LAUTECH Journal of Civil and Environmental Studies DOI: 10.36108/laujoces/9102/20(0250)
Volume 3, Issue 1; September 2019

Evaluation of Abattoir Effluent on Ground Water Quality

[1]Adejumobi, M. A. and [2]Alonge, T. A.
[1&2]Department of Agricultural Engineering, Ladoke Akintola University of Technology Ogbomosho, Oyo State, Nigeria
Corresponding E-mail: maadejumobi@lautech.edu.ng

Abstract
The study was carried out on analysing the effect of effluent from abattoir at 20m to 50m distance on the quality of adjacent well water in Arowomole, Ogbomosho. The choice of the location was to reflect the variation in concentration of the parameters of water quality issue: these parameters were based on their relative important in abattoir effluents composition by the wash down from the abattoir activities. Water samples were collected at four wells around the abattoir. The water was examined for physicochemical and microbiological characteristics. Water quality parameter tested were: pH, colour, turbidity, conductivity, total dissolved solids (TDS), Total suspended solids (TSS), Total Solid (TS), Biochemical Oxygen demand (BOD), chemical oxygen demand (COD), ammonia (NH_3) and nitrate, heavy metals (Zn, Fe, Pb, Al) among others. Standard procedures were observed for analysis. The ranges of physicochemical parameters studied were as follows: PH (6.3 - 6.7), TS (21.40 – 26.20mg/l), TSS (18.50 –74.60mg/l), Turbidity (0.3 -6.7NTU), BOD (38.0.2-63.7mg/l), and Conductivity (4.60 – 37.42ms/m) and Nitrate (0.063 – 0.59 mg/l), faecal coliform count exceed the WHO recommended value. The chemical composition of the ground water which was 20m to 50m from the slaughter house also found unsatisfactory as raw water source for drinking purpose. There is need to develop and prevent the water from environmental pollution so that the water will never be a risk to the human health.

Keywords: Effluent, Abattoir, Quality, raw water, Ground water.

Introduction
Groundwater quality has become an important water resources issue due to the rapid increase in population. Effluent is generally considered to be water pollution such as the out flowing from sewage treatment facilities or waste pollution such as the out flowing from sewage treatment facilities or waste water discharge from facilities *(Alam et al., 2007)*. Waste from the slaughtering and dressing grounds are washed into open drainages untreated and the leachates from series of decomposition processes of these wastes percolate into the underlaying aquifers to contaminate the hang dug wells which serves as dual purpose of drinking water for the butchers and other working in the abattoirs (Abiola, 1995). Pollution of groundwater natural habitat for aquatic or indirectly, since less than 1% of freshwater about 0.007% of all water on earth is readily accessible for direct human use (UNESCO, 2006). The physicochemical and microbiological analysis of surface and groundwater are important towards a meaning impact assessment of domestic and industrial activities on these water bodies. Abattoir effluent discharge is very harmful to the environment. It has caused the degeneration of river (Sangodoyin and Agbawhe, 1992).

In Nigeria many abattoirs dispose their effluent directly into stream and rivers without any form of treatment and the slaughtered meat is washed by the same water (Adelegan, 2002). Most process in slaughter houses, tanneries require the use of water. This water used for general cleaning purpose will produce waste water. Generally, water quality parameter can be divided into physical (Odour, Colour), chemical (pH, Sulphate, Biochemical Oxygen Demand (BOD), Chemical Oxygen demand (COD), Chloride (Cl), Nitrogen (N), and biological parameters (Suspended Solids (SS) and Hardness). Abattoir effluent contains high concentration of suspended solid (SS) including piece of fat, grease hair flesh manure grit and undigested feed (Bull and Sterritt, 1992). The insoluble and biodegraded (SS) represented 60% of the influent discharged in screened (1 mm) abattoir effluent, while another 25% originated from colloidal solids (Cadmus *et al.*,1999). Abattoir effluent also contain high concentration of suspended solid (SS) including piece of fat, grease hair flesh manure grit and undigested feed (Bull and Sterritt, 1992). The discharge of untreated domestic, industrial, slaughterhouse wastewater and agricultural waste into a body of water may result in general deterioration of such water reaching health

economic and aesthetic consequences. Domestic wastewater contains a variety of micro-organism including pathogens which are typhoid, cholera, cause of water borne disease (Lively, 1996) this study investigates the importance of surface water and ground water and the problem associated with it. Abattoir effluent whether it reaches the water body through a point source or non-point sources reduce oxygen in water and endanger aquatic life and can leads to life threatening effect. The organic nutrients added to ground water produce excessive microbial growth causing unpleasant taste and odours of water from this source (Ojekunle and Lateef, 2007).

Material and Methods

Overview the Study Area

The study was carried out in Ogbomoso, Oyo state Nigeria. The town lies on longitude 4º.16' and latitude 8.08'. Ogbomoso is the administrative head quarter of both Ogbomoso North and South local government. It was situated 57 kilometre north of Ibadan and 58-kilometre North West of Oshogbo the capital of Osun State. Arowomole abattoir is located at the southern part of the town, the abattoir is a public type characterized by simple enclosed concrete slab adjoined with open shed where meat is sold.

Sample Collection and Analysis Methods

Water samples, SA, SB, SC and SD were collected using 2 liters of cover bottle, at 20m, 30m, 40m and 50m, respectively distance from slaughter house to the well water. All visitation and sample collection were done as earlier as 7.00am, when slaughtering through processing of meat have not commence so as to allow the effluent from the abattoir of the previous days to flow the wells. All equipment such as conical flask, measuring cylinder and test tube were washed with detergent rinsed in clean water and dried in the drying cabinet. The equipment was then sterilized in the hot air oven at 121ºC for 20 minutes to avoid microorganism. Samples were preserved by addition of HNO_3 to make the water clear prior to laboratory analysis, other preservation was done by refrigeration to avoid loss of nitrate. The water samples were examined for physiochemical and microbiological characteristics.

Physicochemical parameters of water sample were determined using World Health Organization (WHO) standards methods of examination of water quality for drinking. (WHO, 2004) and (APHA, 1998)

Results and Discussion

The pH of the adjacent wells from abattoir ranged from 6.30 – 6.70 with a mean value 6.4 (Table 1) It falls within the acceptable range 6.5 – 8.5 as stated by WHO (WHO, 2004) and (NSDWQ, 2007). The temperature of the samples ranged from 24 – 27^0C, only sample A (Table 1) falls within the acceptable range 25^0C of WHO and NSWDQ and less than that of (Mogaji and Chup, 2012) which implies that pollution level is minimal. The temperature of SB, SC, and SD were higher than the acceptable range in (Table1). Temperature influences the amount of dissolved oxygen in water (Ojekunle and Lateef, 2007). Turbidity ranges between 0.3 – 3.8NTU and this is lesser than 5mg/l recommended by WHO and NSWDQ standards. Total Solid of the samples ranges from 21.40 – 71.40mg/l, high level of total solids makes water unpalatable and prone to corrosion. Chloride ranges from 62.40 – 91.40mg/l, which falls within WHO and NSWDQ standard. Nitrate ranges from 0.063 – 595.62mg/l. SB, SC, and SD falls within the acceptable range of WHO and NSWDQ while SA has higher value greater than WHO and NSWDQ standard, this is hazardous to human health. Sulphate ranges from 0.87 – 27.50mg/l which falls below WHO and NSWDQ standards all the samples have lower concentration. Electrical conductivity obtained ranges from 4.60 – 37.42mg/l, which are lower than the recommended value for drinking water of 900µS/cm (Lively, 1996). This indicates that the water samples are not saline. The recommended value of conductivity for Iron ranges from 0.03 – 140mg/l. It was observed that the value obtained for the Iron for SB, SC, and SD were not within the range of the stated guideline by (WHO, 2004) and (NSDWQ, 2007) 0.3mg/l while SA falls below the standard. Manganese ranged from 4.62 - 11.20mg/l. Aluminium ranges from 0 – 10.70mg/l. The recommended value of Aluminium for drinking

water is 0.2mg/l by (WHO, 2004) and (NSDWQ, 2007). The total coli form counts from 0.04 to $0.4x10^4$ (Table 2) which indicates the presence of faecal contamination WHO recommended zero value, presence of Coli form in water might leads to water borne diseases like cholera and typhoid fever, the water is not suitable for drinking.

Table 1. Results of the physico-chemical parameters of Ground water from Arowomole abattoir Ogbomoso.

Parameters	SA	SB	SC	SD	WHO	NSWDQ	Mean
pH	6.7	6.31	6.43	6.3	6.5-8.5	NM	6.44
Temp^{o}C	24	28.8	29	27.4	< 40^{o}C	NM	27.3
Colour	Colourless	Colourless	Colourless	Colourless	Colourless	Colourless	-
Turbidity	0.3	3.8	6.7	2.7	NM	15NTU	3.38
Total Solid mg/l	26.2	27.6	71.4	21.4	<1000	-	36.65
Total Hardness	10	7.1	16.1	21.4	100	NM	13.65
Chloride mg/l	62	71	91.4	71	<250	250	73.86
Nitrate mg/l	0.59	0.197	0.293	0.063	50	50	0.285
Sulphate mg/l	0.87	23.5	27.5	21.4	250	100	18.32
Dissolved Oxygen	11.82	12.4	18.7	14.7	2	-	14.41
Biochemical Oxygen Demand	38.2	72.4	142.4	63.7	10	-	79.18
Total Suspended Solid mg/l	18.5	48.4	74.6	51.6	30		48.28
Conductivity µs/cm	37.42	4.6	23.7	7.24	900	900	18.24
Iron	0.03	11.5	140	110	0.3	-	65.38
Manganese mg/l	4.62	9.7	11.2	10.8	0.05	0.2	9.08
Aluminium mg/l	Nil	7.2	10.7	9.9	0.2	0.2	9.27

SA - 20 meters (m) away from slaughtering house, SB 30 meters (m) away from slaughtering house, SC 40 meters (m) away from slaughtering house , SD 50 meters (m) away from slaughtering house

*NM: Not Mentioned. NSWDQ (2007), WHO (2008)

All parameters in mg/l except pH, Colour (TCU), Turbidity (NTU) and temperature (^{0}C)

Table 2: Microbiological Characteristics Of Sampled Ground Water

Parameters	(cfuml)	SA	SB	SC	SD
Coliform Count		$0.4x10^4$	$0.11x10^4$	$0.18x10^4$	$0.04x10^4$
E.Coli		$1x10^4$	$18x10^4$	$24x10^4$	$1x10^4$

Conclusion

Based on the above results adjacent well water in Arowomole abattoir is polluted and unfit for drinking because most of the parameter tested does not meet WHO and Nigerian Standard for Drinking Water quality as well. The Arowomole abattoir in Ogbomoso contained high concentration of organic matters. The slaughtering and meat processing operations have continuously resulted in large content such as faeces, carcass, horn, scraps of tissue and other solid waste.

It is recommended that proper waste management is required for separation and classification of these wastes to ease treatment process and control to a large extent the amount of toxic material g emptied. There is need to develop and prevent the water from environmental pollution so that the water will never be a risk to the human health.

References

Abiola S.S. (1995). Assessment of Abattoir and Slaughter Slab Operation in Oyo state. *Nigeria Journal of Animal Production*. (5):54-64.

Adelegan J.A. (2002). Environmental Policy and Slaughterhouse Waste in Nigeria. *Proceeding of the 28th WEDC conference 2002*, Calcutta India,6Alam J.B. Islam Z. R, and Mayen M.S. (2007). Water quality parameter along river int. *J. Environment Sci, Tech*.:159-162.

American Public Health Association, (APHA). (1998). APHA Standard Methods for the Examination of Water and Wastewater 19th Ed, APHA, Washington D.C.

Bull, M.A and Sterritt, R.M. (1992). The treatment of Waste Waters from the Meat Industry. A review *Environ, Technology, 3:117-126*.

Cadmus S. I.B, Olugasa, B.O and Ogundipe, G.A.T(1999). The Prevalence of Zoonotic Importance of Bovine Tuberculosis in Ibadan Nigeria, *Proceeding of 37th Annual Congress of Nigerian Veterinary Medical Association, Kaduna 833 – 886*.UNESCO (2006). Water a Shared Responsibility. The United Nations World Water Development Report 2. New York. 601 at *http//unesco-unesco.org/water/images/001454/145405.pdf.*

Lively, L.D. (1996). Water Conservation and Waste Control in Meat Packing Plant. *Workshop on Plant Waste Reduction in the Meat Industry EPA.*Sangodoyin A.Y. and Agbawhe O. M. (1992). Environmental Study of Surface and Ground Water Pollutant from Abattoir Effluent *Bioresources Technology* 41:193-200,

Mogaji J, Chup C. D. (2012). The effect of abattoir waste on water Quality in Gwagwalada-Abuja, *Ethopia Journal of Environmental Studies and Management* 5 (4)

Ojekunle O.Z., Lateef S.T. (2007) Environmental Impact of Abattoir Waste Discharge on the Quality of Surface Water and Ground Water in Abeokuta. *J Environ Anal Toxicol* 7:509. WHO, (2004) Guideline for Drinking Water Quality, 3rd Edition, Vol. 1, Recommendation Gevena: 515.

Nigerian Standard for Drinking Water Quality (NSDWQ). (2007). Draft Version 2. 22. Federal Ministry of Health,