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Research Article

Impact of Abattoir Effluent on River Landzu, Bida, Nigeria

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ABSTRACT

This study assesses the impact of Abattoir effluent on the physico-chemical parameters of Landzu River. Water samples were collected from four different sampling point; P1, P2, P3 and P4, it was collected at both the upstream and downstream of the effluent point of discharge. The parameters tested were pH, Dissolve Oxygen, Suspended Solids, Electrical Conductivity, Manganese, Chloride, Copper, Iron and standard method of water and wastewater analysis were used and compared with WHO permissible limit. The results shows that virtually all the sample were above the WHO standard which make the river water to be unsafe to both Human and aquatic life. There is need to upgrade the present abattoir to reduce it level of pollution.

Keywords: Abattoir, Effluent, Physico-chemical, Wastewater, Impact, River Landzu

INTRODUCTION

Increase in population growth all over the world in the last decades, particularly in many African countries like Nigeria, which leads to intensive increase in urbanization, and greater exploitation of natural resources [1].Due to this increase and its impact on the environment, large amount of waste are generated and lack of proper system of discharge have undesirable effect on man and its environ. One the most critical problems of developing countries is improper management of vast amount of waste generated by various anthropogenic activities[2]. It is well established that a large number of diseases are transmitted primary through water supplies contaminated with human and animal excreta particularly faeces [3].

Environmental problems have increased in geometric proportion over the years with improper management practices being largely responsible for gross pollution of the aquatic environment with concomitant increase in water borne diseases especially typhoid, and dysentery [4]. Abattoirs are generally known all over the world to pollute the environment either directly or indirectly from their various activities [5].An abattoir has been defined as a premise 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 [6]. Abattoir are generally located near a flowing river especially in developing countries because of water scarcity, since there is high demand of water for washing of meat and cleaning the environment, therefore the effluent from the washing are directly discharge to the nearby flowing river.

The effluent contains high level of organic matter due to presences of manure, blood, fats, grease, heir, grit and undigested feeds [7], since it has high concentration of organic matter, it will definitely have an impact on

the river water and it can be hazardous to human beings and aquatic life. In a related study, it shows that improper disposal of effluent from slaughter houses could lead to transmission of pathogens to human, and are caused by the following bacteria *E- Coli* which can produce a bloody diarrhoea due to toxins it secretes when it infect human intestinal tracts, *Bacillus* which is responsible for food poisoning in human and also affect food spoilage of highly acidic, tomato based product, *Salmonella* which are mostly found in cold, and warm blooded animals (including human) and causes illness like typhoid fever, paratyphoid fever [8]. Hence, abattoir has an impact on the river and also affects man and its environment. The aim of this research was to assess the impact of effluent discharge from abattoir on the river Landzu.

Description of the Study Area: Bida is the capital of Bida Local Government and the second largest city in Niger State; it is located southwest of the capital Niger State, Minna. Bida have annual rainfall ranges from 1000mm to 1200mm with a marked raining season from April to October. Average annual air temperature at about 27 ^{O}C. The abattoir under study is located at the eastern part of the town in an area called Ebangaie. The abattoir is located at about 100 m from river Landzu, River Landzu is the river that cuts across Bida from Dokoza and flow through Masaga and pass through Ebangaie and connect to river Musa. Major activities around the river are agricultural activities which include irrigation farming and gardening, fishing etc. The abattoir has an open slaughtering slab; where cows, rams and goats are slaughtered; removal of hair from the skin is done either with hot water or burning with fire in an open. Butchering of slaughtered animals takes place all over. The waste materials from the abattoir are washed through a drainage, which links the abattoir and the stream.

MATERIALS AND METHODS

Field sampling was carried out throughout the period of the research. The samples were collected for four weeks at four different sampling points. It was carried out on river Landzu and a representative sample was taken inside the abattoir. The river was segmented from the point of discharged at 50 m interval for four different locations, that is, 50 m upstream and 50 m downstream of the discharged point as shown in **Table-1.**

Table- 1: Sampling location descriptions.

Point of collection	Distance (m)	Description
P1	50	50m upstream of point of discharge
P2	0	Point of discharge
P3	50	50 m downstream of point of discharge
P4	100	100 m downstream of point of discharge

At each sampling location, water samples were taken in a polyethylene bottles. All bottles were previously washed with detergent and finally rinsed with deionised water prior to usage. Before taking the sample water the bottles were rinsed three times with sample water at the point of collection. The sample bottles were labelled according to location name. pH and temperature of the sample were taken immediately on the spot. The collected water sample were immediately put in an ice bag to maintain the required temperature and transported to the laboratory of Civil Engineering Department of Federal University of Technology, Minna. The physico-chemical analysis of the water samples were conducted using standard analytical method [9]. The laboratory results were analysed by standard statistical method and compared with WHO water quality guidelines[10].

RESULTS AND DISCUSSION

The pH of the abattoir waste water before discharge has an average value of 9.92 which shows it is slightly basic is as shown in Table 2. pH is the measure of acidity or alkalinity of water; hence the pH value is above the WHO tolerance limits of 6.0-9.0 for discharge of wastewater from all industries into river. The waste water analysed before discharged from **Table-2** indicated that they are all above WHO permissible limit of waste water to be discharge to river.

The average values of the sampled points for pH was taken for four weeks and it ranges from 8.80-9.17 as shown in **Figure-1,** with the highest value recorded at point P3 which is the point of discharge and the lowest

value from P4 which is the point upstream of the point of discharge. Only P4 that is within the permissible limit of 6.5-8.5 of river water, hence the remaining three points are above the WHO limit, which indicates that the water is slightly basic.

Table- 2: Characteristic of the waste water before discharge to the river.

Parameter	Results
pH	9.92
Suspended solid	51248 mg/L
Dissolve solid	4356 mg/L
Volatile solid	19 mg/L
Total solid	8519.21 mg/L
Nitrite	20.03 mg/L
COD	6899 mg/L

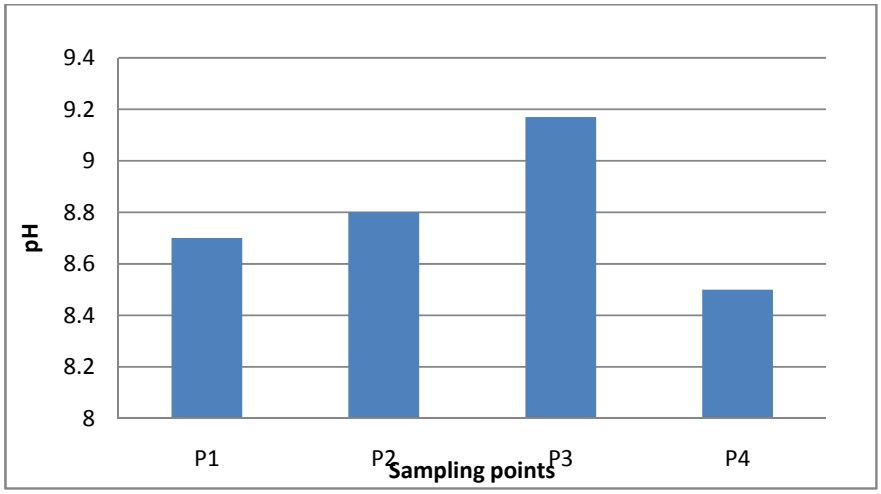

Fig. 1: pH average values of sampling points.

Table-3: Physico-chemical analysis results

Parameter/unit	Distance from the point of discharge (m)			
	100m downstream (P1)	50m downstream (P2)	0 m point of discharge (P3)	50m upstream (P4)
Temperature ^{O}C	27.0	27.0	27.1	27.0
Manganese mg/L	1.8	9	16	2.0
Chloride mg/L	228.46	1400.20	1362.72	52.10
Copper mg/L	0.16	6.4	5.8	0.78
Iron mg/L	0.11	2.1	1.9	0.06
Conductivity µm/cm	497	5400	6359	284
Hardness mg/L	95.08	1501.35	1701.53	141
Suspended solid mg/L	331.49	3610	4248.69	188.28
Dissolve oxygen mg/L	2.60	3.86	3.28	2.50

The average level of temperature at the sampling points ranged from 27.0-27.1^{O}C, as shown in table 2 which is adequate for river water. The average values for four weeks at four different sampling points indicates that manganese ranged between 1.8-16 mg/L with the highest at the point of discharge and the lowest at P1 but the values are all above the WHO limit of 1.0 mg/L. The level of chloride in the sample water

ranged from 52.10-1362.72 mg/L which is also above the permissible limit of 1.0mg/L. Chloride sources could be soluble salts (NaCl and KCl) from blood discharged into the effluent and from agricultural activities along the river bank [11]. Chloride also increases the electrical conductivity of water and thus, increases its porosity [12]. The average concentration of copper ranged from 0.16-0.78mg/L, P1 and P4 are within the WHO permissible limit of 1.0mg/L.

The average concentration of Iron show that only P4 is within the allowable range, although P1 is slightly above the limit of 0.1mg/L by giving 0.11mg/L but P2 and P3 are all above the limit. The conductivity levels in the waste water ranged from 317-325 µmcm-1. The average values of the sample are all above the range except P4 which is 284µm cm-1 and is within the allowable limit. Conductivity is used to indicate the dissolved solids in water because the concentration of ionic species determines the conduction of current in an electrolyte[13] and the moment it is above the permissible limit, it is no longer safe[14] The concentration of suspended solid ranged from 188.28-4248.69mg/L, the highest value of 4248.69mg/L is at P3 which is the point of discharged. This could be due to lack of proper sedimentation facility to separate the solid waste from liquid waste before the effluent is discharged, it could also be due to irrigation activities taken place along the river bank. High concentration can cause visibility problem to aquatic animal and also affect fish gills by clogging. The dissolved oxygen concentration taken throughout the period of the research shows a ranged from 2.50-3.86 mg/L. Dissolved oxygen is a measure of the degree of pollution by organic matter and is one of the significant tests of measuring water quality. The dissolved oxygen content of a water way is often the single most important feature which influence fish and other aquatic biota life [15].From is the results of this research it indicates that all the sample points are below the allowable limit of 4mg/L, but it not safe for any water dissolved oxygen to be lower than 4mg/L in order for the animals to survive. It was reported that fish kills occur when they are exposed for a few hours to less than 3 mg/L dissolved oxygen[16]. Therefore, it will be very difficult for an aquatic animal to survive in this water due to the level of concentration. Duping or discharging untreated waste material to surface water bring about it contamination and also affect ground water quality[17]. Therefore, discharging untreated waste into the river should be avoided.

CONCLUSION

The study revealed that abattoir activities and its management have direct effect on the built environment. There is no doubt that the pollution generated by Bida abattoir effluent is clear a evidence that the meat processing has high quantities of effluent which affect both the water and the entire environment. It also shows that most of the parameters in river Landzu are above the recommended values by WHO. The local authority should embark on regular monitoring activities of the river to ensure its safety and swift intervention by the Government and other stakeholders by putting in place effluent treatment facility which is lacking presently. Abattoir should be excluded from facilities to be located within residential neighbourhood.

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