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Research Article

Bacteriological and Physicochemical Characteristics of Abattoir Effluents from Ado - Ekiti Municipal Abattoir, Ekiti State, Nigeria

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Abstract: Bacteriological and physicochemical contents of effluents from Ado - Ekiti Municipal abattoir in Ekiti State, Southwestern, Nigeria were studied. Effluent samples from four points; slaughter slab, drainage within the abattoir, drainage just outside the abattoir and drainage 20metres away from the abattoir were analyzed. Effluents samples were collected for the determination of pH, Temperature, Total Dissolved Solids (TDS); Total Suspended Solids (TSS); Biochemical Oxygen Demand (BOD); Coliforms; Pseudomonas aeruginosa; Faecal streptococcus and Clostridium perfringens. TDS and TSS were significantly ($p<0.05$) higher in drainage within abattoir than the slaughter slab however BOD, pH, nitrate, phosphate, turbidity and temperature were similar ($p>0.05$) statistically, also TDS, TSS, BOD, nitrate and turbidity were significantly ($p<0.05$) higher in the drainage 20metres away from the abattoir than the drainage just outside the abattoir while other parameters like pH, phosphate, and temperature were similar ($p>0.05$) statistically. Coliforms, Pseudomonas aeruginosa, Faecal streptococci and Clostridium perfringes values obtained for effluents samples collected from the slaughter slab, drainage within the abattoir, drainage just outside the abattoir and drainage 20metres away from the abattoir were statistically different. The presence of high contaminants and microbial load in abattoir effluents with its environmental pollution tendencies especially surface water corroborates the fact that proper effluents treatment should be done before its discharge into the environment.
Keywords: Abattoir, Water, Physicochemical, Bacteriological, Sanitary, Total Suspended Solids, Total Dissolved Solids, Biochemical Oxygen Demand, Coliforms, Public Health.

INTRODUCTION

The characteristics of abattoir wastes and effluents vary from day to day depending on the number, types of stock being processed and the method of processing employed. Waste generated by abattoirs include solid waste, made up of paunch content, bones, horns and feacal components, slurry of suspended solids, fat, blood and soluble materials[1]. When organic matter exceeds the capacity that the micro – organisms in the water can breakdown and recycle, it encourages rapid growth, or blooms of algae leading to entrophication.

Equally, improper disposal systems of wastes from slaughter houses could lead to transmission of pathogens to human as such cause zoonotic diseases such as colibacillosis, salmonellosis, brucellosis and helminthes. Clostridium perfringes a common cause of gas gangrene and food poisoning as well as bowel disease called necrotizing colitis has been isolated from wastewaters[2,3].

Wastes from abattoir operations can also be separated into solid, liquid and fat. These wastes are highly organic. The solid waste includes condensed meat, undigested ingesta, bones, horns, hairs and aborted fetuses. The liquid waste is usually composed of dissolved solids, blood and gut contents, urine and water, while fat waste consists of fat/oil, grease which are characterized with high organic levels[4-5].

MATERIALS AND METHODS

Study Location

The study location is Ado-Ekiti municipal abattoir, Ekiti State, Nigeria. It is the largest abattoir in the state as it slaughters over 700 cattle per week. It has sections such as lairage, slaughter slabs and butchering sections. One characteristic of this abattoir is high traffic of humans and carcasses. Effluents generated in this abattoir are voluminous and were discharged indiscriminately into the surrounding abattoir environment.

Effluent Sample Collection Method

500mls water samples were aseptically collected as follows:

1. 8 samples were collected from the slaughter slab.

2. 8 samples were collected from the drainage within the abattoir.
3. 8 samples were collected from the drainage outside the abattoir.
4. 8 samples were collected from the drainage 20metres away from the abattoir.

Samples were transported to the laboratory immediately after collection.

Samples were processed immediately at the laboratory, that is, between 6- 12hours post collection.

Bacteriological Assessment of Effluent Samples

About 100mls of the water sample was filtered through a filter that retains bacteria. The filterate was then transferred to Petri dishes containing MacConkey agar and incubated at 37^0C for 48hours [6]. The numbers of coli form colonies formed were counted using a microscope and then the values were expressed as CFU/ml.

Physicochemical Assessment of Effluent Samples

Temperature of the samples were taken using digital thermometer while pH was determined using a digital pH meter. Milton Roy (USA) Spectronic 20D meter was used to determine the turbidity of the samples. BOD coefficients of the samples were determined using the Winkler's Titration Method as recommended by APHA[6]. Gravimetric method involving filtration and evaporation were used to measure TSS and TDS.

Data analysis

Experimental results were analyzed using one-way analysis of variance (ANOVA) to determine the significant difference between the means. Differences were considered at $P<0.05$.

RESULTS AND DISCUSSION

Table 1 showed the physicochemical properties of effluents from the slaughter slab and drainage within the Ado – Ekiti municipal abattoir. From the table TDS and TSS were significantly ($p<0.05$) higher in drainage within abattoir than the slaughter slab while other parameters like BOD, pH, nitrate, phosphate, turbidity and temperature were similar ($p>0.05$) statistically. The high values of TDS, TSS and turbidity obtained for the drainage within the abattoir implies that there is high soluble and insoluble waste materials from the carcasses being processed on different slaughter slabs in the abattoir which is washed into this adjoining drainage within the abattoir while the high values of BOD, pH, nitrate, phosphate and implies that there is possibility of additional pollutants from humans operating within the abattoir thus wastewater in the drainage within the abattoir is more polluted than that in the slaughter slab. This result corroborates Coker et al [5] that abattoir wastewater is heavily polluted regardless of the point from which it is taken from.

Table-1: Physicochemical properties of effluents from slaughter slab and drainage within the Ado-Ekiti municipal abattoir

Parameters	Slaughter slab	Drainage (within abattoir)
TDS (mg/l)	4688.00 ± 416.49^a	11053 ± 588.07^b
TSS (mg/l)	6348.00 ± 1481.40^a	12145 ± 11210.50^b
BOD (mg/l)	135.00±35.36	125.00±36.35
pH	7.20±0.28	7.30±0.14
Nitrate (mg/l)	408.46±3.50	445.23±2.25
Phosphate (mg/l)	51.49±3.31	52.45±2.51
Turbidity (NTU)	3652.00±18.96	3700±15.5
Temperature(^{o}C)	27.35 ±0.35	27.15±0.25

Means with different superscripts along the same rows are significantly ($p<0.05$) different

Table 2 showed the physicochemical properties of effluents from the drainage outside and drainage which is 20metres away from the Ado – Ekiti municipal abattoir. From the table TDS, TSS, BOD, nitrate and turbidity were significantly ($p<0.05$) higher in the drainage 20metres away from the abattoir than the drainage just outside the abattoir while other parameters like pH, phosphate, and temperature were similar ($p>0.05$) statistically. The high values of TDS, TSS, BOD, nitrate and turbidity obtained for the drainage 20metres away from the abattoir implies that there is addition of nitrogenous and other wastes from humans to the abattoir effluents. This result agrees with work done by Ojo [9] that the amount of pollutants in abattoir wastewater increases as it moves from slaughter slab to the drainage outside abattoir and its environment.

Table -2: Physicochemical properties of effluents from drainage outside and drainage in the Ado-Ekiti municipal

Parameters	Drainage (outside abattoir)	Drainage (20mtrs from the abattoir)
TDS (mg/l)	12690.00±510.52[a]	13871±348.14[b]
TSS (mg/l)	14577.00±255.60[a]	13361±112.75[b]
BOD (mg/l)	102.50±33.65[a]	313.50±63.50[b]
pH	7.25±0.49	7.28±0.15
Nitrate (mg/l)	558.60±2.50[a]	851.15±32.52[b]
Phosphate (mg/l)	55.94±4.51	57.35±5.10
Turbidity (NTU)	3825.00±11.68[a]	5800.00±5.50[b]
Temperature(^{o}C)	28.05 ±0.07	28.50±0.75

Means with different superscripts along the same rows are significantly ($p<0.05$) different

Table 2-physicochemical properties of effluents from drainage outside and drainage 20metres from Ado- Ekiti municipal abattoir.

Table 3 showed the bacteriological properties of effluents samples collected from the slaughter slab and drainage within the abattoir in which the values obtained for Coliforms, Pseudomonas aeruginosa, Faecal streptococci and Clostridium perfringes were statistically different. The values for these microbes were higher for drainage within the abattoir except for Pseudomonas aeruginosa which is lower. This corroborates Omole *et al.;* [7] that abattoir effluents is heavily ladened with microbes.

Table 3: Bacteriological values of effluents from slaughter slab and drainage within the Ado-Ekiti Municipal abattoir

Bacteriological properties	Slaughter slab	Drainage (within abattoir)
Coli form (10^5CFU/ml)	30.00±14.14[a]	43.00±31.18[b]
Pseudomonas aeruginosa (10^5CFU/ml)	85.00±21.21[a]	11.00 ±1.41[b]
Faecal streptococci (10^5CFU/ml)	120.00 ±42.43[a]	150.00 ±0.28[b]
Clostridium perfringes (10^5CFU/ml)	8.00 ±2.83[b]	15.00±0.07[a]

Means with different superscript are significantly different ($p<0.05$)

Table 4 showed the bacteriological properties of effluents samples collected from the drainage outside the abattoir and drainage 20metres away from the abattoir in which the values obtained for Coliforms, Pseudomonas aeruginosa, Faecal streptococci and Clostridium perfringes were significantly different($p<0.05$). The values for these microbes were higher for the drainage which is 20metres away from the abattoir except for Pseudomonas aeruginosa .This is line with the work done by Adesemoye *et al.;* [8] that high number of microbes are often discharged with abattoir effluents indiscriminately into the environment especially soil and surface waters.

Table 4: Bacteriological values of effluents from drainage outside and drainage 20meters from the Ado-Ekiti Municipal abattoir

Bacteriological properties	Drainage (outside abattoir)	Drainage (20mtrs away from abattoir)
Coli form (10^5CFU/ml)	58.00±11.31[a]	73.00±12.18[b]
Pseudomonas aeruginosa (10^5CFU/ml)	27.00±4.42[a]	40.00 ±1.14[b]
Faecal streptococci (10^5CFU/ml)	27.00 ±3.54[a]	48.00 ±2.55[b]
Clostridium perfringes (10^5CFU/ml)	10.25±3.18[b]	15.00±0.15[a]

Means with different superscript are significantly different ($p<0.05$)

CONCLUSION AND RECOMMENDATION

From the results the pollution of the environment by the effluents from Ado-Ekiti Municipal abattoir will constitute serious environmental problem and public health risk. The abattoir management authorities should make available points where the

effluents will be treated with organic water purifiers which will have high purification efficiency and also environment friendly. This will reduce the level of microbes especially the pathogenic ones and contaminants in the generated treated effluents thus lowering to the bearest minimum the pollution tendencies of this effluents.

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