analyzed for alkaloids, tannins, glycosides, steroids, flavonoids, saponins, volatile oil and resins using standard procedures. The methods that was used for the test of the phytochemical components were according to (Ogukwe *et al.,* 2004; Trease and Evans, 1996).

Statistical analysis: The data was collected, results presented in figures, tables and graphs. The results will be expressed as mean ± standard error (S.E). The recorded data was subjected to statistical analysis using Statistical Package for Social Sciences (IBM SPSS) Microsoft Excel 2010 (Blunden and Evans, 1990).

RESULTS AND DISCUSSION

The physicochemical parameters of hair dressing salon effluent showed that the Total solid ranged from 3012.8mg/l to 6443.8mg/l which showed high significant($p<0.05$) levels. Whereas other physicochemical parameters (pH ranged from 6.2 to

10.4, Conductivity, ranged from 260us/cm to 460us/cm. TDS ranged from 137.8mg/l 8460NTU. COD ranged from 12700mg/l to 39200mg/l. BOD ranged from 15.9mg/l to 22.3mg/l. S, ranged from 1800mg/l to 2250mg/l. P ranged from 42.49mg/l to 157.54mg/l. Cd ranged from 0.374mg/l to 0.896mg/l. Cr ranged from 0.24mg/l to 0.421mg/l. Pd ranged from 0.865mg/l to1.244mg/l) and were not significant (p>0.05). The results of the physicochemical parameters of soil sample polluted with hair dressing salon effluent showed that of all the parameters (pH, particle size, C, P, N, Ca, Mg, K) investigated, pH ranged from 3.3 to 3.6 and clay ranged from 0% to 5% and was highly significant at P<0.05. Acidity is produced when ammonium containing materials are transformed to nitrate in the soil. (Total Organic Carbon ranged from 0.678mg/kg to 1.097mg/kg, silt ranged from 15% to 17%, Sand ranged from 78% to 85%, TOC ranged from 0.678mg/kg to 1.097mg/kg, P ranged from 1.347mg/kg to 2.291mg/kg. N ranged from 0.18mg/kg to 0.855mg/kg, Ca ranged from 3.14 to 8.73, Mg ranged from 6.11mg/kg to 40.37mg/kg and K ranged from 148.65mg/kg to 315.38mg/kg) and were not significant (p>0.05). The total heterotrophic bacterial count of effluent and soil showed that THBC effluent ranged from 0.010±0.00cfu/ml to 333.3±147.3cfu/ml and soil ranged from 16±3.27cfu/g to 680±86.4cfu/g, which did not show any statistical difference (P > 0.05). However, the fungi count for soil which ranged from 4.67±1.70 to 11.33 ±1.25cfu/g revealed high statistical significance (P < 0.05). While the total fungal count for effluent ranged from 1.67±1.25 to 93.67±4.64cfu/ml and was not statically significance. This implies that there was significant variation observed in all the count obtained from all the sampling point (1-6), except for total fungal count for soil which ranged from 4.67±1.70cfu/g to 11.33±1.25cfu/g.

Result of Salon effluent utilizing bacteria and fungi counts of hair dressing salon effluent and soil polluted with hair dressing salon effluent. The effluent utilizing bacteria ranged from 0.00 to 91.33±8.99cfu/ml and fungi count of hair dressing salon effluent ranged from 0.00 to 14.33±11.5cfu/ml also, soil polluted with hair dressing salon effluent ranged from 22.67±4.99 to 333.33±49.89cfu/g and did not show statistical significance (P> 0.05). This implies that there was significant variation observed in all the count, obtained in all the sampling point (1 to 6).

Result of total Nitrosomonas and Nitrobacter counts of soil polluted with hair dressing salon effluent. The total Nitrosomonas and Nitrobacter count of soil polluted with hair dressing salon effluent showed Nitrosomonas and Nitrobacter count ranged from 0.00 to14.67cfu/ml and 0.00 to 46.67cfu/ml respectively, which did not show any statistical significance (P > 0.05). This implies that there was significant variation observed in all the counts obtained in all the sampling point (1 -6) In characterization of fungi isolate, some of these were the possible fungi isolated: *Apergillus fumigertus. Apergillus niger, Aspergillus parasiticus, Mould spp, Mucor spp, Aspergillus ochraceous, Yeast, Aspergillus flavus.*Result of the effect of hair dressing salon effluent on the growth and survival of *Telfairia occidentalis*. The seeds were planted at different concentration of effluent. Here it showed that the number of first cotyledon and % seed germination ranged from 0-3% and 0-100% respectively and were highly significant (P < 0.05) for week one and two for all concentration considered when compared to the control, whereas week three, showed range from 1-3% first cotyledon and 33.3- 100% seed germination and there was no statistical significance recorded, when compared to the control, whereas at week three, there was no statistical significance recorded. This implies that concentration (50 to 200mg/kg) influenced the number of first cotyledon and % seed germination at week 1 and 2 but there was no influence of concentration (50 to 200mg/kg) at week 3.

Table 1: Physicochemical parameters of soil samples polluted with hair dressing salon effluent

Parameters	**Unit**	**Station 1**	**Station 2**	**Station 3**	**Station 4**	**Station 5**	**Station 6**	***P-values***
pH	-	3.6	3.6	3.6	3.5	3.4	3.3	0.000
particle size								
Silt	%	16	16	16	16	17	15	1.000
Sand	%	81	81	81	81	78	85	0.862
Clay	%	3	3	3	3	5	0	0.000
Elements								
Total Organic Carbon	mg/kg	0.718	1.097	1.057	0.838	0.698	0.678	0.102
Phosphorus	mg/kg	2.225	1.347	2.291	2.021	2.156	2.156	0.827
Nitrate	mg/kg	0.398	0.484	0.226	0.855	0.18	0.995	0.872
Calcium	mg/kg	4.58	8.73	6.11	5.95	7.58	3.14	0.986
Magnesium	mg/kg	40.37	35.64	6.11	21.28	31.18	22.43	0.480
Potassium	mg/kg	275.43	315.38	275.16	248.26	268.28	148.65	0.872

Table 2: Physicochemical parameters of hair dressing salon effluent

Parameters	Unit	Station 1	Station 2	Station 3	Station 4	Station 5	*P-values*
pH	-	6.2	10.4	10	9.8	10.3	0.452
Conductivity	µS/cm	260	340	380	340	460	0.648
T.D. S	mg/l	137.8	180.2	201.4	180.2	243.8	0.641
Total Solid	mg/l	3012.8	6630.2	6201.4	4780.2	6443.8	0.002
Suspended solid	mg/l	2875	6450	6000	4600	6200	0.311
Turbidity	NTU	3330	8460	7620	6500	8450	0.164
Chemical Oxygen Demand (COD)	mg/l	12700	39200	34400	37700	31400	0.408
BOD	mg/l	15.9	22.3	19.8	20.9	18.1	0.618
Sulphate	mg/l	1125	2250	2125	1800	2050	0.552
Phosphate	mg/l	42.49	80.84	99.64	93.25	157.54	0.791
Cadmium	mg/l	0.453	0.896	0.374	0.752	0.511	0.791
Chromium	mg/l	0.24	0.421	0.145	0.401	0.27	0.113
Lead	mg/l	0.865	1.244	0.783	1.054	0.877	0.690

Table 3: Total heterotrophic bacterial and fungi counts of hair dressing salon effluent and soil polluted with hair dressing salon effluent

S/N	$THBC_{effluent}$ $\times10^4$cfu/ml	$THBC_{soil}$ $\times10^4$cfu/g	$THFC_{effluent}$ $\times10^3$cfu/ml	$THFC_{soil}$ $\times10^3$cfu/g
1	333.3±147.3	93.33±49.9	93.67±4.64	5.67±0.47
2	26.67±18.86	426.7±99.8	8.33±1.25	4.67±1.70
3	0.790±0.52	440±65.3	9.67±6.02	7.33±3.86
4	0.020±0.01	16±3.27	8.33±2.05	7.33±2.05
5	0.010±0.00	680±86.4	1.67±1.25	11.33±1.25
6	-	17.33±4.99	-	5.67±1.70
P-value	0.206	0.056	0.234	0.001

Values are means ± standard deviation, THBC: total heterotrophic bacteria count, THFC: total heterotrophic fungi count effluent utilizing bacteria and fungi counts of hair dressing salon effluent and soil polluted with hair dressing salon effluent.

Table 4: Total *Nitrosomonas* and *Nitrobacter* counts of soil polluted with hair dressing salon effluent

S/N	TNSC $\times10^5$cfu/ml	TNBC $\times10^5$cfu/ml
1	0.00	46.67
2	14.67	29.33
3	0.00	34.67
4	0.00	37.33
5	0.00	40.00
6	0.00	0.00
P-value	0.363	0.962

Values are means ± standard deviation, TNSC: total Nitrosomonas counts, TNBC: total Nitrobacter counts

Table 5: Phenotypic characterization of fungal isolates

Code	Description on agar plate	Possible isolates
FF21	Velvety to flaky surface with gray-green color. Hyphae is septate	*Aspergillus fumigatus*
FF1	Velvety to flaky surface due to marked sporulation with black colour spot white colonies. Hyphae is septate	*Aspergillus niger*
FF21	Velvety to flaky surface due to sporulation with gray-green colonies. Hyphae is septate	*Aspergillus fumigatus*
FH1	White flaky surface, hyphae contains conidiophores	*Mold* spp.
FA2	Flaky surface with greenish coloration. Hyphae is septate with branching of mycelium	*Aspergillus parasiticus*
FF12	Initial color was white, become gray, brown in time with fluffy colony. Hyphae is septate with conidiophore	*Mucor* spp.
FFA21	Fluffy brownish color colony. Hyphae is non-septate	*Aspergillus ochraceous*
FG12	Fluffy white with brown Centre. Hyphae is non-septate	*Aspergillus flavus*
FC1	Sticky light brown colony that dry up with time. Hyphae is septate with pseudo hyphae	*Yeast* spp.

Table 6: Acute toxicity of earthworms exposed to varied concentration of hair dressing salon effluent composite

	Week 1				
Parameters	**Control**	**50 ml/kg**	**100 ml/kg**	**150 ml/kg**	**200 ml/kg**
Weight (g) 1	2.762±0.52	2.09±0.91	1.678±0.40	2.026±1.15	2.064±1.25
Weight (g) 2	2.148±0.82	2.648±0.97	2.002±0.49	1.87±0.58	1.788±0.76
Length (cm) 1	17.6±4.89	14.78±5.66	9.600±0.96	10.36±4.40	12.2±4.62
Length (cm) 2	17.16±7.04	16.52±5.06	14.12±4.09	9.86±4.26	11.6±4.05
	Week 2				
Weight (g) 1	2.414±0.87	2.53±0.91	1.914±1.27	0.948±2.12	1.716±1.60
Weight (g) 2	2.866±0.45	2.742±2.55	1.966±1.29	0.000	0.000
Length (cm) 1	19.44±8.29	15.6±5.24	9.24±6.08	2.9±6.48	10.28±9.42
Length (cm) 2	18.48±5.65	12.8±11.70	9.68±6.58	0.000	0.000
	Week 3				
Weight (g) 1	2.150±0.68	1.988±1.82	1.406±0.72	0.806±1.80	0.000
Weight (g) 2	2.320±0.95	1.798±0.48	2.142±0.87	0.000	0.000
Length (cm) 1	14.540±4.60	17.820±17.59	10.700±6.29	4.600±10.29	0.000
Length (cm) 2	18.480±5.99	14.040±4.49	13.900±7.58	0.000	0.000
	Week 4				
Weight (g) 1	2.285±0.78	1.316±0.91	1.338±1.33	0.748±1.67	0.000
Weight (g) 2	2.312±0.47	2.072±1.90	1.578±1.02	0.000	0.000
Length (cm) 1	20.540±9.06	12.680±9.38	11.100±11.29	3.900±8.72	0.000
Length (cm) 2	17.320±6.15	13.900±13.44	9.600±6.79	0.000	0.000
P-value (weight)	0.533	0.152	0.486	0.093	0.092
P-value (Length)	0.529	0.505	0.538	0.058	0.082

Mean concentration were obtained from 5 replicate earthworms; all values in mean ± standard deviation; values in zero are indicating complete death of 5 worms in each group

Table 7: Effect of hair dressing salon effluent on the growth and survival of *Telfaira occidentalis*

Planting Time	**Conc.**	**No. of first cotyledon**	**% seed germination**	**No. of leaves**	**Plant colour**	**Length of stem (cm)**
Week 1	Ctrl 1	0	0	0	0	0
	50mg/kg	2	66.7	0	0	0
	100mg/kg	0	0	0	0	0
	150mg/kg	1	33.3	0	0	0
	200mg/kg	0	0	0	0	0
	Ctrl 2	0	0	0	0	0
	50mg/kg	0	0	0	0	0
	100mg/kg	1	33.3	0	0	0
	150mg/kg	1	33.3	0	0	0
	200mg/kg	1	33.3	0	0	0
p-value		0.024	0.024	-	-	-
Week 2	Ctrl 1	3	100	5.00±0.58	Lemon green	45.00±5.68
	50mg/kg	3	100	4.00±1.15	Lemon green	20.50±6.05
	100mg/kg	2	66.7	4.00±1.15	Lemon green	22.00±6.37
	150mg/kg	3	100	4.00±1.15	Lemon green	25.00± 2.36
	200mg/kg	0	0	0.00	0	0.00
	Ctrl 2	2	66.7	4.00±1.15	Lemon green	42.00±15.72
	50mg/kg	3	100	6.00±0.00	Lemon green	43.00±0.58
	100mg/kg	0	0	0.00	0	0.00
	150mg/kg	3	100	6.00±0.00	Lemon green	66.50±5.25
	200mg/kg	3	100	7.00±2.08	Lemon green	58.00±18.56
p-value		0.07	0.07	0.213	-	0.125
Week 3	Ctrl 1	3	100	13.00±0.58	Green	>100
	50mg/kg	3	100	10.00±1.15	Green	>100
	100mg/kg	3	100	7.00±0.58	Green	>100
	150mg/kg	3	100	10.00±0.58	Green	>100
	200mg/kg	1	33.3	0.00	-	>100
	Ctrl 2	2	66.7	6.00±1.73	Green	>100
	50mg/kg	3	100	9.00±1.00	Green	>100
	100mg/kg	3	100	11.00±1.53	Green	>100
	150mg/kg	3	100	21.00±1.00	Green	>100
	200mg/kg	3	100	9.00±1.73	Green	>100
p-value		0.373	0.373	0.818	-	-

3 seeds per setup, $p<0.05$ was significant compared to the control

Hair dressing salons are integral to modern society contributing to personal grooming and aesthetics. However, the chemical used in hair treatment and waste generated during these processes can find their way to water bodies, leading to potential ecological consequences. The salon effluent contains a complex

mixture of chemical and pollutant that can have detrimental effect on aquatic ecosystem and organism residing within them.

The result from this study showed various physicochemical parameters analyzed. The physicochemical parameters of soil sample polluted with salon effluent revealed that all parameters assayed, pH showed high level of acidity which ranged from 3.3-3.6 and was highly significant. It falls below the WHO acceptable limit (6-9) for wastewater to be discharge into the environment (WHO, 2004). Clay ranged from 0% to 5% which also showed high significant level ($P < 0.05$) reason being that they were drawn from the same population. Silt and sand ranged from 15-17% and 78- 85% respectively and were not significant ($P > 0.05$). The TOC ranged from 0.678 to 1.097mg/kg P, N, Ca, Mg and K where not significant $P>0.05$, while a variety of nutrient are required for microbial growth the two-nutrient required in largest stoichiometric ratio and relative to the contaminant are N and P (macronutrient). Trace nutrient (micronutrient such as K and Mg are also required for microbial growth). The commonly used electron acceptor is molecular oxygen, although nitrate, sulphate and other compounds have been used (Bouwer and chaney, 1974.)

The physicochemical parameters of hair dressing salon effluent showed that the pH of all the analyzed sample was all alkaline the lowest pH was recorded at station one with value 6.2. The highest pH was recorded at station 2 with a measured value of 10.4. The alkaline wastewater could be because of the bleaching agent and chemical, such as NaOcl, hair relaxer (which are mainly from sodium hydroxide), surfactants, hair dye and sodium phosphate used in the beauty process. The pH value (6.2-10.4) recorded was within the World Health Organization (WHO) acceptable limit (6.00-9.00) for wastewater to be discharged into the environment (WHO 2004). Electrical conductivity is the ability of any medium, water in the case to carry an electric current. The lowest and highest EC value was recorded for station I and station 5 samples with value of 260 and 460 us/cm respectively. TDS are the inorganic matters and small amount of organic matter, which are present as solution in water. The recorded TDS value fell below the WHO acceptable limit of 2000. This result is in line with the one observed by Atuanya and Tudararo-Aherobo (2014).

Turbidity is a measure of suspended particles in water system and normally correlates significantly with microbial load (Obi *et al*., 2007) turbidity under study varied from 3330 NTU (Owa-ekei) to 8460 NTU (Efeizomor). The high turbidity of the salon wastewater 8460NTU could be due to large number of volatile organic compound such as (LiOH), formaldehyde, neurotoxin sulfate, (Tsigonia *et al*, 2010). The value of turbidity recorded fell high above WHO acceptable limit of (5 NTU) for wastewater discharge. The high turbidity of salon effluent wastewater could be due to large number of components including several VOCs. The COD values 12700 to 39200mg/l fell above permissible limit of 250mg/l recommended by WHO (2005). BOD is the measure of the concentration of biodegradation substances in the wastewater. The BOD ranged from 15.9 to 22.3mg/l with highest value in Efeizomor and the lowest Owa-Ekei. The BOD value fell below the acceptable limit of 50mg/l recommended by the WHO (2004). This could be due to environmental stresses and other immune induce factors. Sulphate concentration of this study ranged from 1125 to 2250 was higher than the WHO permissible limit of 5mg/l, Phosphate with value 42.49 to 157.54 was equally higher than WHO permissible limit of 5mg/l. The phosphate level in this study was higher than that observed by (Atuanya *et al*, 2020). This could be attributed to phosphate containing shampoo and conditioner used in these salons also other organic and inorganic compound present in dissolve or particulate form. Chromium and lead value 0.240 to 0.421 and 0.865 to 1.2440 fell below the permissible limit of 50 and 10 respectively. Total heterotrophic bacteria count for effluent (THBC effluent). Mean count ranged from 0.010 ± 0.00 to 333.3 ± 147.3 with lowest and highest value from station 5 and station 1 respectively and THBC soil mean ranged from 16 ± 3.27 to 680.1 ± 86.4 with lowest from station 4 and highest from station 5. THFC effluent ranged from $1.67 + 1.25$ to 93.67 ± 4.64 with lowest and highest value from station 5 and highest station 1 respectively. THFC soil mean ranged from 4.67 ± 1.70 to 7.33 ± 3.86 with lowest to highest value from station 4 and station 3 respectively. They were not statistically significant.

This implies that they were significant variation observed in all the count except for total fungal count for soil which was significant ($P< 0.05$). The mean salon effluent utilization bacteria count ranged from 0.00 to 91.33 ± 8.99 with lowest and highest value from station 5 and 1 respectively. The SEUFC mean count ranged from 0.00 to $14.33 \pm 11.5 \times 10^2$ cfu/ml. The result from the nitrifying bacteria Table 4 showed mean Nitrosomonas count ranged from 0.00 to 14.67×10^5 cfu/ml. TNBC mean count ranged from 0.00 to 46.67×10^5 cfu/ml. They did not show any

statistical difference (P>0.005). This implies that there was significant variation observed in all the counts obtained in all the sampling point. Although both bacteria many have similar cell wall morphology as gram negative rod /Odokuma and Oliwe, 2003) the difference in response of these bacteria to salon effluent concentration could be due to genetic difference and enzyme composition (Udochukwu *et al*., 2017). As shown in Table 5b the following fungi isolate were identified which include. *Aspergillus fumigatus, Aspergillus niger*, *Aspergillus ochraceous*, mold spp, *Aspergillus parasiticus*, mucor spp, *Aspergillus flavus*, yeast spp. The research study of Hansel *et al.,* 2018 analyzed the use of *A. niger* as an efficient means of protein waste bio conversion while working on olive mill. Karlen *et al.,* 1997 also demonstrated the utility of fungal sp via *A.flavus* , *A. niger* in the treatment of pharmaceutical waste (Table4. 5b). The result from the earthworm bioassay also revealed few death of earthworm in 150ml/kg and 200ml/kg group which ranged from 0.000 to 2.026 $\pm$1.15g (weight) from 0.0000 to 10.36 $\pm$ 4.40cm (length) from 0.000 to 2.064 $\pm$ 1.25g weight and from 0.000 to 12.2 $\pm$ 4.62cm length respectively when compared with control varied concentration of hair dressing salon effluent composited revealed no statistical difference (P> 0.05). This implies that the concentration of hair dressing salon for the study 50mg/kg to 200mg/kg did not influence the length and the weight of the earthworms. Karten *et al.,* 1997 observed that the presence of effluent in earthworm led to significant stabilization of sludge by enhancing the reduction of volatile suspended solids. Earthworms in wastewater can transform insoluble organic material into soluble form.

The findings from this research showed effect of hair dressing salon effluent on the growth and survival of *Telfairia Occidentalis*. It was observed that the number of first cotyledon and % seed germination ranged from 0-3 and 0-100% respectively and were highly significant (P<0.05) for week 1 and 11 for all the concentration when compared to the control. Week 3 showed ranged from 1-3 first cotyledon and 33.3 – 100% seed germination and there was no statistical significance recorded when compared to the control. This implies that concentration (50 to 200mg/kg) influence the number of first cotyledon and seed germination at week 1 and 2 but there was no influence of concentration (50 to 200mg/kg) at week 3. A similar work was done with cowpea by Tindell, (1983) it was observed that the hair dressing salon effluent had no negative effect on germination of maize seed which may be attributed to the pH of the effluent which was within favorable range of germination. GC-MS of mixed composite revealed that the peak no/retention time of the five different locations which include: Okobi, ranged from 2.91 to 18.793min, Onyeibe ranged from 5.672 to 17.428min Convent, 4.854 to 18.804min, Owa-Ekei, ranged from 9.034 – 17.428min and Efeizomor, ranged from 4.409 to 17.425min.the possible dictated compound were the following: 3 methyl pentane, 7 Hexadecane (Z), undecanal, methyl cyclopentane, Fumaric acid, Cyclopentasiloxane, Ethanol, Cyclotetradecane, Stannane etc. Screening test for bacteria isolate revealed that several isolates were identified it includes: *Escherichia coli, Bacillus cereus, Enterococcus faecalis, Bacillus sp, Pseudomonas sp, Proteus mirabilis, Nitrosomonas, Nitrobacter*. The result shows that at day one *Pseudomonas* (SSF62) has the highest optical density of 5nm and the lowest was *Nitrosomonas* (Win1A21) with OD of 0.2nm, At day 2 *Proteus mirabilis* (SSF12) had the highest value of OD of 2.7nm, while the lowest was *Nitrobacter sp* (Win2B1) with OD of 0.1nm Day 3 revealed there was significant increase of all the isolates but *Bacillus cereus* (SEUB2) had the highest OD of 3.7nm and *Bacillus sp* (SSF42) had the lowest OD of 1.5nm

Conclusion: The study showed the effect of salon effluent composted soil, on earthworm *Apporectoda longa* and *Telfairia occidentalis*. The research generally showed the acceptable limit of wastewater. The presence of E coli indicating fecal pollution and posing a threat of poisoning when contaminated seafood is consumed. More so, the result obtained from this study suggest that autotrophic transformation of nitrifying bacteria and earthworm which enhances soil fertility may be hindered in an ecosystem polluted with hair dressing salon effluent, as nitrifying processes will be reduced.

Declaration of Conflict of Interest: The authors declare no conflict of interest.

Data Availability: Data are available upon request from the corresponding author

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