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Assessment of the Relationship between Hair Salon Effluent and Groundwater Quality in OBIO/AKPOR LGA, Port Harcourt

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Abstract: *Hair beauty salon is one of the most common endeavors embarked upon by women in the bid to making a living. The proliferation of hair beauty salon generates wastewater with constituents that are harmful if allowed to percolate to ground water untreated. To examine the constituent of salon waste water and its extent of contamination of ground water, samples of salon waste water and ground water was collected within 50 meters of salon location from 30 beauty hair salons and borehole using sterile 250ml bottles. Samples were analyzed for dissolved oxygen, turbidity(mg/l), potassium, nitrate(mg/l), chemical oxygen demand (mg/L), biochemical oxygen demand (mg/L), total dissolved oxygen (mg/L), conductivity (µ(s/cm), temperature (°C), and pH. From the analysis using the students t test, it was revealed that there is significant difference between the samples pH, Conductivity, BOD, COD, Nitrate, DO, TDS and Turbidity levels. From the test of relationship it was revealed that there is high relationship between the conductivity level of salon waste water and the borehole water at p value 0.01 which is less than .005 critical values. Therefore chemicals utilization in salon waste water do not seeps in to the ground water of surrounding environment.*

Keywords*: Salon, proliferation, percolate, borehole, environment*

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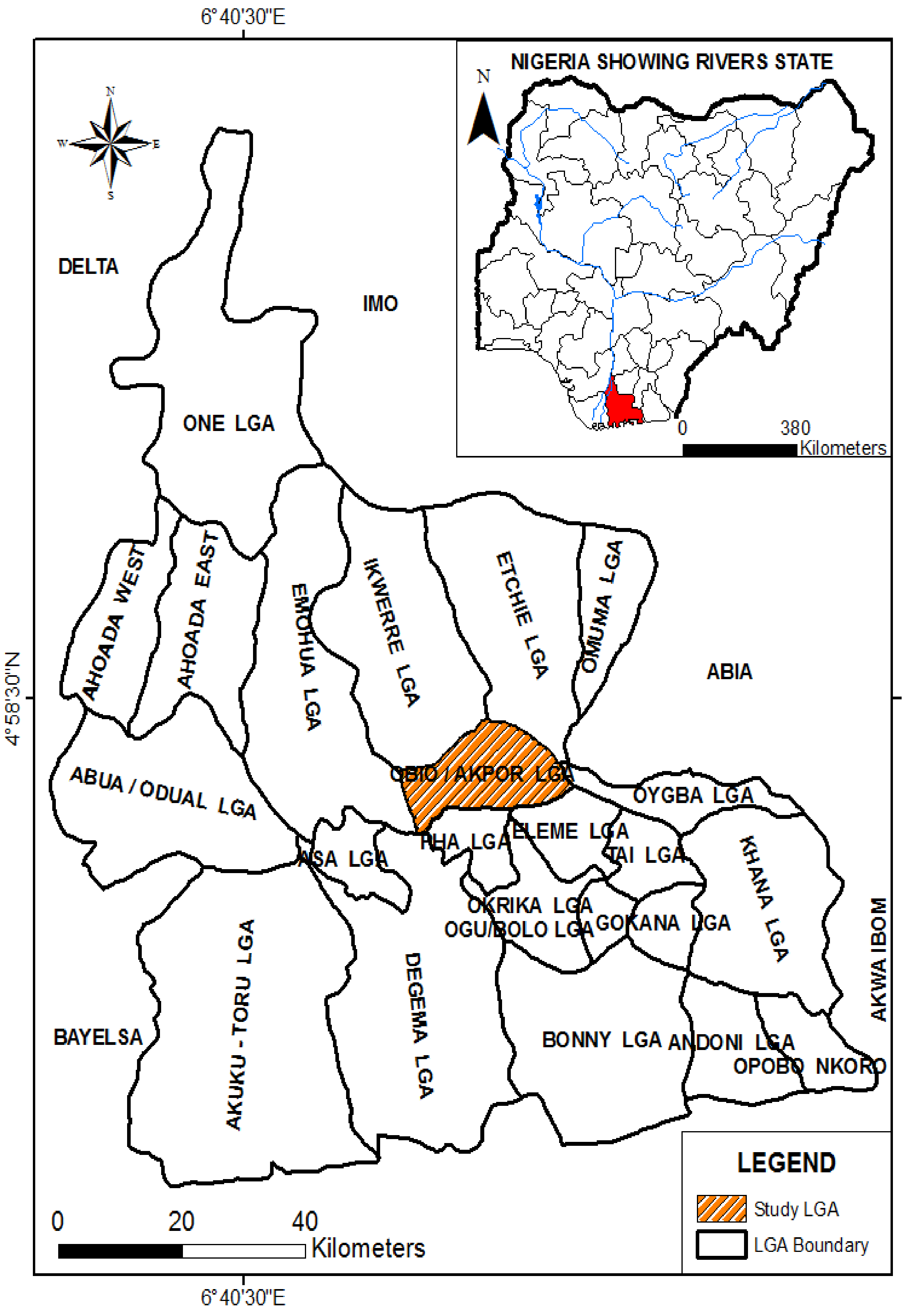
I. Introduction

A major problem in Nigeria has been the management of waste, its adequate treatment alongside its flow. This problem is not restricted to Nigeria alone but is also a major problem in most countries that are undergoing the process of development, which do not treat wastewater management as a priority on their list. When human influence has affected water quality negatively, it is termed wastewater. Examples of waste water are discharges from institutions, small and large scale industries, commercial properties, domestic residences, etc. Generally, wastewater is usually classified on the basis of specific contaminants, physical characteristics, organic contents and bulk (Damelle, 1995). The United Nations Environmental Programme (UNEP) as well as other bodies, have made great effort in respect to reducing the problem of pollution in the world today. An average hair beauty salon generates wastewater each day. The diversity of biological and chemical sources in the waste water could mean a lot of chemical and biological components in their assorted products t are washed into the soil or poured down the drain.

Most hair beauty salon wastewater generated effluent enters directly in a septic system if channeled. The waste generated by salon is usually collected in plastic containers which are emptied in to the artificial drainage systems (gutters). When this waste water is channeled in to the dug septic tank made of concrete, it makes sure that the bacteria population naturally found there has got enough time to dissolve as well as breakdown the chemical and organic wastes which are found in the septic tank. Liquid chemical waste which is already in the dug waste tank flows into the soil's system by infiltration which is replaced by further waste water runoff. In this process, it eventually seeps into the soil which underlines that area, and there will be more degradation of the liquid waste that was treated partially by the micro-organisms that live in the soil. The leftover compounds and solids usually stick firmly to particles of soil. The final treatment stage of effluents is marked by the combined natural interaction and process of soil micro-organisms found in the septic system. Improper functioning of the septic system brings about a discharge of waste water that is highly untreated and in large volumes, discharged to the soil directly, and this is just atop the ground water supply. Therefore, the possibility of contaminated ground water will be increased if the septic system does not have the ability to degrade or dilute wastewater that is being received or when there is a direct flow of effluents without any added treatments whatsoever through the soil. Possible substances that can contaminate the soil or water which is found in waste water are chemicals used in the salon, nutrients (phosphorus and nitrogen), and pathogens (organisms which cause diseases such as viruses and bacteria). Most chemicals which are situated in septic systems have their origin from hair beauty salons, products from households and so on which are poured down in an improper form as well as when the recommended concentrations on the label of the product to be used are exceeded. Some products used in the saloon, for example, nail polish removers, cosmetics, shampoos, solvents and solvent-based products poured down the drain pose risk to the environment as they contain metals, including cadmium, chromium, silver, zinc and chemicals that may cause contamination to ground water. When chemicals which are in large volumes with concentrated pollutants are released into the septic tanks they become toxic in concentration to the beneficial bacteria which normally breaks down the wastewater. Hence, there is a flow of waste water, unchanged from the septic tank to the groundwater which eventually contaminates it. Products which are used for personal care, some of which contain heavy metals such as lead (Pb) washed down the drain are often a part of the sludge found at the base of these septic tanks. These eventually seep into the surrounding soil and groundwater. This is because a lot of these substances do not break down with ease neither do they mix with water even when many days of retention have been recorded in the septic tank. This then results to percolation into the soil by these unchanged chemicals, through the septic tank. Conferences, both local and international conferences have been held in this regard. The 1992 Rio de Janeiro conference is one of such international conference that has been held to this effect (Oyesola, 1998). Anthropogenic daily businesses and functions still go a very long way to affect the environment negatively in various sections of the world. Negative effects on mans' health, destabilisation of the balance of the ecological system, eutrophication of natural water bodies and transmission of disease by water-borne pathogens, are all resultant effect of these anthropogenic source of pollution (Chikere and Okpokwasili, 2004). More pollution problems could come out of the formation of brand new tips for beautification and satisfaction of the population which increases everyday. Meeting the demands of the increasing population as well as the creation of cutting edge products has become the vague in recent times. A broad spectrum of products and services for hair and skin are made available in today's world for example make over applications, skin treatments, manicure, tanning, hair styling etc. For these services to be provided, generation of waste will be part of the process. In the majority of incidences the septic system receives the waste, where it may have negative impact on the environment (Bowers, Cole, & Hoffman, 2002). Various ways of treating waste have been designed because of conservation and public health which brings about pathogen destruction as well as the organic compounds being mineralised before discharging into the sewer system. An example of a method is the usage of granular sludge reactor in the anaerobic wastewater treatment (Boadi and Kuitunene, 2003). Even in the presence of establishments such as the Federal Environment Protection Agency (FEPA) which was established since the year 1998, the flow of waste water which is not treated into the environment is still a major problem in not just Nigeria alone, but many other developing countries in the world today. Removing biochemical oxygen demand (BOD) or sediment loads, changing the physical condition of the water for example, electrical conductivity, pH etc, by the removal of toxic organic pollutants and heavy metals are other considerations for treatment. There have been a number of scientific researches on the effects of solvents in groundwater, household waste water, and septic tank effluent. Frequent observations were made for the effluents leaving the septic tank, for solvents present in the waste water, irrespective of the quantity. A research was carried out in Canada, Ontario precisely, which looked at the transport and fate of commercial plumbing cleaner, which is solvent based through a septic system. The standards set in Canada for drinking water was exceeded even though 99% of dichlorobenzene which is the active ingredient was degraded or volatized. Therefore, this study seeks to investigate the impact salon wastewater on soil and ground water quality in Port Harcourt metropolis with the aim of examining saloon waste water impact on groundwater in Port Harcourt Metropolis, determine the composition of the liquid waste water generated by hair salons in the study area and examine the extent to which groundwater is contaminated by beauty hair salon wastewater in Port Harcourt metropolis.

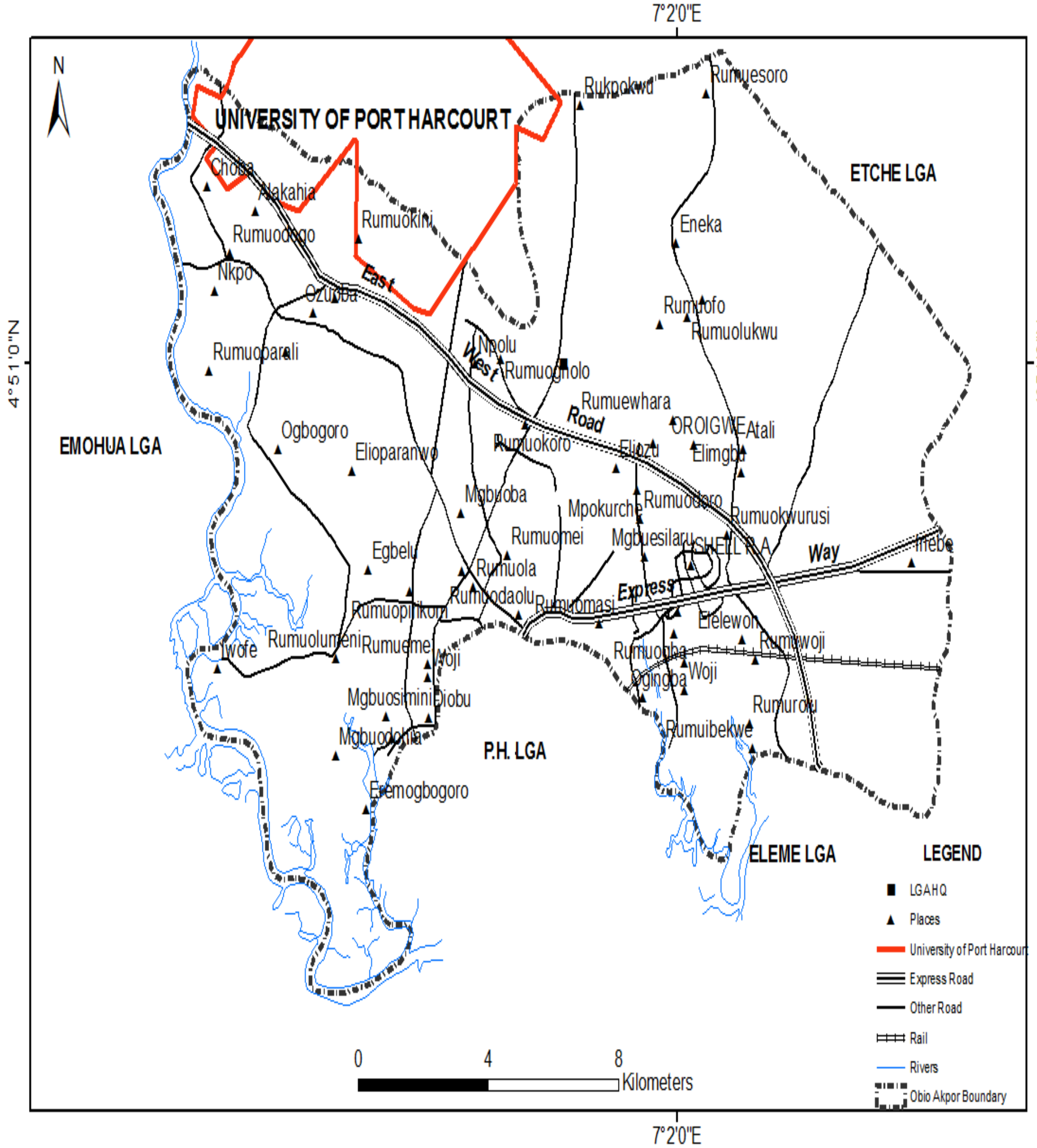
II. Study Area

The Metropolis of Port Harcourt is situated in Nigeria, in the south-southern part of the Niger Delta. It covers a stretch within latitudes 4^0 44' 58.888''N and 4^0 56' 4.625'' through longitudes 6^0 52' 7.231''E and 7^0 7' 37.749''E. Port Harcourt began humbly as a settlement where fishing was dominant having a populace of about five thousand persons. Currently, the metropolis engulfs three Local Government Areas namely: Eleme, Obio Akpor and Port Harcourt. From the Atlantic Ocean, its distance is about 66kilometers, and it is on a firm ground. At the beginning, the limit of the city was from new layout market to UTC junction. Due to the fast rate of urbanisation and industrialization, as well as the growth in commerce in the city since in the 1960s, there has been expansion which has included other settlements which were at its outskirts.



Source: Ministry of Land & Housing, Rivers State

Figure 1. Rivers State Showing Study Area



Source: Ministry of lands & Survey, Rivers State

Figure 2. Study Area showing Communities

III. Relief And Drainage

The study area is undulating. This means that, it has lowlands and highlands which characterize the location. In dominance is the low-lying coastal plain, belonging to the classification under the recent Niger Delta sedimentary formation, having its elevation as 15.24meters (Oyegun, 1999). The rivers in this area have a low flow of velocity due to the gentle slope which the low relief in the area possesses. This results in the creation of rivers meanders that are well developed. The Port Harcourt landform is a horse shoe-like spur which projects into the low lying swamp. Towards the north of the state, gently rolling plain is seen but towards the south, sand bars, mud flat and swamp tidal basin predominate that area (Umeuduji and Aisuebeogun, 1999). It could be said though, that the entire state possesses gentle rolling coastal plain sandbars**.** The coastal lowland controls the drainage in the region structurally. The pattern of the rivers is dendritic though the tributaries branch irregularly, at any angle and direction. The likelihood of finding them on sedimentary rocks is high. Though it has been said that the pattern of the rivers in the study area is dendritic, it is worthy of note that it categorically does not fit into a typical trellised or dendritic drainage pattern. There are many creeks and lakes which flow into the Atlantic Ocean, criss-crossing the entire area (Umeuduji and Aisuebeogun, 1999).

IV. Climate and soil

Wind and pressure systems in Nigeria are two in number. One has got its origin from the subtropical high pressure cell. The cells of which are referred to as anti-cyclones, known for generating and driving the southwest and northeast trade winds. The former brings in wetness or rains to the area while the latter transports the hamerttern winds blowing through the sahara desert. February through November marks the rainy season in the region while November through February marks the dry season in the Port Harcourt region. Inter-tropical convergence zone (ITCZ) and inter-tropical discontinuity (ITD) are the meeting points of the two winds on land and ocean respectively. There is abundance of sunshine in the study area due to the close proximity to the equator. Due to the thick cloud cover in the location, there is a reduction to a great effect, in the amount of solar radiation that is received by the region at the surface. This also induces slight annual, monthly and diurnal variation in the temperature of Port Harcourt metropolis over 33^0c.

Soil formation in the region is a function of climate, organism, relief, parent material and time. The surface soil is made up of different types of surficial deposit overlaying thick layer of tertiary sandy and clay deposits which have depth often over 100 meters.

Temperature

The sunshine is abundant in the region because of its favourable position to the equator and it is also found in the equatorial region. 280c marks the mean yearly temperature having its lowest temperatures in January, and the highest in July

Land Use and Population

The 1976 satellite imagery which was drawn showed the vegetal cover and the land use of the area. The built up area and environs accounted for 16.25Km^2 .in 1995, a more recent version of the imagery were digitized and it showed the value of the built up area as 282.25Km^2 accounting for an increase of over 17 times in about 20 years (Oyegun, 1999). This clearly shows that the area experienced an exceptional increase. For example, a region generates trip or traffic based on the activities in the area and how intense they are, and how activities are attracted to the center and the difficulties of journeying to the center. The 2006 census gave the population figure of the study area as 324,204 females and 369,212 males totaling 703,416 persons (NPC, 2006).

Socio Economics of the Study Area

The Industrial potentials of the study area have continued with her policy of attracting entrepreneurs by offering those incentives such capital allowances, provision of Industrial Estate and many others. Also the location of mega Industrial projects such as petrochemical, Liquefied Natural Gas Industries gave the LGA a bright future for Industrial activities as a wide range of raw materials from agricultural and mineral resource are available. These raw materials from agricultural and mineral resource include Oil palm, Rubber, Cassava, Fruits and Vegetable, Fisheries, Timber and Crude oil. In addition, the LGA agricultural resource potential quickens industrial development in agro – allied, textile industries resulting in the influx of people to the study area increasing their patronage of beauty hair salon. This has lead to the proliferation of beauty hair salon in the study area varying products for hair making as shown in figure 3 and plate 1.

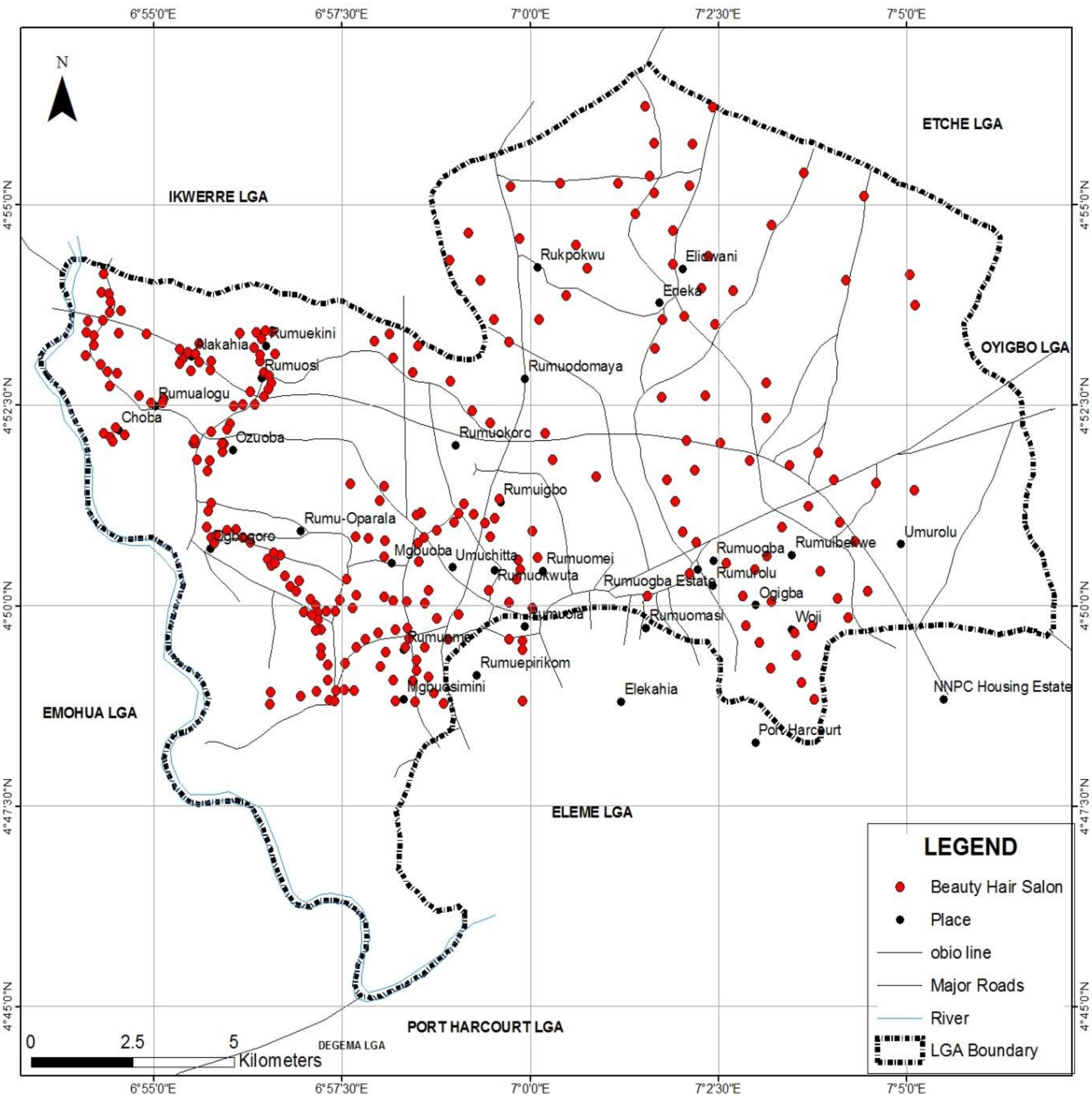


Figure 3: Location of Beauty Hair Saloon in the Study Area

These are products used as hair conditioner by salonist. The products include Nail polish and contain chemicals such as Dibutyl Phthalate. Hair hardeners and strengtheners contain chemicals such as Toluene. Hair extension glue contains chemical like Styrene. Wave solutions contain chemicals such as Glyceryl thioglycolate. Hair bleach contains chemicals such as Ammonium perulfate while nail polish and hair glue remover contain chemicals such as Acetone, Acetonitrile and isopropyl acetate. These chemicals were noticed to have an impact on the quality of water through seepage also the presence of Phthalate and these other chemicals in an environment could create exposure rate in manners that endanger children chewing and crawling (Schleyer, Ranner and Miihlhausen 1991; Thuren, 1998).

Plate 1: Variety of Products used in Hair Beauty Saloon

V. Empirical Review

As far back as the 20th century, it was evident that heavy metals were toxic to the microorganisms found in the soil. Since then, a lot of researches have been done to establish the relation of heavy metals to their toxicity and the findings of metal toxicity on for microbial assays. The majority of these researches have been carried out on a short term basis relatively in which metal salts are added to soil at intervals and the measurement of the effects take place in the laboratory. There results to a broad disparity in the concentration of metals and the occurrence of effects that are toxic (Baath, 1989; Giller, Amijee, Brodrick, and Edje, 1998).

The soil's community of microbes has resulted in a reduced diversity in Rhizobium due to the long exposure effect of metal toxicity. This is caused by sewer sludge which was applied in time past which caused one strain of Rhizobium only to survive in the soil that was contaminated (Giller et al, 1998). Witter, Giller, McGrath, (2000) did a study on soils from the sludge from sewage which have been exposed to long term experiment. This was done in Braunschweig, at the Federal Research Centre for Agriculture, in Germany. The findings revealed structural changes in the microbes, diversity and an increased tolerance for metals in both narrow and broad subsets of the community of the microbes.

Lind and Karro, (1995) carried out studies investigating the probability of storm water contaminants in a run off polluting the groundwater when it gets to the aquifer. There has been the focus on contaminants in soils and their concentrations which bring about polluted storm water infiltration.

Fred (2002) characterized hair beautification salons for the aim to regulate their system of disposing their waste. In New Jersey, samples of sludge and waste water were fetched from sewers in beauty parlors located there. This was done so that the resulting effect of the discharge on the quality of ground water and the environment can be considered. For a suite of the chemical parameters of concern, the total number of beauty parlors sampled was eight. The EPA standard which applies to the sample characteristics was sure to be followed. A certified laboratory carried out the analysis of the sample. Findings Reviewed from the analysis of facilities in the beauty parlors in the target population showed that liquid waste fell into the group which bore a characteristic feature as a bit more "industrial strength" than typical domestic waste.

Christopher and Bright analyzed in Benin, the physiochemical and bacterial features of hair beauty parlors of contaminated soils. Five hair beauty parlors were sampled from different places around the study area. The study showed that for all samples at temperature remaining constant at 28.3°C, 180.00 mg/l and 208.00 mg/l, were values gotten for the maximum values of biological oxygen demand at Ekenwan and chemical oxygen demand at Ugbowo respectively. The bacterial count on the average was from 3.52 x 103 to 6.86 x 103 cfu/gm. Isolated microorganisms were S. aureus which occurred most, Klebsiella sp., Bacillus sp., Escherichia coli, Pseudomonas aeruginosa and Staphylococcus aureus.

Transportation of Pollutant

Transport phenomena in soils generally show a tremendous dependency upon the degree of saturation (Fredlund, 1993). When the surface of the soul is saturated, most elements found in salon waste water could be dissolved and hence percolate in to the ground water passing through the soil pore spaces. This is achieved by the reduction in the quantity of pore water making the transport way become effectively reduced. Simultaneously, a new transport path emerges by the increasing pore gas content. Many dissolved substances prefer only one of these two transport paths, depending on their solubility in water and their vapor pressure (Atkins, 1993). Therefore, for one special matter, there will be dramatic changes in total permeability of a soil during changing saturation.

The dewatering process of a soil, on the one hand depends upon the acting physical conditions such as temperature and moisture (absolute values as well as their gradients in time and surrounding space). Distance from groundwater level, depth below the ground surface and climatic conditions are indicating and generating these conditions. On the other hand, some properties of the soil are very important for drying-wetting processes. These are mainly the pore-size distribution which dominates the capillary forces and capillary water content as well as the inner grain surface, which is responsible for the amount of adsorbed water.

Environmental Management and Sustainable Development

It is observed that most beauty salons spatially located in the study area are not served by sanitary sewers. From personal observations, some salons in the study areas collect their liquid wastes in buckets and discharge them into drainage setup or different types of sub-surface disposal setup as shown in plate 2 and 3. Presently, very meager knowledge was in existence as regards the conceivable risk which has to do with the waste water generated by the beauty parlors. The personnel of the enforcement unit of the New Jersey Department of Environmental Protection in the year 1992 started a scheme in which eighth parlors for beauty were sampled to determine the properties of the aqueous waste which these beauty parlors generate and providing a standard with which they will be regulated. These conclusions were drawn based on what was found out during the course of the research. These are the summary of the policies which are used to regulate beauty parlors in New Jersey which are:

- Hair/beauty parlor business possessors inspired to make use of materials that are not toxic and hazardous while avoiding using perms, bleaches and dyes for hairs when it flows on site for example, a septic tank.
- Industries should endeavor to create goods that are non-hazardous so as to enable salon possessors to get approval to get their septic systems with ease.
- Sewage disposal authorizes parlors for beautification, giving a benchmark of sewer systems as 120 gallons per day per sink which the local health department approves. Salons that have in excess of fifteen (15) sinks will have the limit exceeded; hence, they are required to secure a permit for “discharge to ground” water requiring monitoring.
- In this regard, big systems will require permits while small ones will be regulated by the local authorities.

The implementation of approaches to curb the effect of hair beauty salon waste discharge into the environment is necessary to ensure environmental quality

This research work examines the effluent discharge from beauty hair salon and the impact they have on receiving soil in order to enact policies to regulate the management of effluent discharged from hair beauty salon in Nigeria

Septic Systems and Groundwater Pollution

Improper functioning of septic systems can cause large amounts of waste water discharged to the bare soil and that it is not treated, which can make the ground water unclean. The exposure of the contamination of groundwater is increased when the ability of the septic system is exceeded, it will lose its degrading ability. This will cause a flow of effluent to the soil without it being treated.

On the other hand, when the system functions adequately, the soil will stop the survival of pathogens and trap them, because the conditions will not be favourable for them to exist there. Bacteria that are beneficial functions adequately and produces ammonia after changing it from nitrogen. Before nitrogen is gotten, phosphates are changed from phosphorus, all these done by organisms in the soil. Plants make use of nitrates. Nitrates can dissolve in water and when they do, they infilterate into the soil, reaching the ground water. This is then consumed by man, an unhealthy choice for *Homo sapiens* when the concentrations are high. Septic tank contains chemicals that come from the house, products for personal care that are not discarded properly, flow into these tanks and they become concentrated, exceeding recommendations, causing toxicity. This could cause contamination to the groundwater and also damage the septic tank. This can also kill the microorganisms which live in the soil's leach field. Whenever a chemical passes the leach field, contamination of ground water is expected. Such water could cause harm to property, vegetation, animals and of course, humans.

Evidence of Metal Toxicity to Soil Microorganisms

It has been complex to emphasize getting relationships that are quantitative for the concentration of metals in soils and its toxic effects. In the field, it is assumed that metals accumulate for a while and are not so soluble when compared to the analysis in the laboratory, where these metals are highly soluble and the quantity added to do the analysis are high. The results from the laboratory are taken to be worse than what is obtainable in the field. The concentration is also disputable. Much recently, analyses have shown that the concentration on fields is lesser than that in of the laboratory (Dahlin, Witter, MÍrtensson, Turner, and Baath, 1997). The possibility may be due to the change in the diversity and structure of the soil's community of microbes over a long time. This will not be considered in a short term study.

Method of Data Collection

Samples of salon wastewater were collected directly from 30 selected shops in the study area. Effluent samples were collected with 250ml bottles which are sterile. Thereafter, they were kept in coolers which contain ice and were conveyed to the laboratory where analysis was carried out. The effluents were sampled for dissolved oxygen, turbidity (mg/l), potassium, nitrate(mg/l), chemical oxygen demand (mg/L), biochemical oxygen demand (mg/L), total dissolved oxygen (mg/L), conductivity (μ(s/cm), temperature (°C), and pH.

Physicochemical Analysis

The hair salon effluent samples that were determined are dissolved oxygen, turbidity (mg/l),potassium, nitrate(mg/l), total dissolved solids (TDS), chemical oxygen demand (mg/L), biochemical oxygen demand (mg/L), total dissolved oxygen (mg/L),conductivity (μ(s/cm),temperature (°C), and pH. The effluent analysis will be in line with wastewater and water testing standards. After calibration and stabilization at 0.0μ.scm-1 of the conductivity meter, it will be used to test for conductivity while Jenway 2030 pH meter will be used to read pH. The filter paper will be measured then the filter paper with the residue which was also measured. The difference between the two gave value for the total suspended solids. The APHA (1998) determined the biochemical oxygen demand, using the method of open reflux. The method of phenol-di-sulphoric acid was used to determine the level of nitrate. Dissolved oxygen was analyzed using the method of meter and probe. Determination of potassium was done with corning flame photometer IV using lithium as a reference filter (APHA, 1998).

Findings

The physiochemical parameters derived from the various samples across communities in Obio-Akpor of Port Harcourt Metropolis in Rivers State. The parameters were derived from the samples of salon waste water and borehole.

From the analysis of the results of the parameters collected from the field see table 4, and tested, the composition as a result of the mixing of chemicals for hair dressing in the salon waste water and possible seepage into the neighbouring borehole water shows the following ph mean value of 5.85 for salon waste water and 6.68 for borehole water.

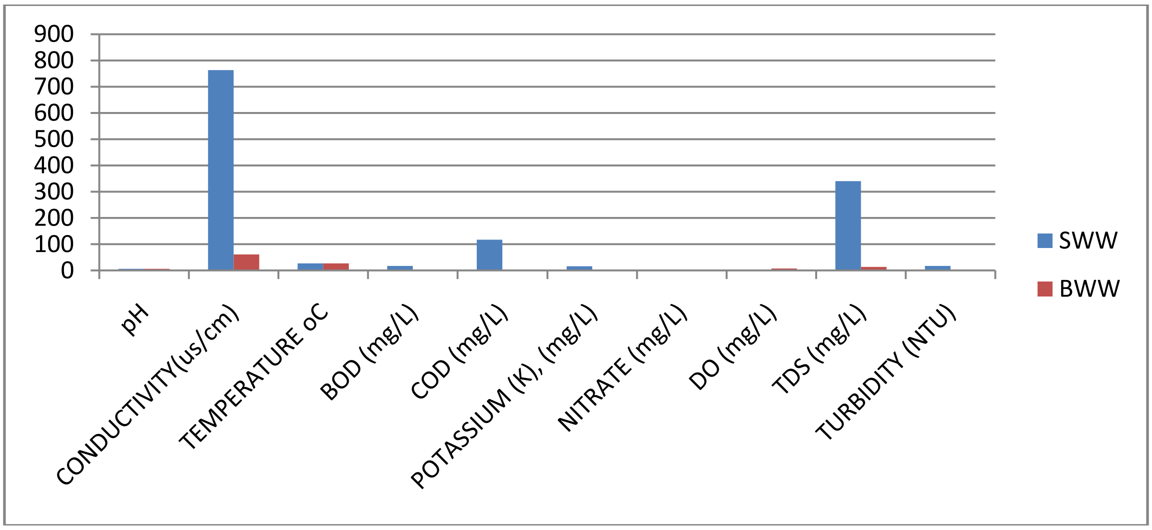


Figure 4 Mean Results from Waste Water and Borehole Sample Analysis

From the analysis, is obvious that salon waste water recorded high levels in conductivity, COD and TDS with very minimal values for borehole waste water.

Table 1 Summary Statistic of the Study Parameters

S/N	Tested Parameters	Mean of Salon Waste Water	Standard Deviation	Mean of Borehole Water	Standard Deviation	Number of Cases
1	pH	5.85	0.27	6.68	0.19	30
2	CONDUCTIVITY(us/cm)	762.8666667	203.7	60.8	38.6	30
3	TEMPERATURE oC	27	0.0	27	0.0	30
4	BOD (mg/L)	16.816	5.10	0.32	0.34	30
5	COD (mg/L)	117.36	48.0	0.43	0.44	30
6	POTASSIUM (K), (mg/L)	16.15066667	3.3	0	0.0	30
7	NITRATE (mg/L)	1.479666667	0.3	0.036	0.04	30
8	DO (mg/L)	0	0.0	7.57	0.70	30
9	TDS (mg/L)	340.355	106.3	13.82	13.7	30
10	TURBIDITY (NTU)	17.56566667	2.27	0.04	0.0	30

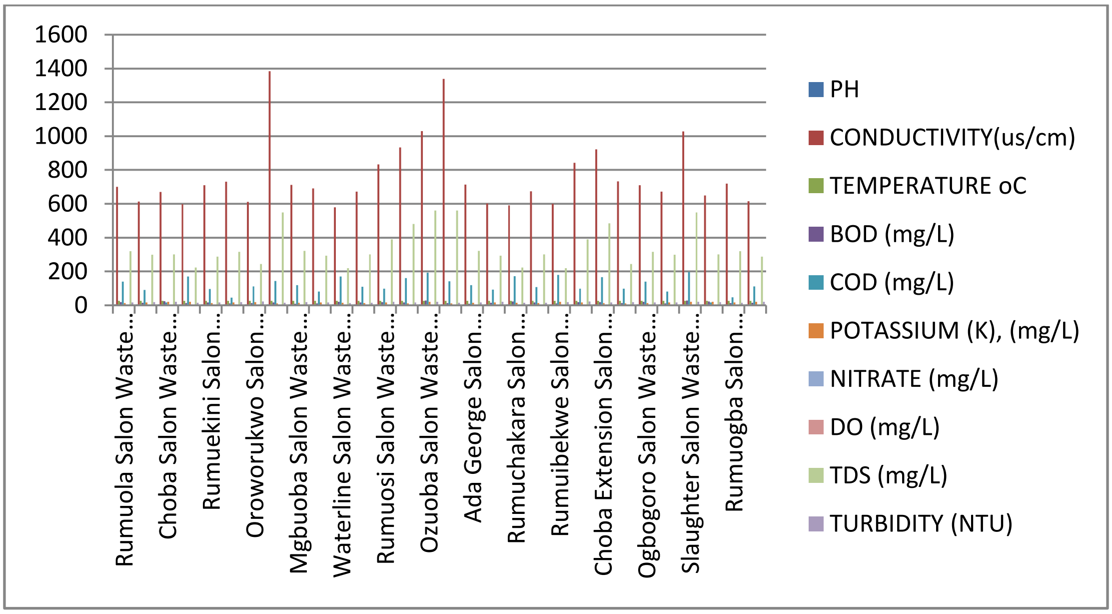


Figure 5 physiochemical parameters of Salon Waste Water Sample

From the analysis of samples, it is obvious that the most noticed parameter present in the sampled waste water is conductivity followed by pH and finally COD as shown above in figure 5. Oroworukwo is most recoded highest values followed by Ozuoba and finally Choba salon waste water.

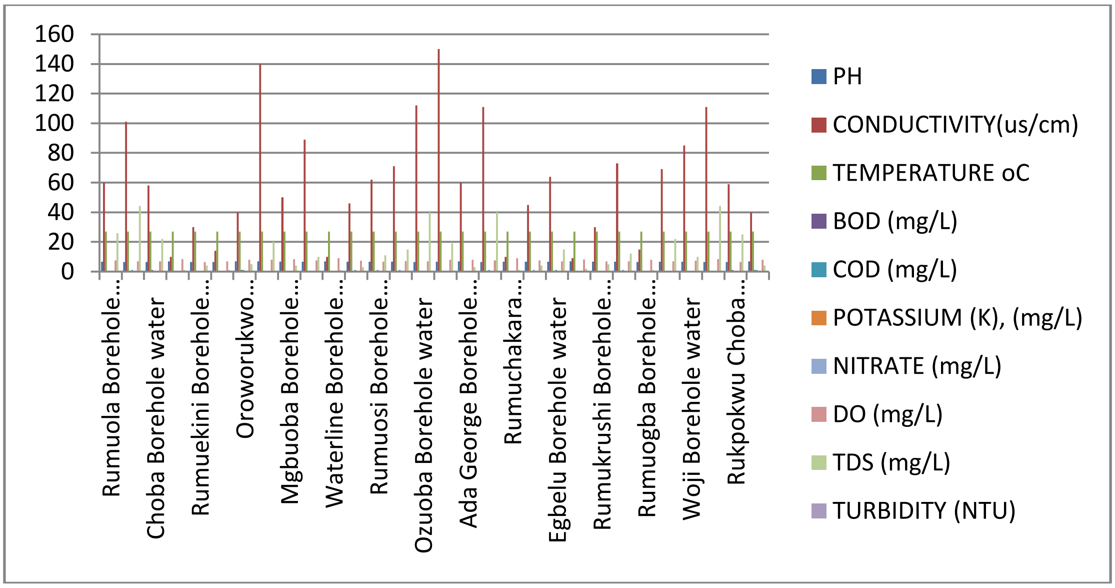


Figure 6 physiochemical parameters of Borehole Water Sample

From the analysis of samples of borehole water, it is obvious that the most noticed parameter present in the sampled waste water is conductivity followed by pH and finally COD as shown above in figure 6. Wimpey is most recorded highest values followed by Iriebe and finally Rumudumya and Woji salon waste water.

From the analysis of results presented in figure 7, the physiochemical analysis for waste water and borehole samples shows that the mean value for pH in salon waste water is 5.85 with Rumuekini, Iriebe and Wimpey having the highest pH values of 6.2 and Choba having the lowest pH value of 5.1 while the mean pH value of borehole water sample is 6.68 with Oroworukwo, Iriebe, Ada George and GRA recording the higest values of 7 and Rumuekini, Rumuodumaya, Slaughter and Rukpokwu recording the lowest values of 6.4. The value of ph that is tolerable is placed at 7. This is because ph value below is termed acidic while value above is alkaline. The presence of value below 7 in borehole water results in the acidity of the water, on the other hand, values of ph above 7 for borehole water makes the water alkaline. This is because ph makes for the corrosivity, hardness of water.

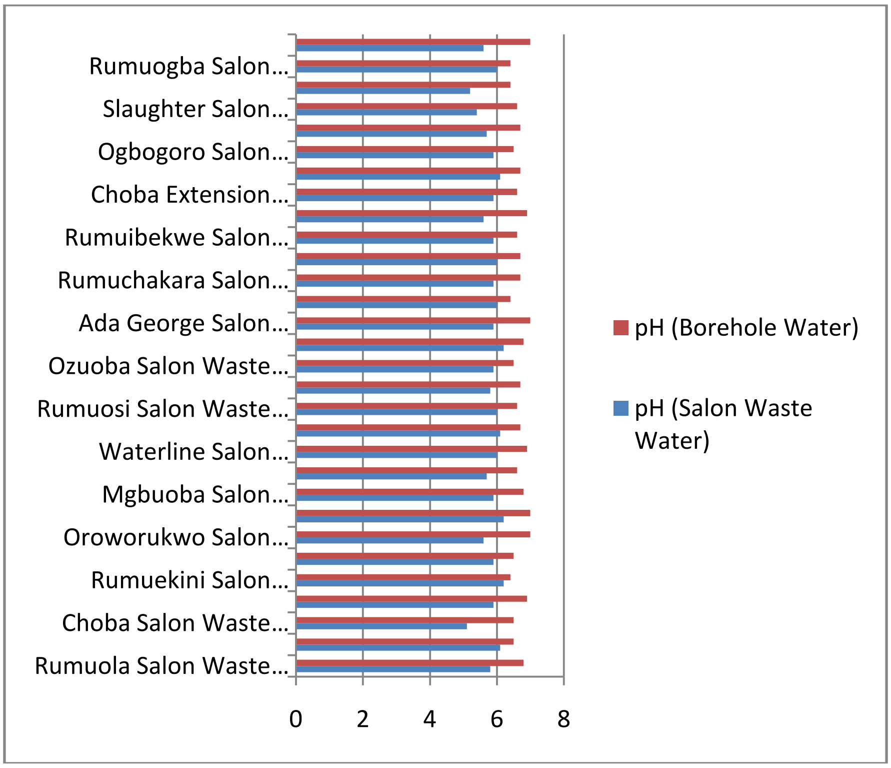


Figure 7 pH values in Salon Waste Water and Borehole water

From the figure 8 which shows the result of conductivity test with a mean value of conductivity in the sampled salon waste water as 762.86us/cm with the highest value of 1385us/cm noticed in salon waste water retrieved from hair beauty salon in Iriebe and lowest value of 580us/cm noticed in salon waste water derived from waterline beauty salon. From the analysis of result derived from the samples of borehole water within the beauty hair salon, it gave a conductivity mean value of 60.8 with the highest occurrence value of 150 in Wimpey and the lowest value of 9.0 occurring in Rumuibekwe. Conductivity shows the ability of the borehole water to accommodate electric current, determined by the level of ions and their mobility, oxidation, and temperature. So when conductivity level in water becomes high such water will not support life. The biological oxygen demand analyzed from the samples gives a value of 16.81mg/l with the highest value of 29.17mg/l as noticed from salon waste water samples derived from hair beauty salon in Ozuoba and lowest value of 9.3mg/l recorded in salon wastewater sample retrieved from a hair beauty salon in Mgbuoba. On the other hand, sample analysis derived from borehole water samples gives a mean value for biological oxygen demand at 0.32mg/l with the highest value occurring at Oroworukwo and Choba while the lowest value of 0mg/l occurring at Slaughter, Rumuogba, Choba Extension, Rumuibekwe, Rumuchakara, Ada George, Ozuoba, Rumuokoro, Waterline, Mgbuoba, and Rumuadalu. The quantity of oxygen required and utilized by microbial activities in the borehole water is measured as biochemical oxygen demand. Therefore, the unit of biochemical oxygen demand in the borehole determines the drinkability of the water.

The physcio chemical analysis of parameters present at the sampled salon waste water in relation to borehole water reveals that there is a difference significantly between the both sample values. This difference do not imply any form of relationship between the parameters of the salon waste water and the borehole water

VI. Results And Discussion

The analysis of samples derived from hair beauty salon waste water and that of borehole around the sampled salon at 50 meters radius shows that the discharges from salon waste water do not have any significant impact on the borehole water utilized by the people at 50- meter radius from the salon. Ten physcio chemical parameters were measured in both the salon waste water and the borehole. The result derived from the measurement reveals that all parameter measured had variation/difference between the salon waste water and the borehole water in pH, Conductivity, BOD, COD, Nitrate, DO, TDS, Turbidity. When tested for the relationship between the variables presence in the salon waste water and that of the borehole it is revealed that except for conductivity which shows a level of similarity with levels present in the salon waste water and the borehole when compared using the Pearson Product Moment Correlation Analytic tools all other parameters revealed a weak relationship between variables in salon waste water and the borehole. This outcome cannot be tied to seepage from salon waste water because other parameters present in the salon waste water were significantly different from the concentration level at the borehole. To this end, it could be said that other factors which include industrial activities (industrialization) could result in the level of conductivity in the borehole water. This agrees with the findings of Christopher and Bright (2011) analyzed the bacterial and physio chemical properties of hair salon in Benin metropolis, Nigeria, that salon waste water have no significant impact on the borehole of the surrounding environment. From this finding, the researcher attributed the discovery to the fact that most salon operating in the study area channel or pour their waste water into the gutter or artificial drainage which is channel to the stream and finally rivers around the vicinity. Going by this trend there is little or no tolerance for waste water percolation or seepage into recharging ground water with the aid of precipitation rather the volume of receiving rivers and streams makes for a little impact of the chemical composition of salon waste water on recharging ground water and finally borehole.

VII. Conclusion

From the analysis of the impact of discharge from salon waste water in the study area, and the test of samples for parameters, it is discovered that salon waste water does not seep into the borehole waters rather other industrial activities in the study area could have contributed and influenced borehole water. Though, despite the result of the test for the relationship reveals that there was no significant relationship between salon waste water parameters and the bore hole except for conductivity.

Recommendation

From the result of the analysis which shows that the salon waste water discharge does not necessarily impact on ground water attempts should also be made to treat salon effluents before disposal as it would help reduce organic and inorganic substances present in the borehole water which serves as drinking water for the people.

References

[1]. Atkins, M.J. (1993). Theories of learning and multimedia applications: An overview. *Research Papers in Education, 8*(2)
[2]. APHA (1998). Standard methods for the Examination of water and wastewater. 16th Ed. American Public Health Association New York.
[3]. Baath E., (1989) Effects of heavy metals in soil on microbial processes and populations. Water and Soil Pollutyion Impact factor Journal. Research gate review
[4]. Boadi K. O., and Kuitunene M., (2003) municipal solid waste management in Accrametropolitan area of Ghana
[5]. Bowers F., Cole K., Hoffman I., (2002) Fred Bower Characteriszing Beauty Salon Waste for the purpose of regulating onsite disposal system. Department of Environmental Protection, New Jersey
[6]. Chikere G., C. Okpokwasili and O. Ichiakor (2009) Characterization of hydrocarbon utilizing bacteria in tropical marine sediments African Journal of Biotechnology Vol. 8 (11)
[7]. Dahlin S., Witter E., MÍrtensson A.M., Turner A.,Baath E. (1997). Where's the limit? Changes in the microbial properties of agricultural soils at low levels of metal contamination. Soil Biology and Biochemistry, 29
[8]. Damelle H. (1995) Chose appropriate water treatment technologies in Chemical Engineering.
[9]. Delwyn G. F. (1993) An Overwiew of Unsaturated Soil Behaviour. Geotechnical Engineering Division/ASCE, Dallas Taxas
[10]. Fred B. (2002) Characterizing Beauty Salon Wastewater for the Purpose of Regulating Onsite Disposal System, New Jersey Department of Environment Protection, Division of Water QualityGiller K. E, Amijee F, Brodrick S. J, Edje O. T. (1998) Environmental constraints to nodulation and nitrogen fixation of *Phaseolus vulgaris* L. in Tanzania II. Response to N and P fertilisers and inoculation with *Rhizobium.* African Crop Sci. Journal volume 6
[11]. John J. S., Ann T, L., Kalpana P., (2004) Water Treatment Notes, Lornel cooperation extension, college of human ecology, Newyork
[12]. Lind, B. B., and Karro, E. (1995). Stormwater infiltration and accumulation of heavy metals in roadside green areas in Göteborg, Sweden, *Ecological Engineering*, Vol 5
[13]. NPC, (2006) Nigeria Population Commission Census Result
[14]. Oyegun C. U. (1999) in Port Harcourt Region, paragraphics, Port Harcourt
[15]. Oyesola D, (1998) Protection and Control of the Environment Polities and International Environmental Regulations. Daily Graphic Publications
[16]. Schleyer, R., Renner, I. & Miihlhausen, D. (1991) Impact of airborne organic contaminants on groundwater quality). WaBoLu-Hefte 5/1991,
[17]. Umeuduji J. E. and Aisuebougun (1999) in Port Harcourt Region, paragraphics, Port Harcourt
[18]. Witter E., Giller K.E., McGrath S.P. (2000): Toxicity of heavy metals to microorganisms and microbial processes in agricultural soils: a review. Soil Biol. Biochem., Vol 30

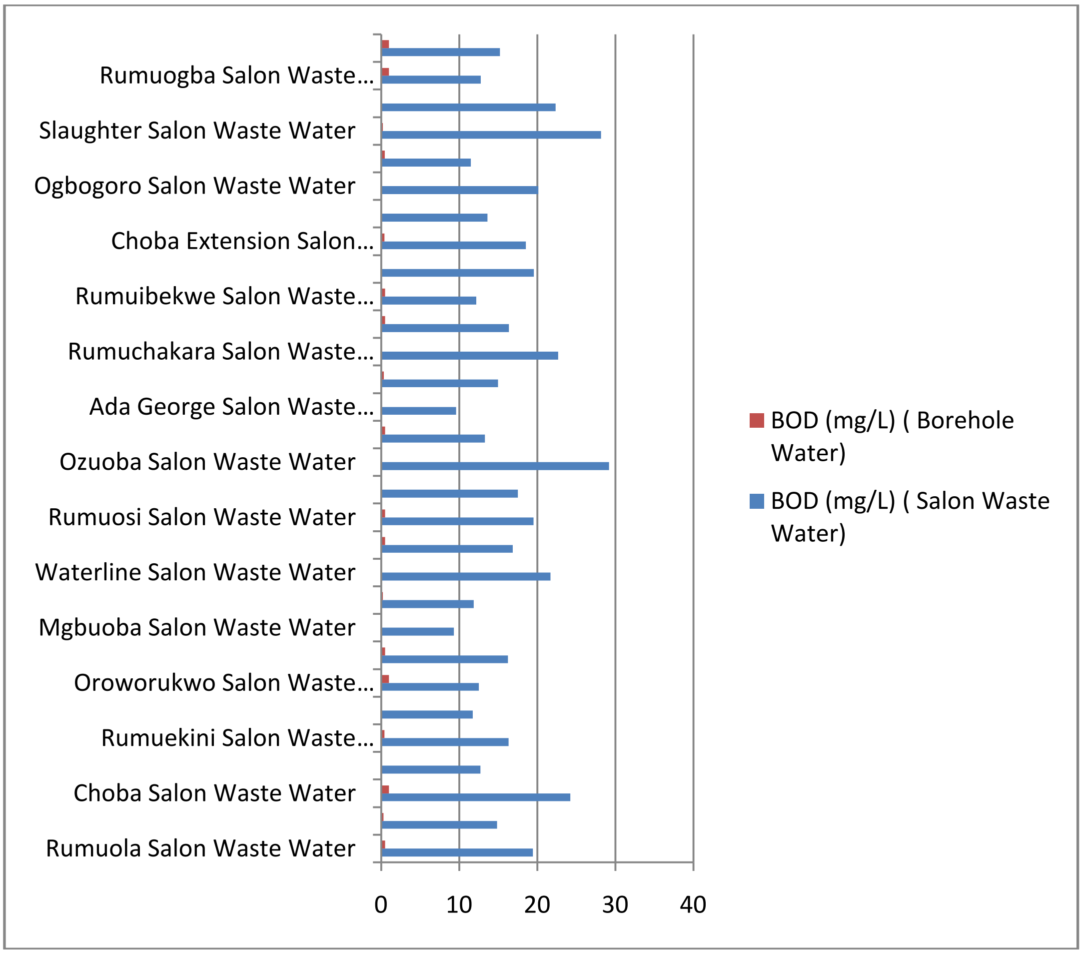


Figure 8 BOD value in Salon Waste Water and Borehole water

From the table 4.8 showing result from the sample analysis for Chemical Oxygen Demand with a mean value of 117.36mg/l as derived from sampled salon waste water. COD shows a highest value of 196.22mg/l in waste water derived from hair beauty salon in Slaughter axis of the study area and a lowest value of 17.3mg/l in salon waste water retrieved from hair beauty salon in Rukpokwu (appendix 4.8). While from the analysis of borehole water, the mean value 0.43mg/l was recorded for COD with a highest value of 1mg/l occurring in sampled water retrieved from communities as Rumuigbo, Oroworukwo, Ngolo, Rumuosi, Rumuokoro, Rumuodumaya, Owhipa, Egbelu, Choba Extension, and GRA. Lowest values of 0mg/l for Chemical Oxygen Demand noticed in samples from Rumuola, Choba, Rumudalu, Alakahia, Mgbouba, Ada George, Rumuchakara, Rumubiekwe, Rumuogba, Slaughter, and Rukpokwu. Chemical oxygen demand helps to understand the level of organic pollutants or compounds in the water or waste water. This implies that COD is very useful in the measure of water quality.

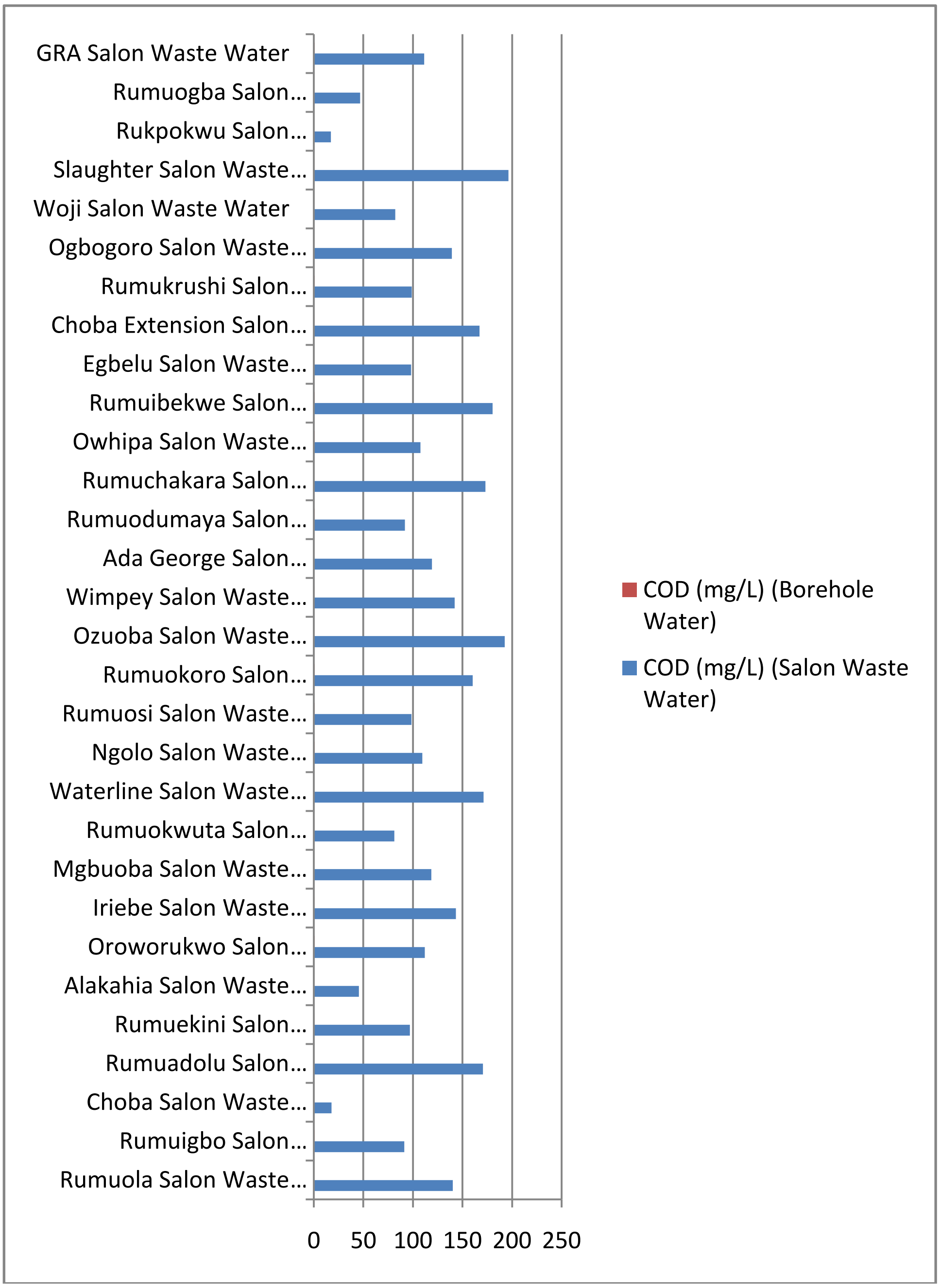


Figure 4.7 COD value in Salon Waste Water and Borehole water

From the analysis in appendix 4.9, Potassium (k) had a mean value recorded at 16.15mg/l with the highest value of 21.52mg/l noticed in the hair beauty salon at Choba and a lowest value of 11.21mg/l noticed in the hair beauty salon at Rumukurushi and Rumuokoro communities in the study area. in borehole water sample, there are no notice of potassium presence across samples analyzed.

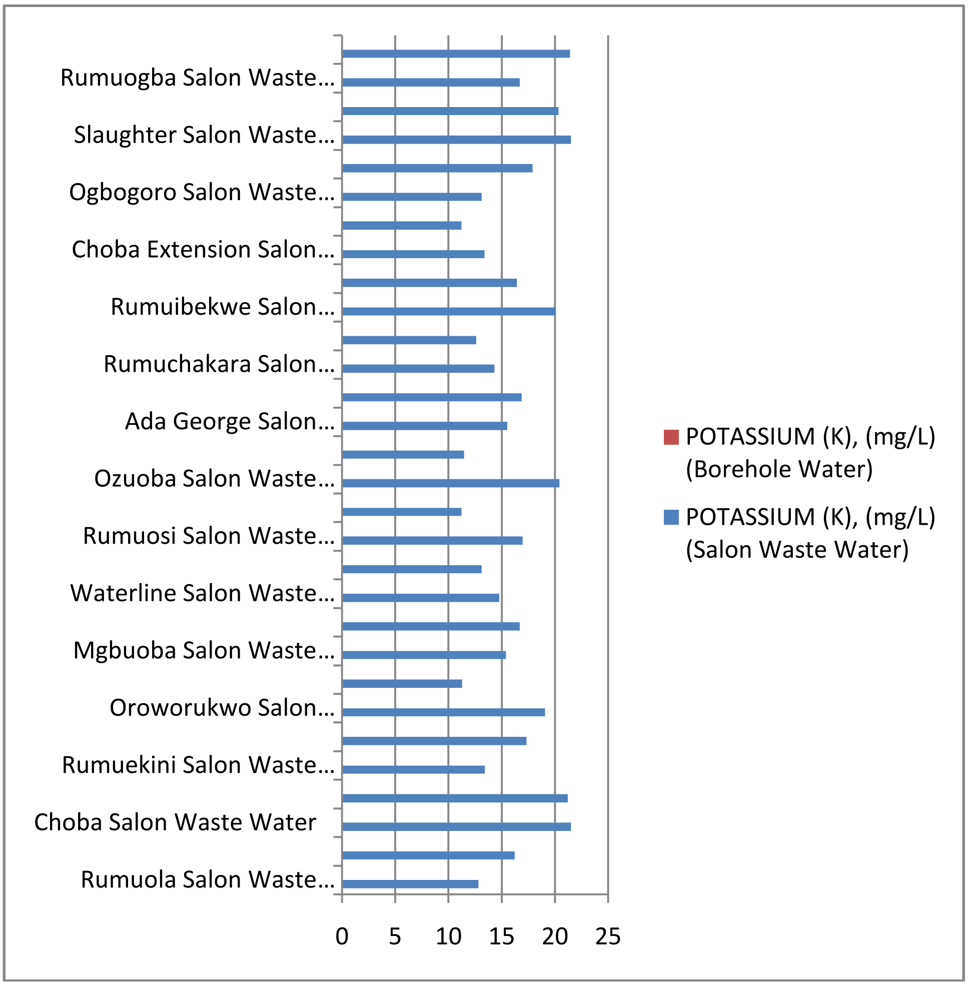


Figure 4.8 Potassium value in Salon Waste Water and Borehole water

Analysis for Nitrate (mg/l) in the sample as displayed in appendix 4.10 shows a mean value for nitrate as 1.47mg/l recording a highest value of 1.99mg/l in hair beauty salon analysis from Owhipa and a lowest value of 0.73mg/l nitrate recorded from sample collected at Rumuogba community. While from the analysis of borehole water samples, mean value for nitrate was noticed at 0.036mg/l with a peak value of 0.09mg/l recorded from samples collected from Alakahia borehole water sample and a lowest value of 0mg/l observed from borehole sampled collected from samples from Choba, Oroworukwo, Ozuoba, Ada George, Slaughter and Rukpokwu. The test for nitrate shows the level of nutrient availability in the water to support plant growth.

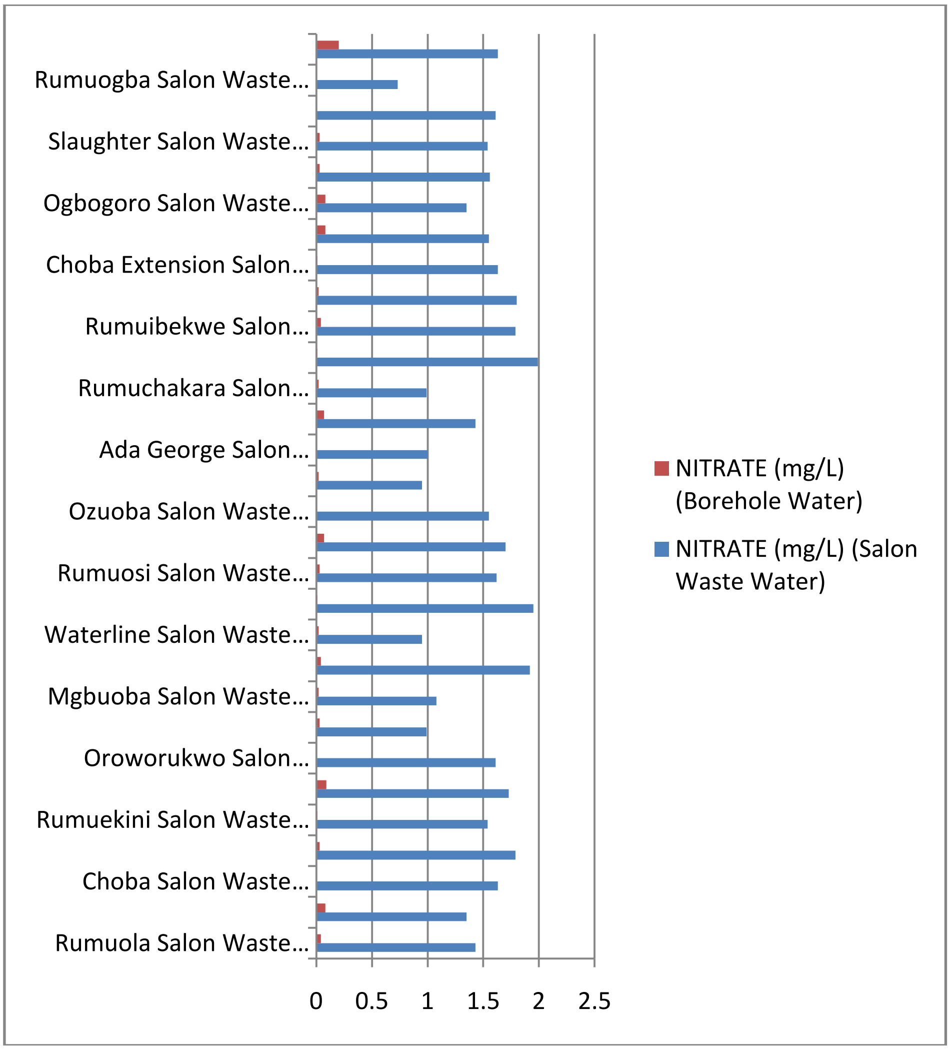


Figure 4.9 Nitrate value in Salon Waste Water and Borehole water

The analysis for dissolved oxygen as shown in appendix 4.11 shows a zero recording for all sampled location across the study area. the analysis for dissolved oxygen in the borehole water shows a mean value of 7.57mg/l with the highest value of 8.5mg/l occurring in Rumuadolu and the lowest value 6.5mg/occurring in Rumuekini and Rukpokwu.
Dissolved oxygen shows the level of organic pollutants in the borehole water and the waste water. The presence of bacterial activity in the samples signifies low or high level of dissolved oxygen.

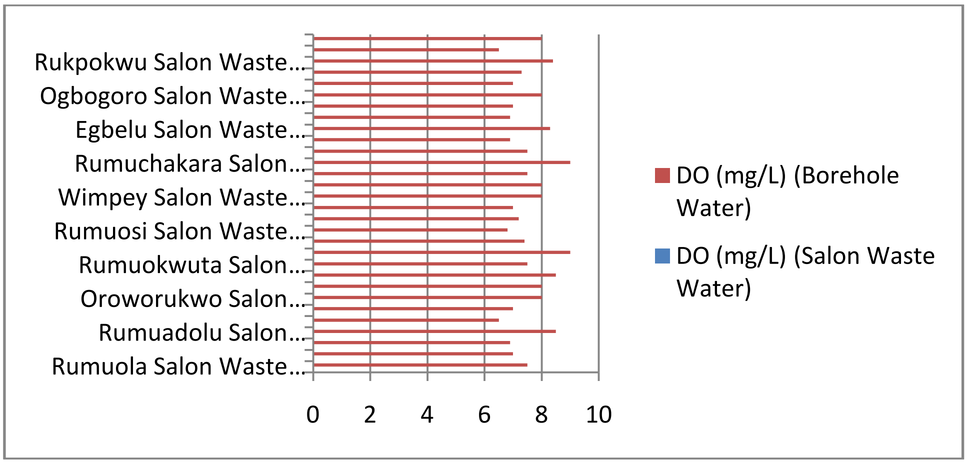


Figure 4.10 DO value in Salon Waste Water and Borehole water

Dissolved oxygen value is more pronounced in the borehole waste sample and not noticed in the salon waste water sample as shown in figure 4.10 with the highest values at Rumuchakara and Rumuokwuta sample locations

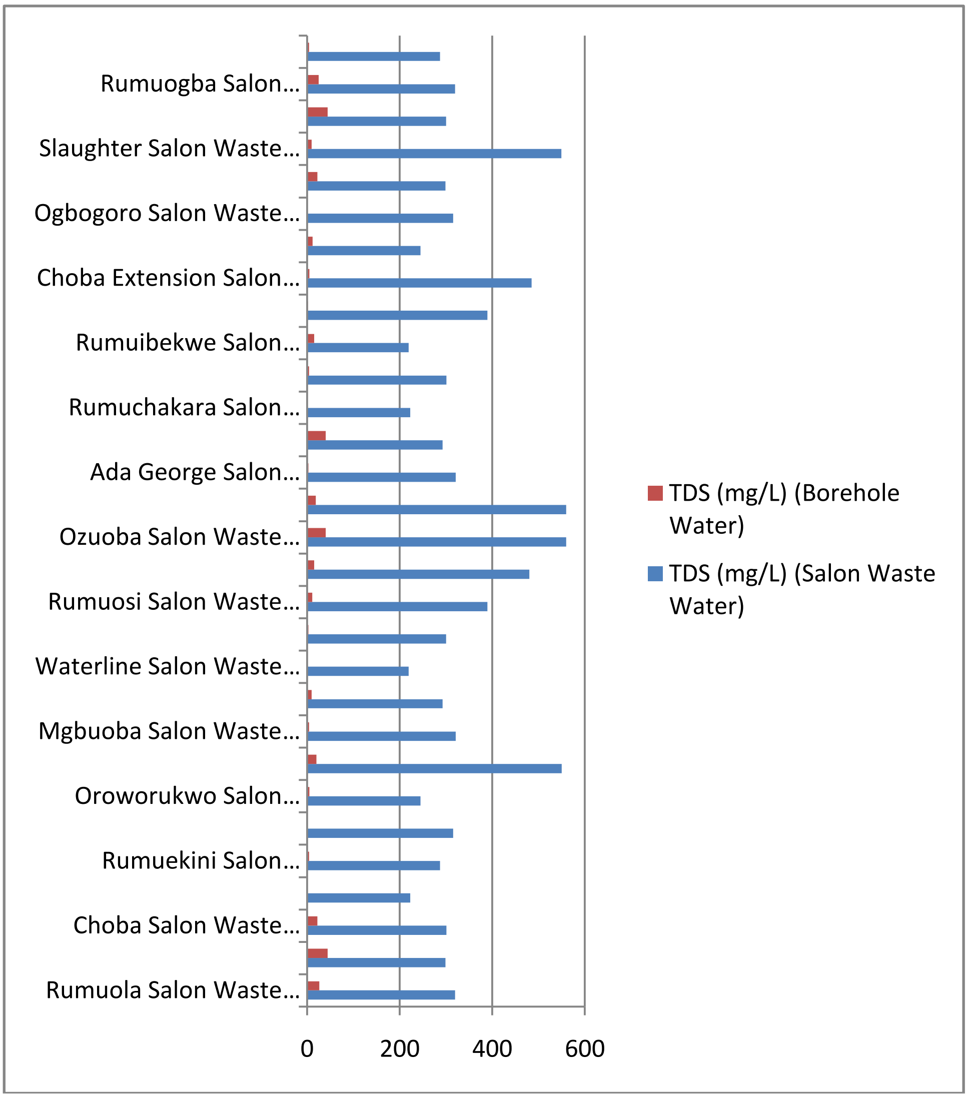


Figure 4.11 TDS value in Salon Waste Water and Borehole water

Total dissolved solids are most pronounced in the salon waste water samples collected from samples from Slaughter, Ada George, Rumuosi and Ngbuoba sample locations with very minimal level in the Borehole water samples.

The result from the analysis carried out for total dissolved solids (TDS) as shown in appendix 4.12, shows a mean value of 340.355mg/l across samples with a highest value of 560.11 mg/l occurring in Ozuoba and Wimpey sampled hair beauty salon and a lowest value of 219.06 mg/l occurring in Rumubekwe and waterlines waste water from hair beauty salons. While from the analysis of sample collected from the borehole water reveals that the mean value for TDS is 13.82 with the highest value of 44.3mg/l occurring in Slaughter and Rumuigbo and the lowest values of 1mg/l occurring in Rumuadolu, Alakahia, Waterline, Rumuchakara, and Rumuogba.

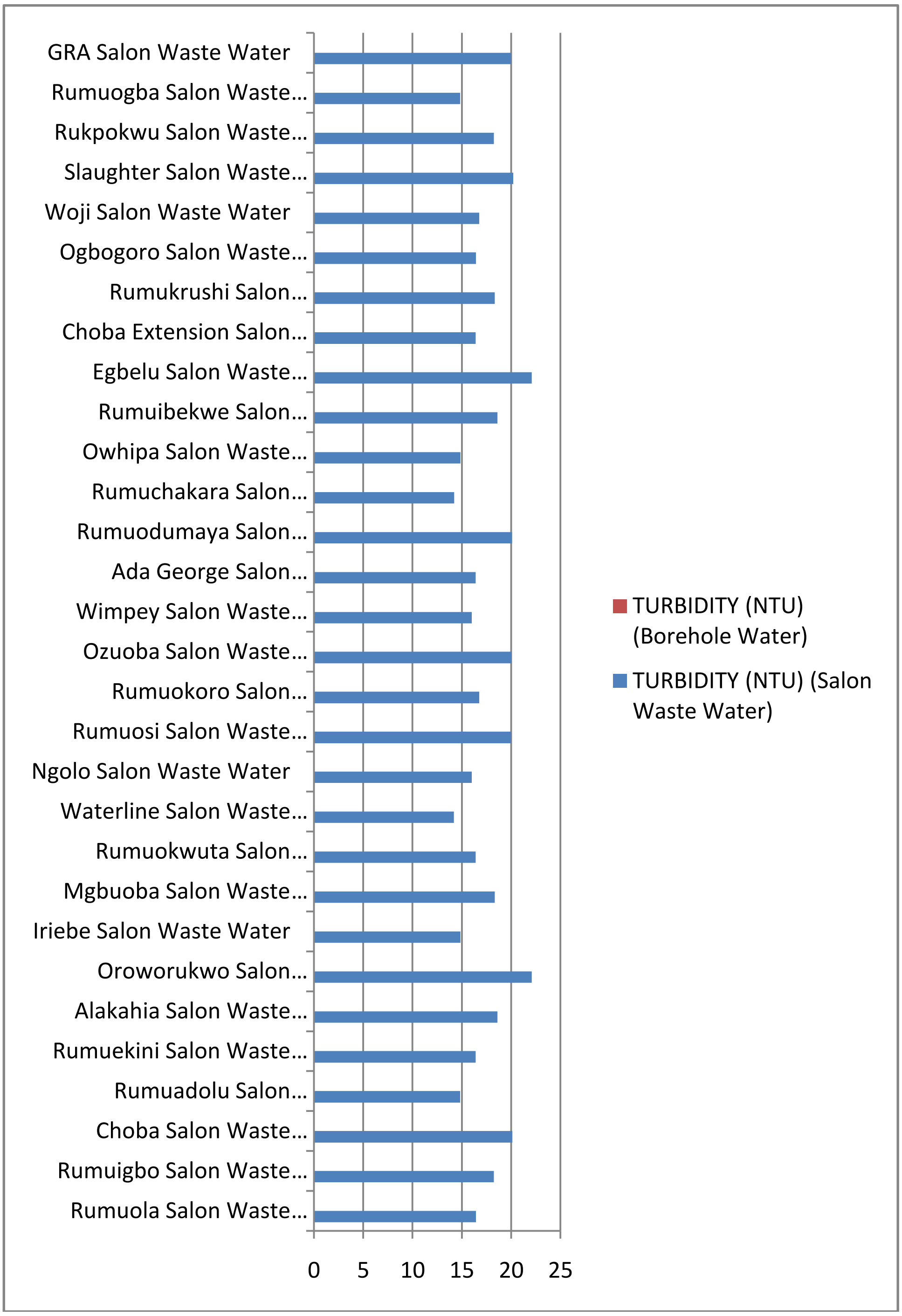


Figure 4.12 Turbidity value in Salon Waste Water and Borehole water

Turbidity analysis s as shown in appendix 4.13 shows a mean turbidity value of 17.56 with the highest value of 22.1 occurring in sampled hair beauty salons in Oroworukwo and Egbelu within the study area with the lowest value occurring in Waterline. While from the analysis of borehole water sample, it is discovered that the mean value for turbidity is 0.4 which is distributed across the entire samples of borehole water.

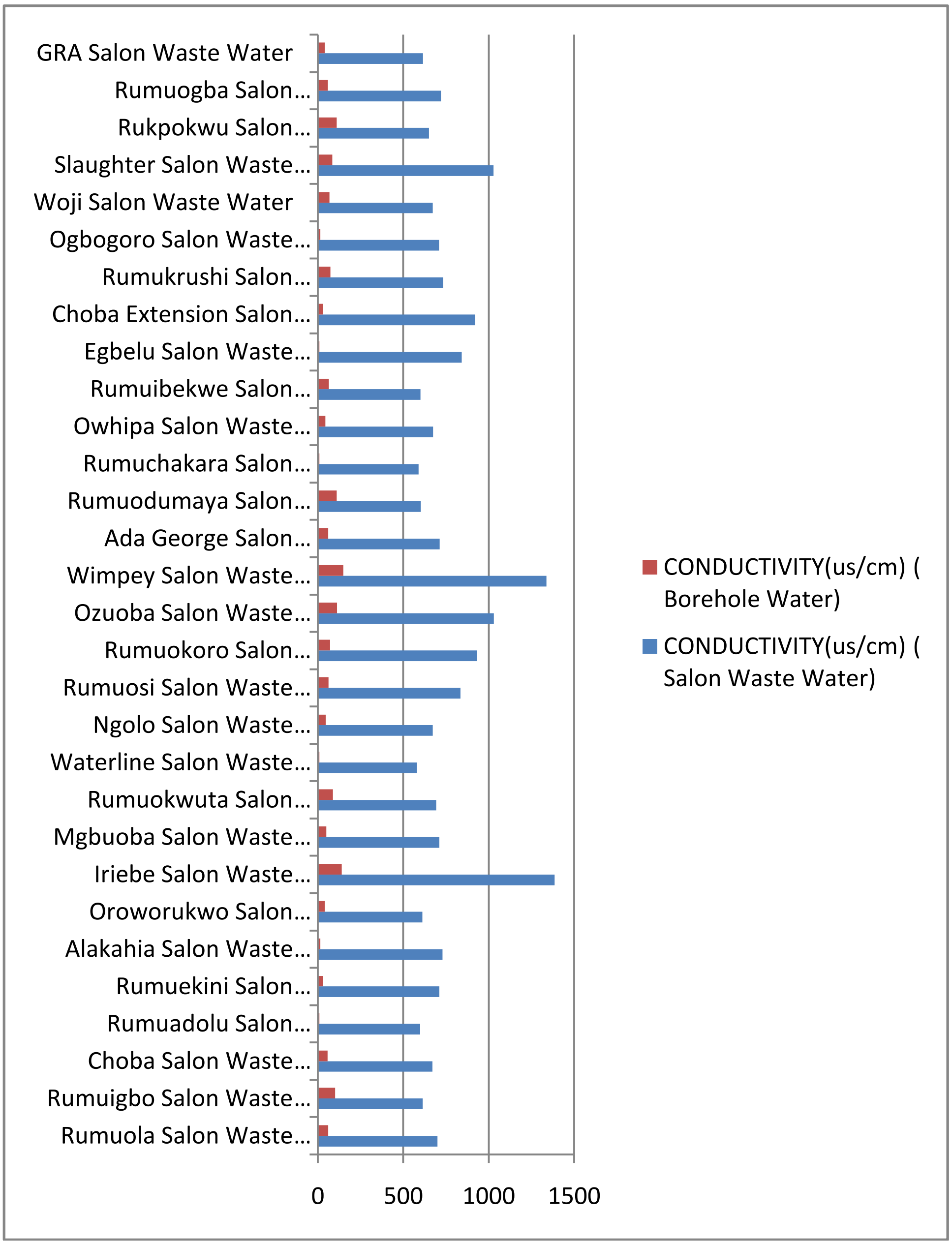


Figure 4.5 Conductivity value in Salon Waste Water and Borehole water

Ebikeme Omayovbi Assessment Of The Relationship Between Hair Salon Effluent And Groundwater Quality In Obio/Akpor Lga, Port Harcourt." IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT) 12.7 (2018): 68-84.