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ASSESSMENT OF THE IMPACT OF SEWAGE TREATMENT PLANT EFFLUENTS ON RIVER WUPA, FEDERAL CAPITAL TERRITORY, NIGERIA

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Abstract
This study was conducted with a view to comparing the efficiency of the output of Wupa Wastewater Treatment Plant (WWTP) with acceptable and permissible international standards and the effect on the receiving River. Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Suspended Solids (TSS), Total Coliform Count (TCC) and other parameters were analysed from sampled wastewater before passing through the plant, after passing through the treatment plant and the receiving river, then compared with National permissible standards. The results of the laboratory analyses showed that the influent going to the treatment plant had BOD, COD, and TSS values of 150 mg/l, 350 mg/l, and 160.6 mg/l respectively while the effluent after the treatment processes recorded 8 mg/l, 20 mg/l, and 15.9 mg/l for the same parameters respectively. The treatment plant recorded 95% efficiency in pollutant removal when compared with National permissible standards. The study revealed that there was no adverse impact of the effluent water on the receiving water body (River WUPA) in terms of physiochemical parameters as the treated effluent from the facility conformed to the specified discharge limits for WHO, but in terms of the bacteriological parameters; values of the total coliform count (TCC) and faecal coliform (FC) were observed to be higher than that of the river at both upstream and downstream sections, which necessitates the development of a maintenance plan for the treatment plant with emphasis on proper maintenance of the unit processes of the treatment plant and UV treating the effluent properly before discharge into the receiving water body.

Keywords: Effluents, Sewage, Treatment Plant, River, Federal Capital Territory.

Introduction
The major sources of water for human uses include but not limited to lakes, rivers, soil moisture and relatively shallow groundwater. Industrial growth, population growth and irrigated agriculture are three main factors affecting water demand over the past century. Water pollution has been of serious concern over the years. Pathogens, nutrients, organic matter, heavy metals, toxic chemicals, silt and salt and suspended solids are the major pollutants (Moazzam, Sher and Parneet, 2015). More so, heavy metals which are natural trace components of the aquatic environment, as well as constitute of most hazardous substances that could be accumulated in the biota, may be discharged from industries, farmlands, municipal urban water run-offs and agricultural activities into water surface, thereby causing pollution (Butu *et al*., 2013). Industries have become integral part of modern society; as a result, production of wastes is inevitable in

industrial activities (Dipu, Rita, Rakesh, 2015). A material becomes waste when it is discarded without awaiting to be compensated for its essential value. Those wastes may pose implicit hazard to human and the surrounding when inaptly treated, stored, transported or disposed or mismanaged (Misra and Pandey, 2014). Like all scarce resources which have regulations guiding their exploitation, ownership, preservation and sustenance, water is protected and secured through laid down rules and regulations to prevent abuse (FGN, 2000).

The level at which the sewage has to be treated depends on where it will be disposed and treatment standards are higher for disposal into freshwater bodies than that disposed into the sea. However, typically even where sewage treatment plants (STPs) exist, sewage collection networks are inadequate; some portion goes for treatment and the rest flows into drains. Sometimes wastewater stagnates in pools from which it leaches into the groundwater table and contaminates underground aquifers (Alhassan and Ahmad, 2013; Ahmad, 2014; Hassan, 2016). Amoo et al. (2017) and Ahmad and Oludele (2022) revealed effluent water transport microbial pathogens to great number of people, causing successive illness in some particular regions. In developing countries, the practice of unintentional indirect reuse is largely responsible for the approximately over 4 billion cases of diarrhoea daily that cause of over 2.2 million deaths a year, mainly in children under five years of age. Construction works on the WUPA sewage treatment plant (WSTP) Abuja started in 2001, blazing the trail for being the largest of its kind in sub-Saharan Africa. Its state of the art, high technology and computerized accessories rank this treatment plant at par with the most modern treatment plants in the world (WSTP Abuja, 2007).

Sludge which is produced as a solid-by product of the sewage treatment process is of agricultural benefit as it could be collected and used as natural fertilizers. The entire treatment process can be divided into mechanical and biological phases. At no stage of the process is the addition of chemicals required. After the sewage has passed through the first stage of mechanical treatment, it enters the Aeration tanks, followed by the final clarifier where the sludge and water will be separated through a biological process (WSTP Abuja, 2007).

Materials and Method

Study Area

The WUPA sewage treatment plant is located upstream to the River WUPA, discharging its effluent directly into the flowing water body. The Wupa village located downstream of the treatment plant uses the river to meet its domestic water needs. Moreover, there are flora and fauna as well as aquatic lives in the river, resulting in the need to ensure that the effluent quality from the treatment plant is of acceptable standards. The Wupa Sewage Treatment Plant is located within the IDU-Industrial Area of Abuja the Federal Capital Territory on coordinates 7˚23'N, 9˚01'E next to the WUPA River (Figures 1 and 2). It covers an area of 297,900 square meters with surrounding rural settlement. The plant was designed to treat waste generated from Abuja city. It has three operating units with one unit being under operation while the remaining two units are standby in the event of failure of one unit. The plants were designed for a full capacity operation of 131,250 m^3 of waste per day, though at the moment, it is operating below designed capacity. The administrative map of the Federal Capital Territory (FCT) is also depicting the location of the WUPA River; this River is part of the Jabi River watershed in Abuja which served as receiving end of the treated waste water from the plant (Saminu et al., 2017; Ahmad and Oludele, 2022).

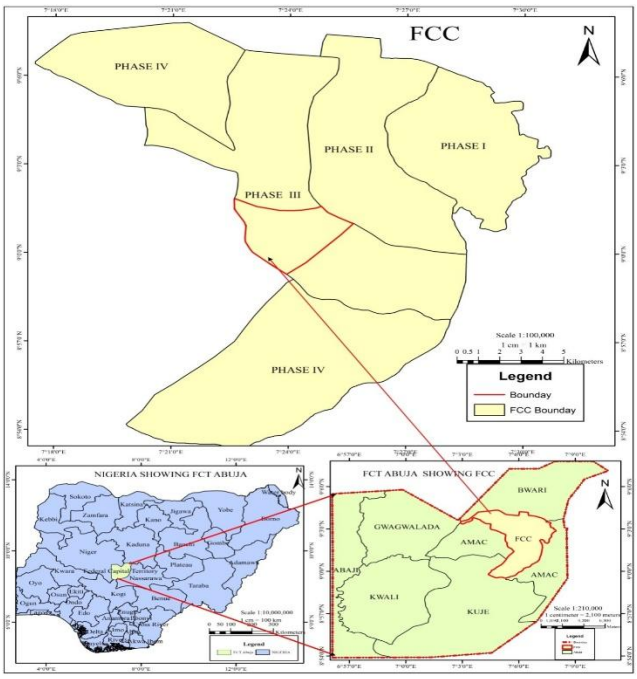


Figure 1: FCT showing location of WSTP, Abuja
Source: Author's work, 2021

The FCT has two seasons, the rainy seasons begins from April to October while the dry season lasts from November to March (GEO – LENESCO, 2011). The average temperature ranges from 29^0 to 37^0c in the dry season month of August and dry season month of March respectively (GEHS, 2014). The drainage pattern generally varies from trellis to dendritic. The area is drained by many rivers in and around Abuja including Rivers Gwagwalada and Usmanu while Rivers Wupa, Wosika and other smaller seasonal southerly-flowing streams form the tributaries and drain the study area. These rivers depend on rainfall for their recharge. As such, their stakes are high in rainy season and decrease appreciably in the dry season. Abuja enjoys a tropical continental climate characterized by two distinct seasons; the dry and rainy seasons. The rainy season spans March/April to September/October, while the dry season extends from October to May. The mean annual rainfall is 1630mm, while temperatures vary from 22ºC around December/January to 35ºC in March/April. The weather conditions reflect the rugged nature of the area with the hills and inselbergs occasionally inducing orographic (relief) rainfall in their immediate vicinity. Vegetation is characterized by thorn bushes and trees, herbs, shrubs, and mango trees, the area being in Guinea Savanna Vegetation zone of Nigeria.

The population of the study area is heterogeneous in nature comprising of the original inhabitants of the town the Gbagyis, Gagagana, Nupe, Gwandara and Koro, and other ethnic groups such as Yoruba, Hausa, Igbos etc. (Mundi, 2000). The population of Abuja has grown rapidly from 1991 to 2006. The population of Area as at 1991 population census was 57,022 people with density of about 241 person/km2 (NPC, 1991) the projected population is 79, 252 (NPC, 2006) and 97, 036 (NPC, 2018).

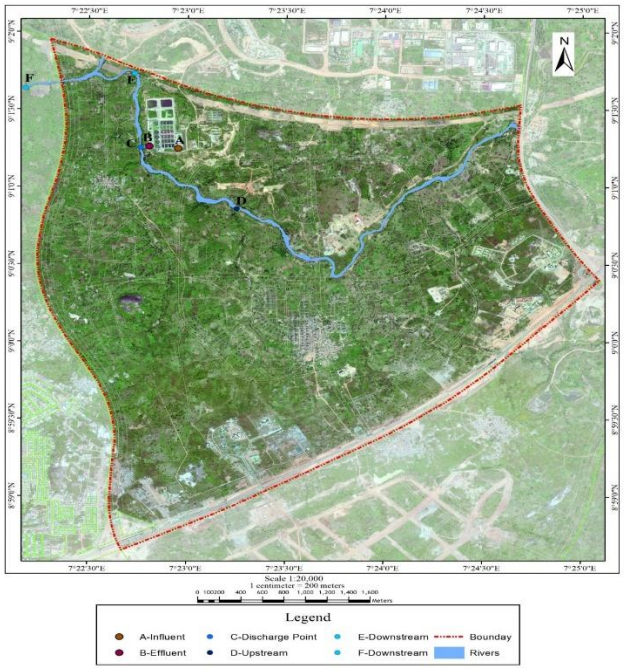


Figure 2: Satellite image base map showing the study Area (WSTP), Institute and Research District, Abuja
Source: AGIS, 2018

The residents of FCT engage in various human activities such as Civil service, farming, trading, tailoring, bricklaying, mechanics, motor cycling transport etc. The indigenes are predominantly trading, farmers, who engage mostly in crop production and domestication of animals while few numbers are employed in institutions as well as offices. The type of crops cultivated in this study area includes millet, yam, guinea corn, maize, rice, vegetables etc. The crop production normally take place during the rainy season though some of the farmers engage in irrigation farming around River Usuma during the dry season (Mundi 2000).

Main Field Investigation

Both primary and secondary data sources were employed in this study**.** These data were obtained directly from the field in the study area. The sources of primary data embraced by this research were analysis of water samples that were collected from the sites, these include; the inlet of the WUPA treatment plant "sample A", effluent before UV spectrometer "sample B", WUPA plant discharge point "sample C", 50m up-stream (before the facility) of the River WUPA "sample D", 50m and 100m down-stream (after the facility) of the River WUPA "sample E and F" (Plates 1 and 2). The study area was visited with a special consideration given to the Effluent Plant Unit with focus on compliance to environmental safety standards. Reconnaissance survey was first carried out to provide an insight to the number of field assistants required. This enabled the researchers and their filed assistants to know the types of safety gadgets to be used for the main field investigation. It also provided the coordinates of each sampling point which assisted in subsequent sample collection by enabling the researchers to collect all the samples at the same point.

The process involves collecting data from WUPA treatment plant and taking water samples, along the River. The collection of water samples along River WUPA took place in the morning between 8-10am when the temperature was low because high temperature might alter the level of pollutants by enhancing chemical reaction. These samples were collected using Grab method which is effective enough for surface water investigation of inland hydrological system. Grab sampling method involves dripping a sample from one or more points in a stream cross section. Grab sampling techniques employed by the researchers in this study were consistent at each site. All samples were taken once in wet season (July-August). In order to realize the aim and objectives of this study, descriptive and inferential statistical tools were employed to analyse the data. Table 1 gives the summary on the samples.

Table 1: Summary of the samples

Sampling Points label	Sampling Points Title	Source
A	WUPA influent before treatment	WUPA Treatment Plant
B	WUPA effluent after UV spectrometer	WUPA Treatment Plant
C	WUPA Plant discharge point	River WUPA
D	WUPA 1km up-stream before the facility	River WUPA
E	1KM down-stream after the facility	River WUPA
F	2KM down-stream after the facility	River WUPA

Source: Field Work, 2021

Method of Laboratory Analysis

The Laboratory Analysis includes;

1. Physiochemical Analysis of the water samples
2. Heavy Metal Analysis of the water samples

3. Physical Description of the water samples
4. Biological Properties of the water samples



Plate 1: Researchers taking coordinates at the WSTP Inlet
Source: Fieldwork, 2021



Plate 2: Effluent from the WSTP
Source: Fieldwork, 2021

Results and Discussion

From the procedures of laboratory analysis of physical, chemical and biological parameters, the following results were obtained from the various water samples. Total of six (6) water samples were collected from different locations within the study area and analysed. These include the water samples from inlet of WSTP (Sample A), Effluent of WSTP (Sample B), up-stream of River WUPA (Sample C), discharge point of WUPA wastewater treatment plant (Sample D), down-stream 1km away from the discharge point (Sample E) and down-stream 2km away from the discharge point (Sample F).

Physiochemical and Biological Properties of Samples obtained from WSTP Compare to Effluent Standard

Table 2: Physical properties of the samples from WSTP

S/N	Parameter	Influent Sample A	Effluent Sample B	National Effluent Limitation (1991) Environmental Protection Regulation
1	Appearance	Greyish	Slightly Turbid Colourless	
2	pH	7.01	7.30	6-9
3	Temperature (ºC)	24.5	23.9	< 40
4	Conductivity (µS/cm)	345	309	1,250
5	Turbidity (NTU)	203.0	16.0	NS

Source: Laboratory analysis, 2021

Table 2 shows that the pH readings of the samples were within the National Environmental Protection Effluent guideline value for effluent (6-9). Influent (A) recorded lowest 7.01 whilst Effluent (B) recorded 7.30. Also, the temperatures of both samples were recorded to be within the National Environmental Protection Effluent Limitation Regulation value which is less than 40 (ºC). Lastly, the conductivity of the influent (A) is

recorded to be higher 345(µS/cm) than that of the effluent (B) 309(µS/cm). Both conductivities are less than the standard value of National Environmental Protection Effluent Limitation Regulation.

Table 3: Chemical Properties of the samples from WSTP

S/N	Parameter	Influent Sample A	Effluent Sample B	National Environmental Protection Effluent Limitation Regulation (1991)
1	D.O (mg/l)	2.1	7.50	Min 4
2	TDS (mg/l)	170.5	150.6	2,000
3	TSS (mg/l)	160.6	15.9	30
4	NH^{-}_{4} (mg/l)	1.8	1.0	10.0
5	NO^{-}_{3} (mg/l)	14.3	8.1	20.0
6	PO^{-}_{4} (mg/l)	2.1	0.9	5.0
7	Cl^{-} (mg/l)	47.5	35.1	600
8	ALK. (mg/l)	60.1	49.1	100
9	BOD (mg/l)	150	8	30
10	COD (mg/l)	350	20	80

Source: Laboratory analysis, 2021

Table 3 shows that D.O for influent recorded below standard 2.1(mg/l) whilst that of effluent 7.50(mg/l) is higher than the standard of National Environmental Protection Limitation Regulation minimum of 4(mg/l). Also, TDS (mg/l) for both sample A and sample B 170.5(mg/l) and 150.6(mg/l) respectively are below NEPLR standard 2000(mg/l). TSS (mg/l) of sample A 160.6(mg/l) recorded above NEPLR value whilst sample B 15.9 falls below NEPLR. Moreover, ammonium, nitrite, phosphate and chloride are all below the standard value of NEPLR except BOD which recorded higher in sample A 150(mg/l) which is higher than the NEPLR value whilst sample B recorded 8(mg/l) less than NEPLR and COD for sample A recorded 350(mg/l) as against the NEPLR value 80(mg/l) whilst sample B 20(mg/l) fall below.

Table 4: Metal concentration of the samples from WSTP

S/N	Parameter	Influent Sample A	Effluent Sample B	National Environmental Protection Effluent Limitation Regulation (1991)
1	Fe^{2+} (mg/)	0.57	0.22	20
2	CU^{2+} (mg/l)	0.43	0.04	5.0
3	Pb^{2+} (mg/l)	0.07	0.03	0.01

Source: Laboratory analysis, 2021

Table 4 clearly indicates that the concentrations of iron (Fe) and copper (Cu) were also below the standard value sample A 0.57mg/l and sample B 0.22mg/l, sample A 0.43mg/l and sample B 0.04mg/l with standard of 20mg/l and 5mg/l respectively. Lead was however detected to be higher in sample A 0.07mg/l and lower in sample B 0.03mg/l at against the NEPELR standard of 0.01mg/l.

Table 5: Biological Properties of the samples from WSTP

S/N	Parameter	Influent Sample A	Effluent Sample B	National Environmental Protection Effluent Limitation Regulation (1991)
1	TBC (cfu/100ml)	$6x10^{5}$	$9x10^{2}$	1,500
2	TCC (cfu/100ml)	$2x10^{3}$	$2x10^{2}$	400
3	FC (mpn/100ml)	$>1.6x10^{3}$	$1.0x10^{2}$	200

Source: Laboratory analysis, 2021

Table 5 shows that the TBC in sample A was recorded to be very high 600000cfu/100ml than sample B 900cfu/100ml and NEPELR standard value 1500cfu/100ml. Also, the TCC in sample A was also recorded to be higher 2000cfu/100ml whilst sample B recorded to be 200cfu/100ml which is less than the standard value 400cfu/100ml. Lastly, the concentration of faecal coliform numbers in samples were 1600cfu/100ml and 100cfu/100ml respectively for sample A and B. Sample A value was higher than NEPELR standard value 200cfu/100ml.

Physiochemical and Biological Properties of Samples Obtained from River WUPA

Table 6: Physical properties of the samples from River WUPA

Parameters	Up-stream Sample C	Discharge point Sample D	Down-stream 1km Sample E	Down-stream 2km Sample F	Water Quality Criteria for Surface Water Source: African Forum for Utility Regulation and National Industrial Standard (2007)
Coordinates of sampling points	**Northings** 9997557.89 **Eastings** 321866.85	**Northings** 996825.19 **Eastings** 322756.13	**Northings** 998265.91 **Eastings** 320796.95	**Northings** 998437.94 **Eastings** 321812.49	
Appearance	Brownish	Slight Turbidity, Colourless	Brownish	Brownish	
Temperature (°C)	24.6	23.5	24.2	23.8	< 40
Conductivity (µS/cm)	248	303	255	245	NS
Turbidity (NTU)	85	24	82	84	NS

Source: Laboratory analysis, 2021

Table 6 clearly shows that the temperature for all the samples have no considerable difference and is in line with the National Industrial Standard which is less than 40^0c (<40). High water temperature enhances the growth of micro-organisms and may increase problems related to taste, odour, colour and corrosion, but because the temperature of all the samples were within the limits, the quality of the water in terms of the odour, taste and colour are good. Whereas conductivity, turbidity show no significant variation.

Table 7 from the research findings shows that the value of pH 7.27 (mg/l), 7.34 (mg/l), 7.35 (mg/l), 7.04 (mg/l), phosphate 2.0 (mg/l), 2.6 (mg/l), 2.2 (mg/l), 3.6(mg/l) and chloride 49.7 (mg/l), 35.5 (mg/l), 35.5 (mg/l), 17.6 (mg/l) of water collected in the various sampling location are below and within safety limit set by National Industrial Standard (2007) 6.5-8.5 (mg/l), 3.5 (mg/l) and 300 (mg/l) respectively. The value of alkalinity of all water samples shows no significant. Also, the value of TSS for sample C 136.2 (mg/l), sample E 137.6 (mg/l) and sample F 137.6 (mg/l) are above the safety limit except sample D which has a lesser concentration of 18.2 (mg/l). Nitrite, BOD and COD of all water samples are also higher than the safety limit set by National Industrial Standard (2007).

Table 7: Chemical properties of the samples from River WUPA

Parameters	**Up-stream Sample C**	**Discharge point Sample D**	**Down-stream 1km Sample E**	**Down-stream 2km Sample F**	**Water Quality Criteria for Surface Water Source: African Forum for Utility Regulation and National Industrial Standard (2007)**
Coordinates of sampling points	**Northings** 9997557.89 **Eastings** 321866.85	**Northings** 996825.19 **Eastings** 322756.13	**Northings** 998265.91 **Eastings** 320796.95	**Northings** 998437.94 **Eastings** 321812.49	
pH	7.27	7.339	7.349	7.04	6.5 - 8.5
D.O (mg/l)	8.61	8.33	9.06	8.24	M
TDS (mg/l)	120.0	140.0	122	111	NS
TSS (mg/l)	136.2	18.2	137.6	137.6	25
NH^{-}_{4} (mg/l)	2.0	1.9	1.90	3.2	0.05
NO^{-}_{3} (mg/l)	11.7	10.1	7.2	11.0	9.1
PO^{-}_{4} (mg/l)	2.0	2.6	2.2	3.6	3.5
Cl^{-} (mg/l)	49.7	35.5	35.5	17.75	300
ALK. (mg/l)	52	57	47	50	NS
BOD (mg/l)	19	20	20	14	3
COD (mg/l)	42	45	44	35	30

Source: Laboratory analysis, 2021

Table 8: Metal concentration of the samples from River WUPA

Parameters	**Up-stream Sample C**	**Discharge point Sample D**	**Down-stream 1km Sample E**	**Down-stream 2km Sample F**	**Water Quality Criteria for Surface Water Source: African Forum For Utility Regulation And National Industrial Standard (2007)**
Coordinates of sampling points	**Northings** 9997557.89 **Eastings** 321866.85	**Northings** 996825.19 **Eastings** 322756.13	**Northings** 998265.91 **Eastings** 320796.95	**Northings** 998437.94 **Eastings** 321812.49	
Fe^{2+} (mg/)	1.06	0.97	0.97	1.11	0.05
CU^{2+} (mg/l)	0.12	0.28	0.20	0.09	0.001
Pb^{2+} (mg/l)	0.20	0.03	0.05	0.06	0.01

Source: Laboratory analysis, 2021

From the research findings, Table 8 shows the concentration of heavy metals in the sampled waters. The result shows that samples obtained from D and E recorded lowest concentration value of iron 0.97mg/l while F with the highest concentration value of 1.11mg/l and all above the safety limit set by National Industrial Standard of 2007. The result also shows that sample obtain from F recorded the lowest concentration value of copper 0.09mg/l, followed by C with a value of 0.12mgl, E with a value of 0.20mg/l and D with the highest value of 0.28mg/l, all above the safety limit set by National Industrial Standard of 2007. Lastly, sample obtain from D recorded the lowest concentration value of lead 0.03mg/l, E with the value of 0.05mg/l, F with value of 0.06mg/l which are little higher than the safety limit set by National Industrial Standard 0.01mg/l except sample C which recorded the highest value of 0.20mg/l.

Table 9 shows that the bacteriological concentration TCC for all the samples 880cfu/100ml, 470 cfu/100ml, 860 cfu/100mland 870cfu/100mlare all above the National Industrial Standard 100cfu/100ml. Also, FC (cfu/100ml) of the samples 970cfu/100ml, 400cfu/100ml, 800cfu/100ml and 700cfu/100ml are also higher in values compared to the National Industrial Standard

50cfu/100ml. While TBC shows no statistical differences among the samples.

Table 9: Biological Properties of the samples from River WUPA

Parameters	**Up-stream Sample C**	**Discharge point Sample D**	**Down-stream 1km Sample E**	**Down-stream 2km Sample F**	**Water Quality Criteria for Surface Water Source: African Forum for Utility Regulation and National Industrial Standard (2007)**
Coordinates of sampling points	**Northings** 9997557.89 **Eastings** 321866.85	**Northings** 996825.19 **Eastings** 322756.13	**Northings** 998265.91 **Eastings** 320796.95	**Northings** 998437.94 **Eastings** 321812.49	
TBC (cfu/100ml)	1,310	900	1120	1200	NS
TCC (cfu/100ml)	880	470	860	870	100
FC (mpn/100ml)	970	400	800	700	50

Source: Laboratory analysis, 2021

Efficiency of WUPA Wastewater Treatment Plant

The laboratory analyses carried out were used to determine the efficiency of the treatment plant. According to Vitez *et al.* (2012), the pollutant removal efficiency of a plant is defined as the ratio between removed concentration of pollutants and their initial concentration as given in Equation 1;

$$Efficiency\ (\%) = \frac{Ci - Ce}{Ci} \times 100$$

Equ.1

Where:

Ci is concentration of the influent (mg/l)

Ce is concentration of the effluent (mg/l)

Table 10: Efficiency of WUPA Wastewater Treatment Plant (WWTP)

Parameter	**Influent**	**Effluent**	**Efficiency (%)**
TSS(mg/l)	160.6	15.9	90
BOD (mg/l)	150	8	95
COD (mg/l)	350	20	94

Source: Laboratory analysis, 2021

Basically, the parameters employed for assessing the efficiency of WWTP in this study are in conformity with Colmenarejo *et al.* (2006). The overall efficiency of the treatment plant was determined by finding the average efficiency of the indicators used in measuring efficiency which were comprised of BOD, COD and TSS as done by Ravi et al. (2010). The resultant 95% efficiency generated in this study is firmly in accordance with the WHO (2009) permissible level recommended for an efficient wastewater effluent allowed for discharge into the environment. As indicated by Sincero and Sincero (1996), the BOD (95%) removal in the biological treatment processes deployed in WUPA Wastewater Treatment Plant is a strong indication that such treatment is efficiently reliable.

Discussion

The physicochemical parameters recorded from different location in River WUPA and WWTP wastewater samples are presented in Table 2 and 3. The overall temperature ranged between 23.5 - 24.6^{0}C. According to Mahgoub *et al*. (2016) and Ahmad and Oludele (2022), a rise in the WWTP influent temperature above 35^{0}C is associated with negative expects on biological activity during the treatment process that may reduce the waste treatment efficiency. Higher temperatures of the WWTP effluent are also undesirable as it can lead to the imbalance of aquatic organisms and its activities in the receiving water bodies was similar to the sampled temperatures reported by Akpen *et al*. (2016) on the effects of sewage effluent discharges on the water quality of WUPA

River in Abuja and they are within acceptable limit by WHO.

Chemical parameters such as increasing nitrate levels in water resources are potential sources of severe environmental stress to aquatic organisms, because nitrate is known to be toxic to insects, amphibians and fish. Nitrates are especially toxic to children less than six months of age. The condition called "blue baby syndrome" (methemoglobinemia) may occur. Pregnant women may be less able to tolerate, and nitrate in the milk of nursing mothers may affect infants directly. Also, High TDS interfere with taste of foods and beverages, and makes them less desirable to consumers (Free drinking water.com). This result is similar with the work of Abinah (2013) where he studied the water quality assessment of River Asuotiain the Dormaa East District of Brong Ahafo Region, Ghana.

Consumption of heavy metals is linked to many serious health concern (Benham *et al*., 2011). Severe effects may include reduced growth and development, cancer, organ damage, nervous system damage and in extreme cases, death. These metals are present in varying concentrations depending on prevailing factors such as temperature, pH, hardness and standing time of the water. Among the water samples from treatment plant and the river studied, the concentration of both Copper (Cu) and Iron (Fe) were below limit of detection except the concentration of Lead (Pb) which was above the limit in samples from the treatment plant. While concentration of Copper (Cu), Iron (Fe) and Lead (Pb) for the studied river was similar to lead concentration reported by Oluwafisayo *et al*. (2017) in Saba River, Osogbo and is above the acceptable limit in potable water. Lead (Pb) is a general metabolic and enzyme inhibitor which causes mental retardation and can damage nervous connections causing blood and brain disorder. Also high concentration of Iron can cause rapid increase in pulse rate, coagulation of blood in blood vessels. Lastly, an increased amount of copper (Cu+) consumption leads to liver problems, brain, kidney, intravascular haemolysis, gastrointestinal and immunological issues (Colmenarejo *et al*.2006).

The resultant 95% efficiency generated in this study is firmly in accordance with the WHO (2009) permissible level recommended for an efficient wastewater effluent allowed for discharge into the environment. As indicated by Sincero and Sincero (1996), the BOD (96%) removal in the biological treatment processes deployed in WUPA Wastewater Treatment Plant is a strong indication that such treatment is efficiently reliable.

Conclusion and Recommendations

The study assessed the impact of sewage treatment plant effluents on River Wupa. The findings confirmed that all the physicochemical and biological parameters of the effluent examined were within the National Environmental Protection Effluent Limitation Regulation, except for Lead (Pb) which was higher than the required amount. The resultant 95% efficiency generated in this study is firmly in accordance with the permissible level recommended for an efficient wastewater effluent allowed for discharge into the environment. Safe and quality drinking water is the basis for good human health as good water source remains the vital sustenance for human and animal lives. However, when this water becomes polluted it may become the source of undesirable substances causing diseases that are dangerous to human and animal health.

There is the need for the intervention of appropriate authorities to monitor the kinds of waste discharged into the river as the concentration of the water sampled on the river in terms of the physicochemical parameters monitored was high compared to that of the effluent water. However, efforts should be geared towards full utilization of the plant capacity so as to maximize its full potentials.

Again, there must be continuous monitoring of the efficiency of the wastewater treatment plant so as to ensure sustained adherence to standardized permissible standards. Looking at the advantages of sewage treatment plant to human health and environment, there is need for a deliberate policy by the government to construct more sewage treatment plants in our states and local government areas.

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