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Physico-Chemical and Microbial Analysis of the Effects of Abattoirs Operation in Estako-West and Central, Edo-State, Nigeria

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Abattoir wastewater has a complex composition and very harmful to the environment. There is always need for reduction in the impact of natural and most especially anthropogenic pollution to enhance water quality, food safety and sustainable development. Physico-chemical and microbial properties analysed using standard laboratory procedures were temperature, pH, conductivity, turbidity, total solid (TS), total dissolved solid (TDS), total suspended solid (TSS), dissolved oxygen (DO), acidity, alkalinity, total hardness, calcium and magnesium hardness, chloride, iron and nitrate. Temperature ranged from 28.04-29.12C, pH between was 7.67-8.01, Alkalinity is 0.45 mg/l, TS, BOD and TSS were 700 mm/l, 48 mm/l, 500 mm/l, DO is 2,100 ppm. Holistic outputs of the investigation revealed various water samples were contaminated with E. Coli *and other enteric bacteria. The presence of coliform* staphylococcus aures *indicated the presence of microorganisms which are associated with water borne disease.*

Keywords*: Slaughterhouse, wastewater, environment, bacteria, abattoirs, water quality, physico-chemical and microbial properties, hazard and safety*

1. Introduction.

Meat quality control is a system that regulates the measure of extrinsic materials such as chemical residues, toxins, pathogenic microorganisms and putrefied tissues, which could be present in meat and are deleterious to human health [1]. Abattoirs generate large amounts of solid waste and effluents such as rumen contents, blood and waste water [2]. Abattoirs often have difficulties in disposing of the solid wastes and wastewater in an environmentally acceptable fashion and in

many instances untreated rumen contents, blood and/or other Abattoir effluents and wastewater are released into the environment [3].

The resulting pollution not only cause problems related to odour, flies and hygiene, but surface and ground water can be polluted with pathogens and undesirable chemical compounds [4]. While the slaughtering of animals results in significant meat supplies, a good source of protein and production of useful by-products such as leather, skin and bones, the processing activities involved sometimes result in environmental pollution and other health hazards that may threaten animal and human health [4].

Abattoir and slaughter houses have been defined as premises approved and registered by the controlling authority for hygienic slaughtering and inspection of animals, processing and effective preservation and storage of meat products for human consumption [5]. Previous studies have shown that the characteristics of abattoir wastes and effluents vary from day to day depending on the numbers and type of stocks being processed [6].

Animals (cow, goat e.tc) prepared in Auchi abattoir alone accounts for about 65% of the total animal in Etasko-West, Edo State, Nigeria. The waste from the slaughtering and dressing grounds in the abattoir are washed into open drainages untreated and the leachates from the series of decomposition processes of these wastes can introduce enteric pathogens and excess nutrients into the surrounding surface waters and also percolate into the underlying aquifers to contaminate the hand-dug wells which serve the dual purpose of drinking water for the butchers and others working in the abattoir, and the people in the neighbourhood [7]. Uncontrolled discharge of abattoir effluent on the soil surface and water could lead to serious land and water degradation causing serious economic and health problems. This paper investigates microbiological and physicochemical of effluent being discharge to the river and resulting effects on the environment.

2. Materials and methods.

2.1. Sample Collection

Water samples were collected from five abattoirs with sterile polyethylene bags. The abattoirs were located at different locations in Estako west and central in Edo State, Nigeria. Samplings were done as early as 6.00 am when slaughtering processing to the sales of the meat were carried out. The procedure used is similar to the reported [5]. All glasswares such as Petri dishes, conical flask, measuring cylinder and test tube were washed with detergent, rinsed in clean water and dried in the drying cabinet. The glasswares were then sterilized in the hot air oven (autoclaves) at 121^0C for 20 minutes. All samples were well labeled and transported to the laboratory for analyses immediately after collection. There were a total of 3 replicates for each sample. The effluent was investigated for physico-

chemical and microbiological characteristics. The observed laboratory results were compared with World Health Organization (WHO) standard.

2.1.1. Determination procedures for microbiological and physico-chemical characteristics

The chemical and biochemical oxygen demands were measured according to standard methods described by [8]. The conductivity of the effluent was determined using a conductivity meter (YSI Model 34) according to [9] while the pH of the sample was determined with a pH metre (7020 HACH) following standardization with a buffer solution [9]. Temperature of the effluent and soil stock solution was determined using a mecury-in-glass thermometer (0 – 100^{o}c) in accordance with the method described by [10]. The sample was poured into different clean odour free glass bottle and warmed to room temperature using water bath. The samples were shaken and the stopper of the bottle was removed. The odour was tested using the nose and the characteristic odour was recorded by five judges.[10].

2.1.2. Results-analysis and discussion

The results of the research study reveal the physicochemical and microbiological characteristics of the effluent from the abattoirs. Results of physiochemical and microbiological tests are shown in table 1 and 2.

Table 1. Physicochemical characteristics of effluent from the abattoir

Parameter Tested	**Mean**
Temperature	28.40C (±10.25^{0}C)*
pH	7.67(±0.36)
Colour	Dark brown
Odor	Offensive
Conductivity	18.0 x 10^{2} (±9.25)
Acidity	(ppm) 0.9 (±0.13)
Alkalinity	(mg//0.45(±0.04)
Dissolved Oxygen	(ppm) 2,100 (±233)
Total suspended solid	(mm/l)500
Total Solid	(mm//) 700
Biochemical Oxygen Demand	(mm/l) 48
Total Hardness	176.4
Magnesium ND	
Calcium	85

Chloride	(mm/*l*) 4.8
Aluminium	ND
Lead	ND
Iron	7.6

Standard deviation in parenthesis

Table 2. Result from the bacteriological analysis

Samples	Coliforms	Other Enteric Bacterial (Cfu/mu)
A	174	7.10×10^6
B	185	7.45×10^6
C	180	7.15×10^6
D	178	7.19×10^6
E	186	7.47×10^6

Source: Lab. Result, 2010

The composition of the slaughterhouse is affected by the number of animals slaughtered and the disposal method employed. A significant part of the variation can be seen in the Total Suspended Solids (TSS) and the exhibited high dissolved oxygen and Biochemical Oxygen Demand (BOD) (Akinro et al., 2009). The effluent from the abattoir has high offensive odour. The pH is slightly neutral ranging from 7.92-7.96 which is within WHO standard of 6.5-9.5.WHO defines 6.5-8.5 as the suitable range for hydrogen concentration (pH) levels. The range in the effluent is considered suitable. Conductivity ranges which is within 18 $*10^2$ mS/cm which are within WHO standard permissible limit of 200-1200 mS/cm. Total Suspended Solid (TSS) ranged from 500-550mm/L. This far above the of WHO permissible limit. The concentration of dissolved oxygen (DO) is 2100 ppm. The Total hardness of the water sample ranged from 176.4 mm/l which was also below the WHO (2006) allowable limit of 500 mg/L and Calcium hardness value which 85 is not specified by WHO standard so pollution cannot be predicted and the value of Magnesium hardness was not determined. Chloride, Iron and Nitrate values are all within the permissible limit of WHO (2006) standard permissible limit. DO result indicated that the various samples were contaminated in one way or the other with E.*Coli* and other enteric bacteria. It can be deduced from Table 2 that all the water samples used for the test were polluted biologically beyond permissible limits. The presence of coliform *staphylococcus aurens* was confirmed in all the abattoirs. The presence of this bacteria in intolerable number obviously constitute a serious public health hazards as the presence of these microorganisms is associated with water borne diseases since the waste is discharged into the streams. Such systems of production are not sustainable in the long-term and it is possible to develop integrated systems where local inputs are optimized and recycled, with a reduction in external inputs. Sustainable animal production means, that we are able to produce food animal and animal products without lasting damage to the

environment, which means that essential elements like water, air and soil are left without dead loads and that by-products of animal production creates no animal and human health risks through environmental protection and animal waste management (TIELEN, 2000).

3. Conclusion

The result revealed that effluents from the abattoir pose health and environmental problems. Other possible sources of pollution could be point source discharge from industrial effluents (solid, liquid etc). High level of Total Suspended Solid (TSS) and conductivity show that the samples were heavily loaded with colloidal, organic, inorganic and suspended matters. The maintenance of good environmental conditions by disposing sewage and refuse in a sanitary manner in the abattoir starts with the definition of the minimum requirement for all the links in the production chain. Also the effluent should be well treated and ensure is not harmful before it is discharged

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