

Assessment Of QGBOR-Hill Abattoir Operations On Some Environmental Variables Of Aba River And Property Values

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Abstract—The research assessed the process of operations and facilities at Ogbor hill abattoir, Aba and their impact on some environmental variables and values of land and residential properties in the environs. The methodology involved reconnaissance visit and inventory of facilities and working conditions, environmental field sampling and analysis, noise level measurements, interviews and evaluation of properties. Standard methods were used for field and laboratory studies. It was observed that standard facilities for processing animals and their by products are lacking, and processors operate in unhygienic conditions posing risks to human health and the physical environment. The major problems identified were the discharge of abattoir effluents untreated into the receiving waters of Aba river, washing of the carcass with water contaminated by industrial effluents channelled into nearby streams and use of tyres to burn the animals. The results of the analysis showed that the pH for water samples is slightly acidic especially at the downstream (5.34). The levels of the other measured parameters were within the standard limits except Lead and Iron with sediments having higher values than water samples for most parameters. Seasonal variations also affected some measured parameters such as conductivity, TDS, TSS with higher values in the wet season at the abattoir. The property values of land and buildings near the abattoir were lower than the ones in other locations of Aba city. The noise levels were more at the point of sales of the meat. The activities at the abattoir affected negatively the water qualities of Aba river as well as the property value of the environs. There is need for constant monitoring of the water body and for the relevant government agencies to upgrade the facilities of the abattoir.

Keywords—Abattoir, Parameter, Ogbor-hill, Water, Sediments, Aba

A slaughterhouse or abattoir is a facility where animals are slaughtered for consumption as food for humans [1]. Slaughtering animals on a large scale poses significant logistical problems, animal welfare problems, public health requirements, and environmental problems. In developed countries, these slaughterhouses were regulated by law to

ensure good standards of hygiene (Plate 1), the prevention of the spread of disease and the minimization of needless animal cruelty [2]. The slaughterhouse had to be equipped with a specialized water supply system to effectively clean the operating area of blood and offal [3].



Plate 1: Abattoir with standard facility for processing of meat.

In Nigeria, the development and growth of livestock production has been on the increase and has guaranteed steady supply of food animals meant for slaughter and processing for human consumption. The poor state of abattoirs and meat processing plants; the ineffective meat inspection services and the resultant consumption of unwholesome meat by the public have become a major cause of concern to all stakeholders in the industry and general public [4]. The Fourth Schedule of the 1999 Constitution of Nigeria, subsection 1(e), states amongst others that the main functions of the Local Government Councils will be “establishment, maintenance and regulation of slaughter houses, markets, motor parks and public conveniences”.

Published studies have documented a variety of contaminants, microbial agents (Table 1) and health effects in those occupationally or accidentally exposed to improperly managed abattoir waste [5]; [6]; [7]. The poor state of our national abattoirs, meat processing plants, ineffective meat inspection service and the resultant risk of consuming unwholesome meat have been issues of public health and global environmental concerns [8].

Table 1: Disease causing organisms found in slaughter animals and abattoir wastes in Nigeria

Type	Source of organism	Reference
Bacteria	Bacillus sp, Clostridium welchi(Cl. perfringes), Pseudomonas aeruginosa, Micrococcus luteus, Vibrio sp, Lactobacillus platinum	[9].
Bacteria	Staphylococcus sp., Streptococcus sp., Escherichia coli. Salmonella sp., Proteus sp. Bacillus sp.	[6] [8].
Bacteria	Mycobacterium bovis, Mycobacterium tuberculosis	[10]
Fungi	Aspergillus niger, Mucor sp., Penicillium sp., Saccharomyces sp., Fusarium sp	[9]
Bacteria	Salmonella sp.	[11] [12].
Helminthes	Hydatid cysts	[13]
	Cysticercus cysts	[14]



Plate 2: Abattoir effluents degrading surface water of Aba River

The untreated effluents have resulted in the gradual but steady degradation of the water body and property value of the environs. These changes have also

reduced the social values of the River by spoiling the scenery and restricting recreation as the water is no longer pleasant for swimming (Plate 3).

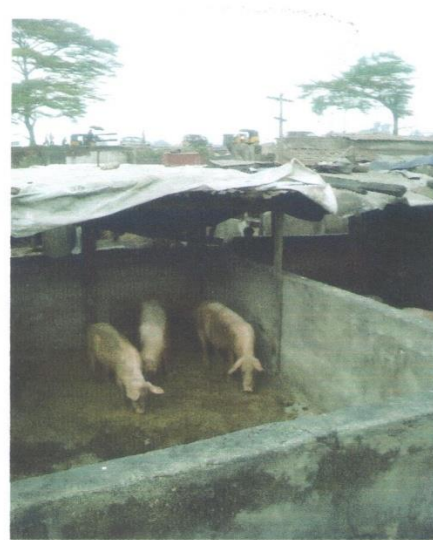
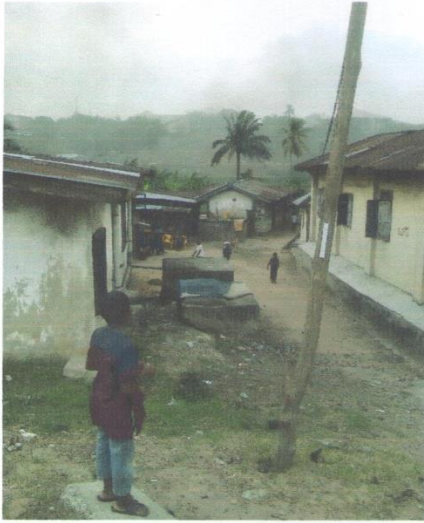


Plate 3: Abattoir operations reducing property, surface water and social values.

Animals slaughtered in *Ogbor Hill* abattoir on a section of Aba River account for the majority consumed in Abia state. An average of seven hundred and seventy five thousand animals are slaughtered in Abia abattoirs annually (Table 2) with a good proportion of water used for washing discharged directly into the Aba River.

It is therefore necessary that the result of the physicochemical and microbial analysis of the surface water and sediments be a basis to ascertain the level of degradation. This in turn together with the activities at the abattoir determines the property value of the environs.

State	Slaughter Houses/Slab	Annual Slaughter
Abia	11	77075
Adamawa	66	119200
Akwa Ibom	25	25550
Anambra	68	35204
Bauchi	22	718060
Bayelsa	10	15000
Benue	38	485914
Borno	30	339450
Cross River	34	386157
Delta	28	341689
Ebonyi	10	14000
Edo	22	325128
Ekiti	24	116481
Enugu	30	33308
Gombe	11	417084
Imo	42	81750
Jigawa	48	589428
kaduna	46	487316
Kano	44	974613
Katsina	41	581385
Kebbi	21	516879
Kogi	21	574121
Kwara	16	285181
Lagos	78	1378716
Nasarawa	19	498743
Niger	30	684132
Ogun	28	104137
Ondo	28	91845
Osun	48	143164
Oyo	44	112609
Plateau	12	317175
Rivers	36	786741
Sokoto	38	689147
Taraba	13	420074
Yobe	21	589188
Zamfara	18	518184
FCT Abuja	10	254040
Total	1077	14127868

Source: Veterinary Council of Nigeria, (2005).

Materials and Methods

Study area

Aba is a city in the southeast of Nigeria and the commercial nerve center of Abia State. Upon the creation of Abia state in 1991, Aba was divided into two local governments areas namely; Aba South and Aba North (Fig.1)

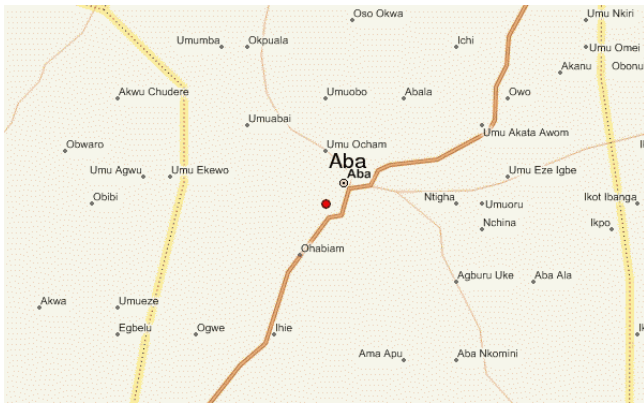


Fig.1: Map of Aba showing Abia South and North Local Government.

Aba south is the main city centre and the heart beat of Abia State, south-east Nigeria. It is located on the Aba River. As of 2006 census, Aba had a population of 534,265 with a total area of 72 km² (28 sq mi) density of 7,400/km² (19,000/sq mi) and elevation of 205 m (673 ft).

Aba abattoir is located at Ogbor hill Aba North Local Government Area and lies between latitude 5° 05' to 5° 30' North and longitude 7° 15' to 7° 40' East in Abia State Nigeria. It has an area of 23Km² and a population of 107, 488 at the 2006 census. The abattoir is owned by the Abia State Government and managed by the State Ministry of Agriculture and Natural resources. Slaughtering and processing of carcass is done on the floor in the slaughter hall and adjacent to the main building of the abattoir on a slaughter slab [16]. Hoists are not available and this means improper draining of blood from the animal which also affects the quality of the carcass as observed by [17]. There is no evisceration section in Aba abattoir. The hides and skin are usually burnt with the use of tyres and this causes serious environmental hazards. The fire releases a dark, thick smoke which carries toxic chemicals from the breakdown of rubber compounds while burning such as carbon monoxide, sulphur dioxide and products of betadine and styrene. Acute exposure to 1, 3-butadiene by inhalation in humans results in irritation of the eyes, nasal passages, throat, and lungs. Neurological effects, such as blurred vision, fatigue, headache, and vertigo, have also been reported at very high exposure levels. [18].

Reconnaissance visit

A reconnaissance visit was undertaken to evaluate the facilities, operations in Ogbor abattoir and visual

examination of effluents discharged in the water body of Aba River.

Sampling

All water and sediment samples were collected 40cm under the water surface for two months, one for wet season and one for dry season. Water samples were collected 72 hours after the rain has stopped in the wet season, so that the water returned to its regular flow condition [19]. Water samples were collected in 1 liter plastic containers. All water samples after collection were well labelled, transported and stored. Sample stabilisation and transportation to the laboratory as well as sample storage were done according to standard procedures [20]. Samples for microbiological examination were collected with sterile polyvinyl plastic vial water bottles.

In situ measurement of temperature was taken in the field during sampling with mercury-in-glass thermometer. Dissolved Oxygen, DO was fixed in the field with Winkler 1 & 11 reagents and transported to the laboratory for analysis. Other physicochemical parameters were analysed in the laboratory and standard analytical methods were adopted [20]. P^H was measured using the Horiba multiprobe water checker U-10 by inserting the instrument into the water sample and reading taken. This same instrument was used to take measurements for conductivity, Turbidity and Total Dissolved Solids by taking readings from the panel as it was dipped into the water sample. For total hardness, a known volume of the sample was titrated with a standard solution of Ethylene Diamine Tetraacetic Acid (EDTA) solution to a pure blue end point from pink with using Erichrome as indicator during complexation [21]. For sulphur determination, sulfaver 4 method was used with powder pillows based on photometric measurement of absorbed light. The phosphate concentration was obtained by the stannous chloride method (APHA, 1998). The Nitrate determination was done by brucine method [21] by adding 2ml +1H₂SO₄ to 2ml of sample in a test tube. The absorption of the treated sample against the de-ionised water was measured at 410nm photometrically with spectronic 21D photometer and the concentration of nitrate obtained from calculation. Determination of exchangeable cations calcium, magnesium and manganese were done by flame photometer. The heavy metals, lead, iron were determined by flame atomic spectrophotometer using Perkin-Elmer model 403 (EPA, 1996). For the determination of Biochemical Oxygen Demand, dilution method using 5-day BOD was used using the equation $BOD(mg/l) = D_1 - D_5$ where D_1 = initial DO of the sample, D_5 = final DO of the sample after 5 days. A faecal coliform test is performed by collecting a water sample in a sterile container. The water sample is filtered and the filter is placed in a sterile petri dish with a special nutrient solution. The faecal counts was determined by inoculating Mac Conkey agar with 0.1ml of the wastewater sample in duplicates using plate method.

The plates were incubated at 37^{0c} for 48hours. Confirmation of the presumptive results was done by counting those faecal coliform organisms which are able to produce acid and gas from lactose at 44-45^{0c}.

RESULTS AND DISCUSSION

The results of analysis of the water and sediment samples, findings of the operations and facilities at the abattoir during reconnaissance visit are shown below.

Assessment of operations at Ogbor-Hill abattoir Aba based on availability of basic facilities during reconnaissance visit.

The facilities for processing animal by- products like leather and skin, livestock waste spills are lacking. All the slaughter slabs are privately owned and they operate in unhygienic environment, posing health risks to humans. In an abattoir with similar situation, out of 500 swab samples collected from slaughter house drains, 310 bacteria species were isolated [22]. The abattoir operations produce a characteristic highly organic waste with relatively high levels of suspended solid, liquid and fat. The solid waste include condemned meat, undigested ingesta, bones, hairs, horns and aborted fetuses. The liquid waste is composed of dissolved solids, blood, gut contents, urine and water. Processors in Aba abattoir do not manage slaughter wastes properly with dung and slurry washed into surface of the river and solid wastes scattered in the environment. The industries around the abattoir such as PZ Cussons, Nigerian Breweries among others generate wastes and discharge most of them especially the liquid into Aba River untreated. Inadequate water supply and poor drainage were identified. The operators use water contaminated by industrial waste water to wash their meats and the by products. There is absence of the following facilities Lairage Slaughter hall, Bleeding section, Flaying section, Evisceration section, Section for halving carcass, Gut and tripe, Cold room, Detained meat room, Condemned meat room, Drainage system, Veterinary laboratory, Pipe borne water, Electricity supply and Administrative block.

The poor sanitary condition, noise and offensive odour from abattoir operations scare first class tenants from inhabiting buildings at the vicinity of the slaughterhouse. This may be as a result of fear of possible outbreak of epidemics. The reconnaissance visit showed unoccupied barren land due to inability of property investors to build at the vicinity of abattoirs. There were many poorly designed structures occupied by poor income earners. The buildings near the abattoir attract poor rent when compared with similar buildings in other locations. The higher the rent, the higher the property values and vice versa. The value of land is relatively lower when compared with land value in other similar locations in Aba such as *Ariaria, Umungasi, New Market, 7Up, Osisioma* among others. The land in these areas are occupied by high income earners who desire accommodation in

descent areas free from persistent point source odours, with potential

outbreak of diseases. These built up places have social amenities that are lacking in the abattoir areas. The barren unoccupied land at the vicinity of the abattoir raised security concerns in so many aspects. Firstly, this created opportunity for low side settlements and hoodlums used such platforms to propagate their nefarious activities. Moreover the erection of shanties could make the environment vulnerable to fire incidence and other forms of disaster. These fears has the tendencies of discouraging potential investors away from the zone of abattoir operations.

Table 1: Result of Water Sample Analysis at Ogbor Hill Abattoir, Aba (Dry Season Month of January, 2016).

Parameters	Sampling Locations and Co-ordinates			
	A Upstream (N05 ⁰ 7.431 ¹) (E007 ⁰ 22.888 ¹)	B Discharge point (N05 ⁰ 45.027 ¹) (E007 ⁰ 29.276 ¹)	C Downstream (N05 ⁰ 06.968 ¹) (E007 ⁰ 22.816 ¹)	Mean
Temperature °c	28.5	29.0	29.0	28.3
pH	6.46	6.58	5.34	6.13
Electricity Conductivity µS	87	150	97	111.1
Total Suspended Solid (TSS) mg/l	3.487	4.886	2.893	3.754
Total Dissolved Solid (TDS) mg/l	12.78	16.43	14.385	14.517
Nitrate (NH ₃) mg/l	0.103	0.117	0.132	0.1143
Nitrite (NO ₂) mg/l	0.186	0.158	0.218	0.1343
Manganese (Mn) ppm	0.09	0.216	0.305	0.201
Sodium (Na) ppm	8.497	9.848	9.141	9.162
Potassium (K) ppm	0.154	0.314	1.58	0.682
Calcium (Ca) ppm	4.386	9.092	21.759	11.746
Magnesium (Mg) ppm	6.66	9.092	11.9021	9.2111
Total Organic Carbon (TOC) ppm	34.3	37.3	43.2	38.2
Cadmium (Cd) ppm	0.035	0.024	0.018	0.0243
Lead (Pb) ppm	0.11	0.16	0.12	0.13
Nickel (Ni) ppm				
Chromium (Cr) ppm	0	0	0	0
Zinc (Zn) ppm	0.031		0.0106	
Iron (Fe) ppm	0.329	0.865	0.357	0.517

Table 2: Result of Sediment Sample Analysis at Ogor Hill Abattoir, Aba (Dry Season month of January,2016)

Parameters	Sampling Locations and Co-ordinates				WHO Standards Limits
	A Upstream (N05 ⁰ 7.431 1) (E007 ⁰ 22.888 ¹)	B Discharge point (N05 ⁰ 45.027 ¹) (E007 ⁰ 29.276 ¹)	C Downstream (N05 ⁰ 06.968 ¹) (E007 ⁰ 22.816 ¹)	Mean	
Temperature °c	32	31	30	31	20-30
pH	6.77	6.18	6.65	6.53	6.5-8.5
Electricity Conductivity µS	110	233	296	213	100
Manganese (Mn) ppm	3.53	3.002	2.998	3.172	-
Sodium (Na) ppm	9.059	9.254	8.005	8.772	-
Potassium (K) ppm	0.496	0.368	0.246	0.37	-
Calcium (Ca) ppm	21.33	15.66	21.331	19.440	-
Magnesium (Mg) ppm	5.619	11.62	13.774	10.318	-
Cadmium (Cd) ppm	0	0	0	0	0.005
Lead (Pb) ppm	0.29	0.32	0.21	0.271	0.05
Nickel (Ni) ppm	0.599	0.239	0.162	0.331	-
Chromium (Cr) ppm	0	0	0	0	-
Zinc (Zn) ppm	0.97	0.9	0.7048	0.851	-
Iron (Fe) ppm	46.14	77.29	75.081	66.140	0.3

Table 3.Result of Mean Values of Water and Sediments Sample Analysis at Ogbor-Hill Aba (Wet Season month of March, 2016)

Parameters	Mean Values of Water Samples	Mean Values of Sediment Samples	WHO Standard
	Coordinates and Elevations N05 07 26.2 E007 22 43.4 Elevation 117ft	Coordinates and Elevations N05 ⁰ 949 ¹ E007 ⁰ 22 834 ¹ Elevation 109ft	
Temperature °C	33	33	20-30
p ^H	5.74	-	6.5-8.5
Iron(Fe) mg/l	17.41	65.692	0.3
Chromium(Cr) mg/l	0	0.202	
Cadmium(Cd) mg/l	0.0058	0.01	0.005
Lead(Pb) mg/l	0.38	0.35	0.05
Manganese(Mn) mg/l	2.465	1.225	-
Zinc(Zn) mg/l	5.0421	4.514	-
Copper(Cu) mg/l	0.0133	0.242	1.0
Nickel(Ni) mg/l	-	0.304	-
Electrical Conductivity µ/S	138	-	100
Chloride mg/l	56	-	250
Turbidity mg/l	31	-	5
Alkalinity mg/l	10.2	-	200
Acidity mg/l	70	-	-
Total Hardness mg/l	5.2	-	150
Total Dissolved Solids(TDS) mg/l	80.3	-	250
Total Suspended Solids(TSS) mg/l	48	-	50
Biochemical Oxygen Demand mg/l	48	--	4,0
Chemical Oxygen Demand mg/l	122	-	-
Total Organic Carbon(TOC) mg/l	43.2	-	-
Phosphate mg/l	1.893	-	
Nitrate mg/l	1.63	-	50
Dissolved Oxygen mg/l	6.7	--	
Feecal Coliform MPN/100	-	--	0

Table 4: Result of Noise levels at Ogbor-Hill Abattoir Aba during field work

Locations	Maximum Noise level	Minimum Noise level
Burning Point	66.1dB	56.6dB
Washing point	72.1dB	59.1dB
Marketing Point	79.3dB	76.6dB

Source: Researchers field work

Discussions

Processors at Ogbor-hill do not manage slaughter wastes properly with dung and slurry washed into surface water of Aba river. Apart from being unpleasant, the waste contains bacteria. Abattoir wastes containing high concentration of microorganisms commonly used as indicators of water quality may have significant impact both in the effluent and the receiving water [15]. The contamination of water by the discharge of untreated sewage into surface or ground water is among the most form of pollution especially in Aba city and is mostly responsible for various types of water borne diseases such as dysentery, cholera, typhoid among others [23]. When animals are slaughtered in places which are frequently polluted with blood and faecal materials, not protected from flies and rodents, meat produced thereof are prone to quick deterioration due to high level of bacterial contamination. Apart from compromised quality of meat, such meat may cause food poisoning and would be a source of infection to man. This is the situation in Ogbor-hill abattoir, Aba. Reports also showed that abattoir waste piled up within the environment can cause pollution and subsequently produce methane gas that intensifies green house effect [6]. The waste could also be washed away by surface runoff to contaminate ground and surface waters including market places and streets [24]; [7]. The results from the physicochemical analysis shows that the P^H is slightly acidic especially at the downstream. Water containing high organic content tends to be acidic [25]. The increased P^H level at the downstream showed that flow dynamics at the Aba River readily transports the effluents away from the discharge point during slaughtering. However the mean P^H during wet season tends to be more acidic (5.74). This is inconsistent with the findings at Woji (Trans Amadi) abattoir [26]. The concentrations of Sodium, manganese, potassium, calcium, magnesium, and heavy metals like cadmium, chromium and zinc were within the limits for water samples during wet and dry seasons [27]. This is an indication that seasonal variations did not affect the qualities of these parameters in the abattoir.

However, the concentration of Lead and Iron exceeded the limits approved by World Health Organisation [28], with the levels of sediments higher than water samples.

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