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IMPACT OF ABATTOIR WASTE ON AQUATIC LIFE: A CASE STUDY OF YOLA ABATTOIR

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ABSTRACT

The impact of abattoir waste on aquatic life, using the Yola abattoir and the Chuchi dam, as a case study was the subject of the study. A total of 36 water samples of Yola abattoir wastewater and the Chuchi dam water was collected and analysed for the physico-chemical and bacteriological characteristics over a period of 6 months (January to June, 2003). Oral interview was also conducted with the abattoir workers and those working around the dam. The abattoir waste was found to be disposed off untreated. The abattoir wastewater was found to be highly polluted, with the physico-chemical and bacteriological parameters exceeding the effluent level recommended for discharge into water bodies in Nigeria. The physico-chemical and bacteriological characteristics of the Chuchi dam water were similar to that of the abattoir waste water. The abattoir wastewater is discharged along a slope draining down into the Chuchi dam. The implications of the results on the aquatic life of the dam are highlighted.

KEYWORDS: impact, Abattoir waste, Aquatic life.

INTRODUCTION

Aquatic organisms are plants and animals that live either part or all of their lives in water. The capacity of fresh water to support biodiversity is highly degraded at the global level, with many fresh water species facing rapid population declines or extinction. The continued neglect of the minimum water requirements for maintaining healthy aquatic ecosystems in term of both quantity and quality have devastating consequences on natural habitat, aquatic biodiversity and human health. Pollution impacts on aquatic environments has been far reaching, triggering algal blooms, damaging reefs, destroying habitats and hurting fishes. Aquatic ecosystems, both fresh water and marine, are sensitive to water quality problems stemming from extensive human activities, including industrial effluents, agricultural chemicals, human and animal wastes (WEHAB, 2002). Extensive spillage into the aquatic environment of untreated animal waste from animal processing industries like the abattoir are among the major pollutants o water bodies and have negative consequences on aquatic life. Abattoir spills can introduce enteric pathogens and excess nutrients into surface waters and can also contaminate ground waters (Meadows, 1995).

In Nigeria and most developing countries, abattoir waste are not treated or processed before disposal. At zoo town in Port Harcourt, slaughter house wastes with large quantities of animal faeces are channeled directly into a portion of one of the tributaries of the Niger (Odeyemi, 1980).

Yola modern abattoir is located in Yola South Local Government area. Yola is the state capital of Adamawa state. The abattoir is the only abattoir that serves Yola and its environs. About a hundred heads of cattle, two hundred and fifty sheep and goats are slaughtered on daily basis. While the slaughtering of animals result in meat supply and useful by-products like leather and skin, it also generates large quantities of solid and liquid waste. The Chuchi dam is located about half a kilometer southeast of the abattoir.

Before the construction of the dam, the water body was mainly used for fishing and fishing festival (Njuwa fishing festival) but now it is mainly used for farming, and watering of livestock (Adamawa State Ministry of Information Buletin, 1999).

This study presents our findings on the characteristics and quality of Yola modern abattoir wastewater and the Chuchi dam. The effect of the abattoir wastewater on the water quality and aquatic life in the dam was also emphasized.

MATERIALS AND METHODS

A total of thirty-six water samples of the Yola modern abattoir wastewater and the Chuchi dam were collected and analyzed for physico-chemical and bacteriological characteristics over a period of six months (January to June, 2003). All samples and field parameters collected from the abattoir and the dam were gathered on an out going tide.
This was done so that the data better represents the abattoir wastewater and the dam water flowing downstream through the system.

All glassware used in the collection samples were sterilized in an autoclave at a temperature of 120^{0}C for three hours. Duplicate samples of 100 ml and 2 liters of each of the abattoir wastewater and the dam water were collected for bacteriological and physico-chemical analyses respectively according to the procedure described in (AHPA, 1995).

Physical parameters

Field parameters were measured at each site suing a Solomat 803PS Multimeter Water Quality Probe (Sonde) and displayed on a Solomat 803 datalogger. Individual probes within the instrument measured water temperature, pH and dissolved oxygen. The instrument was calibrated regularly to ensure accuracy; Evaluation of odour was based on the chemical senses of smell, while colour was determined by observation.

Chemical Parameters

Chemical of the samples were determined using flame photometer atomic absorption spectrophotometer, titration, gravimetry, evaporation to dryness and colorimetry (AHPA, 1995).

Bacteriological parameters

The method of Miles and Misra described by Collins and Lyne, 1976 was adopted to obtain the microbial counts. All media used nutrient agar for bacterial count; macconkey agar for coliform count and M-enterococcus agar for faecal streptococcus count were sterilized in an autoclave at 121^{0}C for 15 minutes (AHPA, 1995). Samples were cultured on the prepared medium in duplicate and incubated aerobically at 37^{0}C for 48 hours and the colonies formed were counted using colony counter and expressed as colony-forming units per milliliter (cfu/ml) of the sample. The abattoir workers and people working around the Chuchi dam were also interviewed orally during the period of study.

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RESULTS AND DISCUSSION

The physico-chemical and bacteriological characteristics of the abattoir wastewater and the dam water as analysed are presented in tables 1 and 2.

It was found that wastewater from the abattoir is not treated or processed before discharge. The solid waster is allowed to pile up at the abattoir premises. While the liquid waste is drained along a slope, which drains out of the abattoir and end in water bodies like the Chuchi dam. A 1997 report revealed that animal waste is the largest contributor to pollution in 60% of rivers and streams classified as impaired b the Environmental protection Agency in the U.S. (Monica, 2002).

Except for the pH, temperature, chloride and manganese, the physico-chemical and bacteriological values of the abattoir wastewater are higher and exceeded the recommended level for the discharge of industrial effluents into water bodies or land in Nigeria. The physico-chemical and bacteriological characteristics of the Chuchi dam water down stream after mixing with the abattoir wastewater were found to have similar characteristics to that of the abattoir wastewater, which is highly polluted for aquatics life. This similarity could be as a result of the abattoir wastewater draining into the dam and mixing with the dam water. The higher levels of suspended solids in the dam water may give rise to production to toxic products, turbidity, and reduction of sunlight to desirable aquatic organisms. Similar findings have been reported (Hodges, 1977). While the low level of dissolved oxygen in the dam water could lead to anaerobic decomposition of organic materials, which will lead to formation of hydrogen sulfide, ammonia and other compounds which give rise to offensive odours. The high levels of coliform colonies, feacal coliform and ammonia indicate that the dam water was polluted with animal waste. Manure, and wastewater containing manure, can severely harm river and stream ecosystems. Manure contains ammonia, the dam water was found to contain 156 mg/l of ammonia and ammonia is highly toxic to aquatic life at low levels, an exposure of fish to 0.006 ppm of unionized ammonia may cause gill irritation and gill damage or hyperplasia (Mitchell and Chet 1978). The higher levels of mineral elements such as copper, phosphate, zinc, iron, lead, manganese and chloride in the dam water as compared to the abattoir wastewater could be as a result of discharges into the dam from agricultural farms, households and industries where these mineral elements are found in fertilizers, farms, households and industries where these mineral elements are found in fertilizers, farm chemicals, household wastes and industrial by products (Amukam, 1997).

Increased amounts of nutrients, such as nitrogen and phosphorus, from animal wastes as found in this study can cause algal blooms, that block water ways and this can kill fish and other aquatic organisms, devastating the entire aquatic food chain (Cecil, 1994). From the interview conducted at the dam, it was found out that before, the water body in the dam area was used for fishing and fishing festival (Njuwa fishing festival) but gradually the level of fish in the water decreased and was no longer used for fishing or fishing festival.

The dam water was found to be polluted and having high physico-chemical and bacteriological parameters that could be harmful to the aquatic life in the dam and was likely the cause of decrease level of fish in the water body as reported during the oral interview.

Unless controlling authorities understand the local water quality process and are monitoring how pollution trends and developing, the associated problems may arrive too suddenly for remedial action to be implemented in good time. If pollution is allowed to grow unchecked, the result may be sudden loss of aquatic ecosystem and a profound effect on down stream users (DFID, 1999).

The situation at Yola abattoir is an indication of what is operating in other abattoir and water bodies in Nigeria, there is therefore a need for the government to address the issue of proper treatment and processing of abattoir waster before disposal in Nigeria, by monitoring, creating awareness, discouraging and making laws against dumping and discharge of untreated or unprocessed animal wastes with parameters above the recommended level for Nigeria into water bodied or land.

Table 1: Physico-Chemical and Bacteriological Characteristics of Yola Abattoir wastewater

Parameter	Mean value of Yola Abattoir wastewater	Mean value of Well Water used at Yola abattoir	*Effluent limit for discharge into surface water in Nigeria	*Effluent limit for land application in Nigeria
Temperature °C	28.4	27.4	<40 within 15 m of outfall	<40
Odour	Objectionable	Odourless	-	
Colour	Dark brown	Colourless	7	-
Total solids (mg/l)	4,796	124	2,000	2,000
Suspended solids (mg/l)	1860	8	30	-
pH	6.8	7.2	6-9	6-9
Dissolved Oxygen	3.6	6.8	-	-
Biochemical oxygen demand at 20°C (mg/l)	2,960	2.8	50	500
Chemical Oxygen Demand (mg/l)	6,020	7.0	-	-
Ammonia-Nitrogen (mg/l)	156	0.22	-	-
Total kjeldahl nitrogen (mg/l)	160	0.26	-	-
Nitrate-nitrogen (mg/l)	108	0.2	20	-
Cadminium (mg/l)	0.8	0.04	<1	-
Chromium (mg/l)	0.06	0.02	<1	-
Cobalt (mg/l)	0.2	0.2	-	-
Copper (mg/l)	2.0	0.34	<1	-
Phosphate (mg/l)	12	1.6	5	-
Zinc (mg/l)	1.8	1.0	<1	-
Iron (mg/l)	19.4	1.1	20	-
Lead (mg/l)	0.08	0.04	<1	-
Manganese (mg/l)	3.2	0.8	5	-
Chloride (mg/l)	84	12	600	600
Grease (mg/l)	1,264	1.1	10	30
CFU/100mls	2.40×10^6	1.20×10^3	400MPN/100Ml	500 MPN/100Ml
Feacal coliform/100mls	1.8×10^6	1.20×10^2	-	-

*Federal Environmental Protection Agency (FEPA), 1991. Guidelines and Standards for Environmental pollution Control in Nigeria.

Table 2: Physico-Chemical and Bacteriological Characteristics of Chuchi dam water upstream before discharge of abattoir wastewater and downstream after discharge

Parameter	Mean value of Chuchi dam water upstream	Mean value of Chuchi dam water downstream
Temperature ^{0}C	28.1	28.4
Odour	No odour	Objectionable
Colour	colourless	Brownish
Total solids (mg/l)	166	1200
Suspended solids (mg/l)	20	300
pH	7.1	7.8
Dissolved Oxygen (mg/l)	6.2	8
Biochemical Oxygen Demand at 20^{0}C (mg/l)	3.8	620
Chemical Oxygen Demand (mg/l)	10	1,420
Ammonia-Nitrogen (mg/l)	0.62	36
Total kjeldahl nitrogen (mg/l)	0.66	38
Nitrate-nitrogen (mg/l)	0.58	32
Cadmium (mg/l)	0.18	0.96
Chromium (mg/l)	0.01	0.08
Cobalt (mg/l)	0.8	0.12
Copper (mg/l)	2.1	2.20
Phosphate (mg/l)	14.8	16
Zinc (mg/l)	3.2	4
Iron (mg/l)	18	24
Lead (mg/l)	0.1	0.1
Manganese (mg/l)	6	7
Chloride (mg/l)	102	109
Grease (mg/l)	4	64
CFU/100mls	$1.2x10^4$	$1.2x10^5$
Feacal coliform/100mls	$1.0x10^3$	$1.0x10^4$

REFERENCES

Adamawa State Ministry of Information Bulletin (1999). Adamawa State Press Publication.

American Public Health Association (APHA) (1995). Standard Methods for the Examination of water and wastewater, 19th Edition, Washington D.C.

Anukam, 1997. Water Pollution Control-A guide to the use of water quality management principle. A case study iv-Nigeria. World Health Organisation/ United Nations Environment Programme Publication.

Ceil, H., 1994. Animal Waste and the Environment. University of Georgina, College of Agricultural and Environmental Sciences. Coops. Ext. Service Bulletin No. 827. Collins, C. H. and Iyyne, P. (1976). Microbiological Methods. 4th Edition. Butterworths, London. Pp. 169 – 195.

Department for International Development (DFID) (1999). A simple methodology for water quality monitoring. DFID reports OD 142 (KAR project R6662). Pearce, G. R; Chandhry, M. R.; and Ghulam, S. (eds).

Federal Environmental Protection Agency (FEPA), 1991. Guidelines and standards for Environmental pollution control in Nigeria.

Hodges, L., 1977. Environmental Pollution, 2nd Edition. Holt, Rinehart, and Winston Publication, New York.

Meadows, R., 1995. Livestock legacy. Environmental Health Perspectives. 103(12): 1096 – 1100.

Mitchell, R. and Chet, I., 1978. Indirect Ecological effects of pollution. Water pollution Microbiology. 2: 177- 199.

Monica, E., 2000. Eating to save the Environment. Animal issues. 31 : 4.

Odeyemi, O., 1980. Consequences of water pollution by solid wastes and feacal Materials in Nigeria. Proceedings of the 3rd National conference on water pollution, Port Harcourt. Pp. 11 – 17.

Water and Sanitation, Energy, Health, Agriculture and Biodiversity (WEHAB) Working group, 2002). A framework for Action on water and sanitation. A paper presented at the world summit on sustainable development in Johannesburg, South Africa.