



# Physical Attributes in Three Abattoirs Wastewater in Kaduna Metropolis

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**Abstract:** Effluents discharged into water bodies have high health implications to human and his livestock. The study was carried out in Kakuri, Sabo and Kawo abattoirs located in Kaduna south, Chikun and Kaduna north local government area of Kaduna State, covering major part of Kaduna metropolis, this cover about 1,039,578 population. Kaduna metropolis is the administrative capital of Kaduna State, Nigeria. It is located between latitudes 9°E 3' and 11°32' North of the equator and longitudes 6°05' and 8°38' East of the Greenwich meridian [1]. Samples were taken for a period of seven months from February to September 2019, Three hundred water samples were analyzed for physico-chemical parameters using the different APHA techniques. The result obtained are lower values of chlorine at means value of 15.20mg/L; calcium means of 62.23mg/L; magnesium mean of 11.80mg/L; sulphate means of 12.90mg/L and poor electrical conductivities means of 250us/cm in the three sites of collection. While higher value of Dissolved Oxygen (DO), Chemical Oxidation Demand (COD), Total Suspended Solid (TSS), Biochemical Oxidation Demand (BOD), turbidity, and nitrate showed high concentration means of 300mg/L at each level of the site collected samples. The water sample obtained from the three abattoirs were observed to have high threat to both terrestrials and aquatic organisms as well as to human being in general due to the concentration value. Wastewater should be treated before discharging into the floating water, because this effluence content a lot of harmful component.

**Keywords:** Abattoirs, Effluents, Metropolis, Physico-chemical

## 1. Introduction

Most of the abattoirs in Nigeria are not well developed and facilities for the handling of abattoir solid waste and wastewater are absent, clean water inadequately available. Abattoirs also provide useful by-products such as leather and skin, livestock waste spills for leather and agricultural industries. However, livestock waste spills can introduce enteric pathogens and excess nutrients into surface waters which can also contaminate ground waters. In light of the negative effects of waste generated from this abattoir into the stream have made the quality of water inadequate for consumption, there is a need for proper analyzing of these discharge of abattoirs effluents generated into water bodies and how these waste can be managed across the different abattoirs [4, 21]. Many streams and rivers are polluted because of the discharge of untreated wastewater and other

organic wastes directly into them. [5, 8] Thus, river pollution is becoming a central issue in water management in Nigeria. One of the major sources of river pollution is livestock production activities especially in terms of nutrient pollution [2, 9].

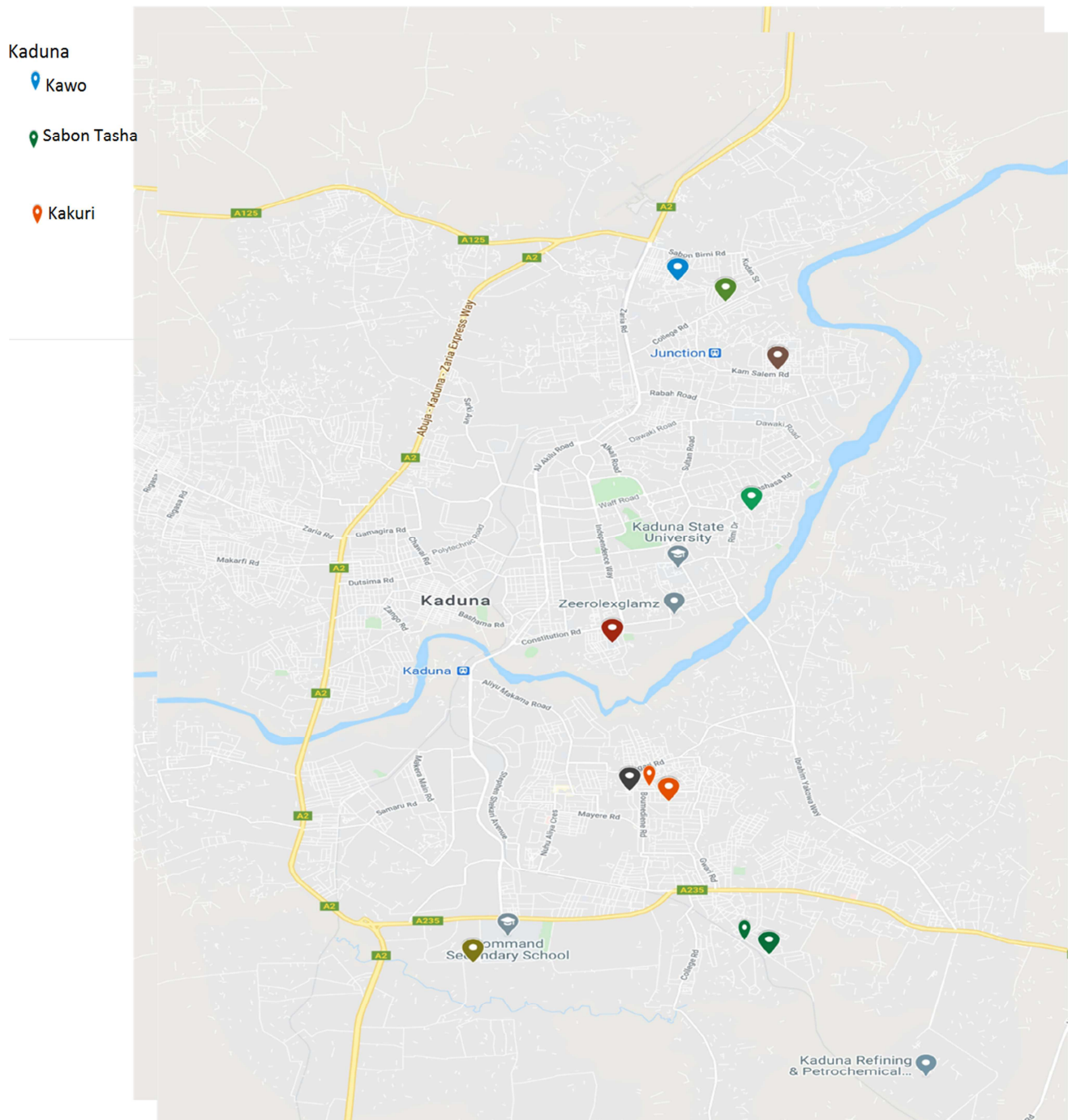
## 2. Materials and Methods

### 2.1. Study Area

This study was carried out in Kaduna South, Chikun and Kaduna North Local Government Areas of Kaduna State, this part of the state formed the major parts of kaduna metropolis. The areas of study has about 1,039,578 populations this cover about 15% of the population. Kaduna metropolis is the administrative capital of Kaduna State, Nigeria. It is located between latitudes 9°E 3' and 11°N 32' North of the equator

and longitudes  $6^{\circ}05'$  and  $8^{\circ}38'$  East of the Greenwich meridian [6]. This population has grown by 8.18% [1]. The present of this abattoirs in this location with an increasing population density, high urbanized societies and

industrialization have made pollution of water bodies become a problem or annoyance in the society due to the inability to properly manage wastewater generated by the activities of man [12].



**Figure 1.** Map showing three site abattoirs.

## 2.2. Water Sample Collection and Transportation

Wastewater sampling, surface water for chemical analysis was collected in five (5) sterilized sampling bottles from three sites of abattoirs in the 4 weeks of every month from February to September and analyzed in the laboratory for

biological and physicochemical parameters like pH, temperature and dissolved oxygen (DO) were performed on the field were analyzed in the laboratory following the methods described by [3, 16]. Three hundred (300) waste water samples collected, one hundred samples from each of the three points were collected between the hours of 6am and 9am using 1500mls sterilized sample bottles.

### 2.3. Physico-Chemical Analysis

The standard analytical methods were used for determination of physico-chemical parameter of water and waste water using American Public Health Association (APHA) series of standard methods of examination of water and effluent. The measurements of Dissolved Oxygen (DO), Chemical Oxidation Demand (COD), Total Suspended Solid (TSS), and Biochemical Oxidation Demand (BOD) in water samples were carried out according to the standard methods of APHA, the filtration process were applied for each parameter. Two hundred volume of water sample was poured on a pre-weighed glass fiber filter of a specified pore size before starting the vacuum filtration process [19, 7]. The filter was removed after the completion of the filtration process and placed in an aluminium dish in an oven at 100°C for 2-3 hours to completely dry off the remaining water. The filter was then weighed, and the gain in filter weight represented the TSS contents, expressed in mass per volume of sample filtered (mg/L). The TDS of the water samples were determined by the gravimetric method. After filtration for TSS analysis, the filtrate was heated in oven at above 100°C until all the water was completely evaporated. The remaining mass of the residue represents the amount of TDS in a sample. [11, 21, 22].

### 2.4. Data Analysis

Data obtained from the total coliform count of the abattoir discharge point and those of the upstream and downstream of the receiving water body were transformed using logarithm to base 10 ( $\log_{10}$ ) compared using a One-Way Analysis of variance. ANOVA. Least Significant Difference (LSD) Test was further performed to compare significant differences between the mean values where differences occurred, the P value at  $p < 0.05$  was considered significant. The statistical package used is Statistical Package for the Social Sciences (SPSS) version 25 [18].

## 3. Result

The results of the physicochemical properties of water samples obtained from three sampling points each of Kawo, Kakuri and Sabo abattoirs are shown in Tables 1 to 3; Magnesium in the sample ranged from 7.34-14.90mg/L with a mean value of 9.56mg/L which is higher than World Health Organization (WHO) accepted standard of 5mg/L. Nitrate in the wastewater samples ranged from 69-520mg/L with a mean value of 398mg/L which exceeded the Environmental Protection Agency (EPA) standard of 10mg/L and WHO standard of 50mg/L.

**Table 1.** The Physico-chemical parameter of water samples obtained from selected point of kawo abattoir.

Sample location	pH	TDS (mg/L)	Conductivity (µs/cm)	TSS (mg/L)	D.O (mg/L)	BOD (mg/L)	COD (mg/L)	Chloride (mg/L)	Magnesium (mg/L)	Nitrate (mg/L)	Sulphate (mg/L)	Calcium (mg/L)	Turbidity (NTU)
Pt 1	7.56	4341 <sup>a</sup>	513 <sup>a</sup>	1158 <sup>a</sup>	11.2 <sup>a</sup>	73.5 <sup>a</sup>	5305 <sup>a</sup>	7.94 <sup>a</sup>	19.4 <sup>a</sup>	456	13.90 <sup>a</sup>	77.0 <sup>a</sup>	57 <sup>a</sup>
Pt 2	7.09	251 <sup>c</sup>	247 <sup>b</sup>	1001 <sup>b</sup>	7.2 <sup>b</sup>	14.0 <sup>c</sup>	3007 <sup>c</sup>	2.81 <sup>c</sup>	7.27 <sup>a</sup>	123	8.45 <sup>b</sup>	45.9 <sup>b</sup>	21 <sup>b</sup>
Pt 3	7.34	395 <sup>b</sup>	501 <sup>a</sup>	1075 <sup>a</sup>	10.5 <sup>a</sup>	55.4 <sup>b</sup>	3346 <sup>b</sup>	3.77 <sup>b</sup>	15.4 <sup>a</sup>	451	13.0 <sup>a</sup>	74.2 <sup>a</sup>	56 <sup>a</sup>
WHO	6-8.5	500	1000	1000	5	0.0	1000	250	50	50	100	75	0-2.0

In each column, values with different superscripts have statistically significant difference ( $p < 0.05$ ).

pt. 1: discharge point; pt. 2: upstream; pt. 3: downstream; TDS= Total Dissolved Solid, TSS= Total Suspended Solid, DO= dissolved oxygen, COD= chemical oxidation demand, BOD= biological oxidation demand.

**Table 2.** The Physico-chemical parameter of water samples obtained from selected point of Kakuri Abattoir.

Sample location	pH	TDS (mg/L)	Conductivity (µs/cm)	TSS (mg/L)	D.O (mg/L)	BOD (mg/L)	COD (mg/L)	Chloride (mg/L)	Magnesium (mg/L)	Nitrate (mg/L)	Sulphate (mg/L)	Calcium (mg/L)	Turbidity (NTU)
Pt 1	7.34	4051 <sup>a</sup>	281 <sup>a</sup>	1124 <sup>a</sup>	9.24 <sup>a</sup>	76.0 <sup>a</sup>	4351 <sup>a</sup>	4.7 <sup>a</sup>	13.4 <sup>a</sup>	520 <sup>a</sup>	13.48 <sup>a</sup>	72.6 <sup>a</sup>	64.5 <sup>a</sup>
Pt 2	7.22	205 <sup>c</sup>	221 <sup>a</sup>	1003 <sup>a</sup>	5.78 <sup>b</sup>	12.0 <sup>c</sup>	300 <sup>b</sup>	2.2 <sup>a</sup>	9.4 <sup>a</sup>	69 <sup>c</sup>	7.65 <sup>a</sup>	35.21 <sup>b</sup>	22.5 <sup>b</sup>
Pt 3	7.31	350 <sup>b</sup>	269 <sup>a</sup>	1110 <sup>a</sup>	9.01 <sup>a</sup>	56.8 <sup>b</sup>	4217 <sup>a</sup>	4.2 <sup>a</sup>	12.3 <sup>a</sup>	499 <sup>b</sup>	13.50 <sup>a</sup>	72.1 <sup>a</sup>	58.5 <sup>a</sup>
WHO	6-8.5	500	1000	1000	5	0.0	1000	250	50	50	100	75	0-2.0

In each column, values with different superscripts have statistically significant difference ( $p < 0.05$ ).

pt. 1= discharge point, pt. 2= upstream, pt. 3= downstream, TDS= Total Dissolved Solid, TSS= Total Suspended Solid, DO= dissolved oxygen, COD= chemical oxidation demand, BOD= biological oxidation demand.

**Table 3.** The Physico-chemical parameter of water samples obtained from selected point of Sabo Abattoir.

Sample location	pH	TDS (mg/L)	Conductivity (µs/cm)	TSS (mg/L)	D.O (mg/L)	BOD (mg/L)	COD (mg/L)	Chloride (mg/L)	Magnesium (mg/L)	Nitrate (mg/L)	Sulphate (mg/L)	Calcium (mg/L)	Turbidity (NTU)
Pt 1	7.34	4001 <sup>a</sup>	500 <sup>a</sup>	1090 <sup>a</sup>	10.0 <sup>a</sup>	54.9 <sup>b</sup>	3450 <sup>b</sup>	3.34 <sup>a</sup>	14.5 <sup>a</sup>	451 <sup>a</sup>	13.0 <sup>a</sup>	79.2 <sup>a</sup>	56
Pt 2	7.09	290 <sup>b</sup>	245 <sup>b</sup>	1000 <sup>a</sup>	6.78 <sup>a</sup>	13.0 <sup>a</sup>	3121 <sup>b</sup>	2.2 <sup>a</sup>	9.4 <sup>a</sup>	69 <sup>b</sup>	7.65 <sup>a</sup>	35.2 <sup>b</sup>	24.0
Pt 3	7.56	4331 <sup>a</sup>	512 <sup>a</sup>	1167 <sup>a</sup>	10.9 <sup>a</sup>	75.0 <sup>c</sup>	5410 <sup>a</sup>	5.89 <sup>a</sup>	14.9 <sup>a</sup>	456 <sup>a</sup>	13.90 <sup>a</sup>	75.0 <sup>a</sup>	57
WHO	6-8.5	500	1000	1000	5	0.0	1000	250	50	50	100	75	0-2.0

In each column, values with different superscripts have statistically significant difference ( $p < 0.05$ ).

pt. 1= discharge point, pt. 2= upstream, pt. 3= downstream, TDS= Total Dissolved Solid, TSS= Total Suspended Solid, DO= dissolved oxygen, COD= chemical oxidation demand, BOD= biological oxidation demand.

## 4. Discussion

From the results obtained in Tables 1, 2 and 3, the waste water from the abattoir has unacceptable colour with high amount of suspended solids, dissolved oxygen, biological oxidation demand etc were all high from the three site this due to the present of faeces bone and others component of from the abattoirs [14, 15, 17]. Similarly, the nitrate concentration for samples in Tables 3, 2 and 1 and samples result on chlorine, calcium, magnesium, sulphate and electric conductivity in Tables 3, 2, and 1 fall below the acceptable standard except PH. This agreed with the work done by [3, 10, 11]. Chemical analysis shows high amount of dissolved oxygen in all samples in conformity with acceptable standard. It was observed that the characteristics of abattoir wastes and effluents vary from day to day depending on the number and types of stocks being slaughtered. [13-15].

## 5. Conclusion

Inference that can be drawn from the analysis of the abattoir effluents and surrounding portable water is the closer to abattoir, the less portable the water for consumption.

Abattoir should be sited relatively far from residential areas, Abattoir activities should be done in an environmental friendly manner in strict compliance with environmental health and safety regulations. Disposal of abattoir wastes must be done in an environmental friendly manner to mitigate contamination. The state environmental protection agency should actively monitor activities of the abattoirs and ensure compliance with health and safety standard.

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