Int J Adv Stu Res Africa, Vol 11 No2 December 2022 ISSN:1920-8693

THE INTERNATIONAL JOURNAL OF ADVANCED STUDIES AND RESEARCH IN AFRICA - IJASRA

is an interdisciplinary journal dedicated to the depth of studies in all aspects of human and applied sciences.

It particularly seeks to foster theoretically innovative scholarship that is simultaneously engaged with the global and grounded in the local. The authorship, the editorship and readership of IJASRA are among the most international of scholarly journals.

A peer-review, quaterly journal containing both scholarly articles and book reviews, IJASRA is published in Canada by **Africa Science** and is indexed in many databases.

Editor-in-Chief: Blaise Nguendo-Yongsi

IVORY-COAST MALAWI MORROCO
RWANDA TUNISIA CHAD
CAMEROON GHANA
SIERRA LEONE
GUINEA
ANGOLA MALI
ETHIOPIA NIGERIA
CENTRAL AFRICA

IJASRA
International Journal of Advanced Studies and Research in Africa
ISSN: 1920-860X (online)
ISSN: 1920-8693 (Print)
Vol.11. Issue/Numéro 2 – December/Décembre 2022

IJASRA

Moving beyond the classic divides of area studies, International Journal of Advanced Studies and Research in Africa (IJASRA) explores the shared concerns of Africa, offers stimulating perspectives on interdisciplinary debates, and challenges established analytic models.

Launched in January 2010, IJASRA publishes articles from around African regions, providing a distinctive link between scholars living and working in Africa and their counterparts in Europe, Oceania and North America.

IJASRA publishes articles related to all aspects of Human and social sciences, life and applied sciences like:

Arts (visual, drama)
Archaeology
Literature
Anthropology/Philosophy /Sociology
Behavioral, Cognitive, and Psychological Sciences
Music and theatre
History
Linguistics
Geography
Political sciences
Religious studies
Economics, Finance and Management Sciences
Communication
Educational sciences
Agricultural sciences
Animal and Veterinary Sciences
Medicine and Biomedical Sciences
Epidemiology and Public Health
Biology and geology
Food and nutrition
Mathematics and Physics
Engineering (all fields)
Computer sciences and software
Environmental studies
Intelligent Systems and Technologies
Mechanical, Industrial and Aerospace Engineering

Before submitting your work to IJASRA, please refer to the full instructions to authors to ensure the most efficient processing of your article through the peer-review process.

Authors are highly encouraged to use online submission system. However, manuscripts can be submitted at the following e.mail: editor.ijasra@africasciencenetwork.org

TABLE DES MATIERES

IJASRA
International Journal of Advanced Studies and Research in Africa

Is published by:

AFRICASCIENCE NETWORK

32, Boundbrook Drive I Brampton I Ontario I L7A 0M2 I Canada
www.africasciencenetwork.org I E.mail: editor.ijasra@africasciencenetwork.org

IJASRA
International Journal of Advanced Studies and Research in Africa
ISSN: 1920-860X (online)
ISSN: 1920-8693 (Print)
Vol.11. Issue/Numéro 2 – December/Décembre 2022

International Journal of Advanced Studies and Research in Africa

Where South meets North… to share knowledge

IJASRA
International Journal of Advanced Studies and Research in Africa
ISSN: 1920-860X (online) ISSN: 1920-8693 (Print)
Vol. 11, Issue/Numéro 2, 2022

Int.J.Adv.Stud.Res.Africa. 2022, 11 (2): 31-39
ISSN: 1920-860X (online/Électronique)
ISSN: 1920-8693 (print/Papier)

Check for updates

ORIGINAL RESEARCH PAPER /ARTICLE ORIGINAL

POOR DISCHARGE OF SLAUGHTERHOUSES WASTES AND POLLUTION OF WATER BODIES IN KUMBA MUNICIPALITY

SOP SOP MATURIN DÉSIRÉ

Senior Lecturer, Department of Geography, The Higher Teachers' Training College-Bambili, University of Bamenda, Cameroon

BESENDE DIDIEN NJUMBA

PhD candidate, Faculty of Arts, Postgraduate Teacher, The Higher Teachers' Training College-Bambili, University of Bamenda, Cameroon

Reçu/Received on: 07-october-2022; Évalué/**Revised on:** 23-november-2022; Accepté/**Accepted on:** 15-December-2022;
Publié/Published on: 31-December-2022

Corresponding author: maturinsop@yahoo.fr

RÉSUMÉ

Background: the slaughtering of animals for human consumption is an important component of every economy. But slaughterhouse activities have a lot of environmental and health risks on the surrounding communities. In Kumba municipality, in most cases, untreated effluents are discharged into the nearby water bodies used by the local communities while the hard parts (horns, hoofs and bones) are discarded off unsustainably around the slaughterhouse premises. These poor methods of managing slaughterhouse wastes exposes the downstream population as well as those who live around the slaughterhouses to water related illnesses, vector borne and air pollution related diseases. ***Objective*** : The goal of this study is to assess water quality of water bodies closed to slaughterhouses in Kumba municipality. ***Methods***: The study adopted a purposive sampling technique to administer one hundred and fifty questionnaires to the population, the butchers as well as to conduct interviews with stakeholders. Information for the study was collected using survey, questionnaires, key informant interviews, researcher's direct observation as well as from hospital reports on the prevalence of slaughterhouse pollution related water borne diseases. The nearby streams close to five slaughterhouses in the study area were laboratory tested to determine changes in their chemical, physical and microbiological compositions. The collected effluents and water samples from all the five slaughterhouses were tested for changes in temperature, turbidity, EC, pH, TDS, TSS, Chloride, sulphate, phosphates, nitrates, iron, sodium, BOD, COD, DO, E.coli and total coliform concentration. The laboratory results were later on compared with the water quality recommendations of the world health organisation. ***Results***: the laboratory results of the streams used by slaughterhouses showed variations in water quality parameters as a result of slaughterhouse activities. The findings were later on compared with available hospital records and the results showed that, the poor management of slaughterhouse wastes affected the local population negatively. The population suffered from diseases like, cholera, typhoid, and dysentery. This is because the streams used by the slaughterhouses for the discharge of untreated effluents had severe alterations in temperatures as well as in their nitrate, phosphate, COD, BOD and E.Coli concentrations. ***Conclusion***: slaughterhouses wastes pollute streams enormously which exposes the local population to lots of pollution related diseases. Efforts should be made to reuse some slaughterhouse wastes or to treat slaughterhouse such wastes before discharge into the nearby steams.

Keywords : Management, Slaughterhouse, Wastes, Pollution, Kumba, Cameroon.

[I] INTRODUCTION

In recent decades, the developing world has experienced significant increase in population, Kumba is not left out in that, the population has moved from 42000 in 1976 to 170157 in 2005 (BUCREP,2005). This galloping urban expansion has brought with it hikes in the demand for agro pastoral products which have increased the number of animals slaughtered for meat and other animal related products. Slaughterhouses are very important components of every city because they provide the meat needed by the population and provide employment to a very large number of people. As such their wastes management activities goes on continuously unchecked even though the government of Cameroon has put in place beautiful that dates back to 1966 after her participation at the Rio conference. Some of the laws put in place for the protection of the water bodies from pollution including those of slaughterhouse activities are Law N0. 98/005 of 4 April 1998; whose articles 1 to 12 puts in place the ethics on the use of water resources as well as the conditions for the dumping of wastes in aquatic milieu, Law N0. 98/015 of 14 July 1998 which calls for proper studies to be carried out on industrial activities and to classify them as dangerous, unhygienic, obnoxious if they pose any danger to the local population and the environment, Law No. 2001-06 of 16 April 2001 which establishes the nomenclature and animal health regulations regarding contagious livestock diseases whose reporting is compulsory and Law No. 2011/012 of 6 May 2011 to protect Cameroonians against industrial induced pollution (Luken et al., 2002). Contrary to the laws and sanctions put in place by the government of Cameroon on articles 15, 16, 54 and 90 of the national penal code, all the slaughterhouses in Kumba continue discharging their untreated effluents into the nearby streams which are equally used by the local population for their domestic water demands. This has led to an exaggeration of phosphorus, nitrogen and total solids and a reduction in the concentration of dissolved oxygen in the receiving water bodies Hu et al., (2017). The direct discharge of untreated slaughterhouse wastes into the nearby water bodies has led to increased occurrences of water borne diseases and other vector borne related illnesses to the local population, increased the number of visits to hospital, increased expenditures on drugs and reduced the quality of life as well as working hours in other income generating activities. This therefore calls for an urgent need to address the dangers associated with the poor management of slaughterhouse wastes, the location of slaughterhouses vis-à-vis human habitation as well as with the usage of contaminated slaughterhouse stream water Doudrick et al., (2013). Other Research have also pointed out that slaughterhouse activities are accountable for the contamination of well water especially those that are shallow. This is because, through the use of contaminated utensils like buckets in the slaughterhouse and also using the same buckets for the drawing/ fetching of water from wells and streams. This directly affects the water quality and the health of the inhabitants making use of such water sources (Debik and Kim et al., 2018). Due to the health effects of slaughterhouse wastes on the water bodies, the population and on the animals several wastes treatment methods have been proposed but the slaughterhouses in Kumba respects none of these methods which has facilitated the spread of slaughterhouse pollution related diseases and zoonotic infections such as pneumonia, diarrhoea, Typhoid fever, Asthma, Wool Sorter disease, respiratory, chest disease , Bacillus, Salmonella infection, Brucellosis and Helminthic diseases and infections (Oyedemi,2000). In Kumba, slaughterhouse are located beside water bodies, wetlands and farms and they usually discharge their wastes directly into the nearby water bodies or openly in huge heaps around the slaughtering premises. This causes water pollution, land pollution and odour problems. This reckless way of discharging slaughterhouse wastes in the city of Kumba cause eutrophication of the water bodies used by the slaughterhouses, dissolved oxygen depletion, change in temperature of water body, death to aquatic life, depletion of surface and ground water quality, soil pore clogging from excessive fat content and zoonosis to humans because; slaughterhouses wastes are usually rich in pathogens, like salmonella and shigella bacteria, parasite eggs, and anaerobic cysts. Hence, it is highly imperative to treat the slaughterhouse wastes before its discharge on land and into water bodies in order to protect the environment, aquatic life and human health. The provision of portable pipe borne water in many Cameroonian cities including Kumba is still a severe a major challenge. In most circumstances the local population collect water for domestic use from nearby streams and shallow hand dug wells which also serve as water collection sources for the local slaughterhouse or as points for the discharge of their untreated effluents. Therefore, the population of Kumba municipality is exposed to health risks. The goal of this study is to

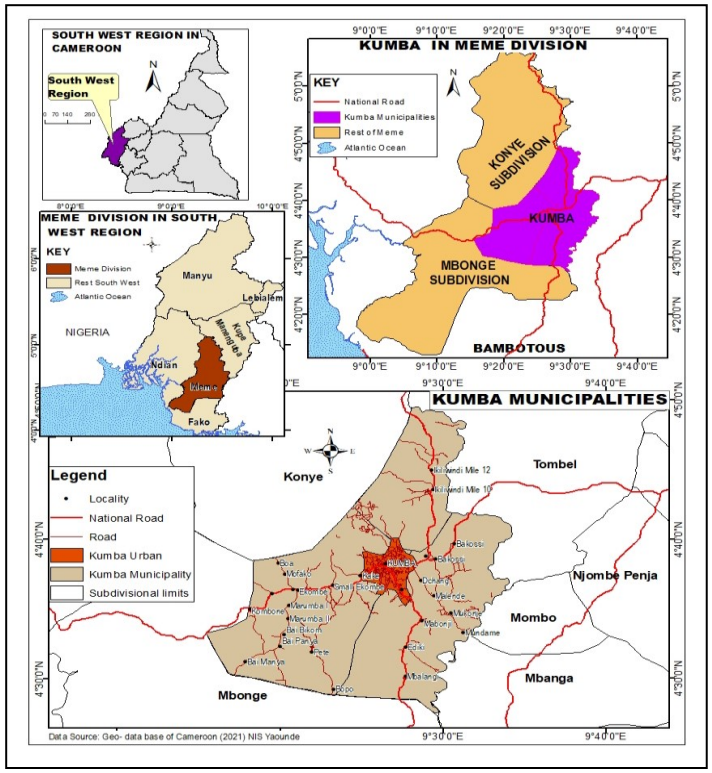
assess water quality of water bodies closed to slaughterhouses in Kumba municipality.

[II] MATERIALS AND METHODS

Scope of the study

Kumba Municipality is located in Meme Division of the South West Region of Cameroon. Kumba is the Divisional Capital of Meme Division. It is situated between latitude 4°38" north of the equator and longitude 9°27"east of the Greenwich Meridian (Kumba Municipal Council 2021). It covers a surface area of about 8.213Km2(Kumba City Council, 2021). Kumba is bounded to the South by Fako Division, to the East by Ndian Division and to the West by Kupe Muananguba (figure 1).

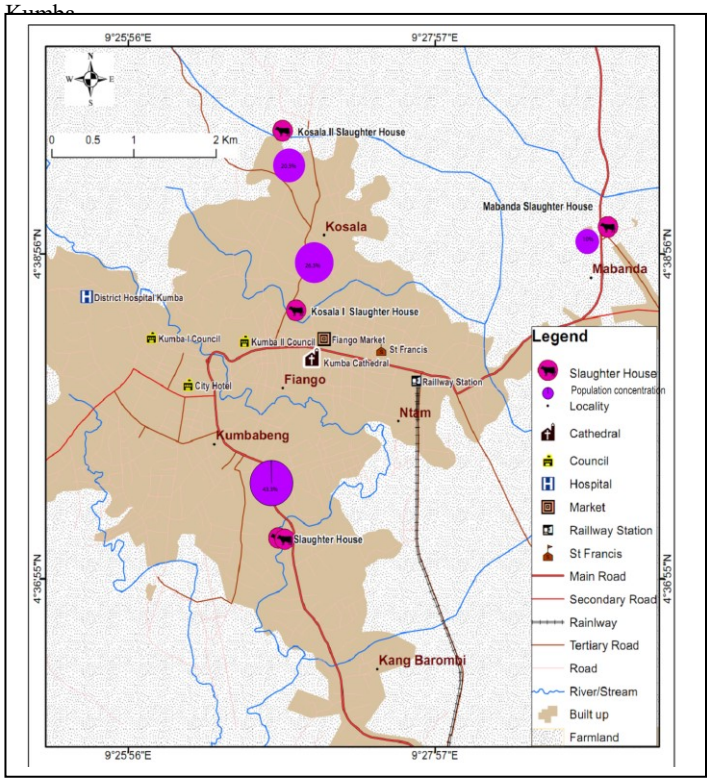
Figure 1: The Location of Kumba municipality in Meme Division South West Region of Cameroon.



Source: Kumba City Council and geo-database of Cameroon (2021)

The Municipality of Kumba has five slaughterhouses which served as the study sites. four of these slaughterhouses used for the slaughtering of only cattle. Two out of the four are located in the south at Buea Road at latitude 4037'8.212" and longitude 9026'55.270", for the first slaughterhouse and latitude 4037'8.992" and longitude 9026'53.428" for the second slaughterhouse in Buea Road. In Kosala which was another study site there are equally two slaughterhouses with one found in the North used only for the slaughtering of cattle and the other in the centre for the slaughtering of pigs. The Kosala cattle slaughterhouse is found at latitude 4.6615630 and longitude 9.4487540 while the pig slaughterhouse is located at latitude 4.6425850 and longitude 9.4500370. The Mambanda slaughterhouse is found in the North East at latitude 4.6514340 and longitude 9.4842150. The figure 2, shows the spatial location of the slaughterhouses.

Figure 2: Geographical Distribution of slaughterhouses in Kumba



Source: field work, 2022

Data collection

The focus of this study is to determine the health effects of raw or untreated slaughterhouse wastes in Kumba. To do this, this study adopted a mixed research approach based on qualitative, quantitative and the laboratory analysis of collected water samples. To obtain information from the affected population the purposive sampling method was used. The purposive random sampling used in collecting information directly from the affected population of kosala II and III, Cow Fence street (kumba mbeng) and Mambanda neighbourhoods. data was also obtained through the administration of questionnaires, interviews with the divisional Delegate of livestock, fisheries and animal husbandry for Meme, the Sub Divisional Delegates of Livestock, Fisheries and Animal Husbandry for Kumba I, II and III Sub Divisions, the Veterinary Officers and the butchers, observation of slaughterhouse activities and from the laboratory analysis of collected water samples from the different study areas. The collection of water samples was done in the morning between 6:30 to 11:00 am. At the point where slaughterhouse liquid wastes entered into a stream, samples were collected at depths of about 8 to 10cm and 2m away from the shore. This was done in a bid to get at a point where the stream maintained a constant flow. The collection of water samples was done before slaughtering for the discharge points and the downstream sections, during slaughtering and washing of carcass for the downstream and effluents discharge point. Water samples were collected in plastic bottles of 0.5ml and 1.5L containers. Before collection of the water samples, the plastic bottles were washed trice with the same sample water at the collection point. This was to avoid possible contamination from the containers used for storage of the sample. At the sample collection sites three different bottles were used to collect three water samples from each location. One set of bottles were used for the collection of upper course samples, another for the collection of liquid wastes at the slaughterhouse effluents discharge canals while the last set of bottles were used for the collection of downstream samples. Each collected sample were meant to be used for physicochemical and microbiological analysis. The samples were later on labelled with the location, the date, the time sample was collected and the kind of analysis to be done on the sample. Laboratory Analysis were conducted for the collected water samples to analyse each sample for physical and biochemical parameters that are shown on table 1.

Table 1: Physico-Chemical and Microbiological Test for Water Collected Samples

1	Temperature(°C),	**9**	Phosphate(mg/l),
2	Turbidity(NTU),	**10**	Nitrate(mg/l),
3	Electrical Conductivity (µS/cm),	**11**	Iron (mg/l),
4	pH	**12**	Sodium(mg/l),
5	Total Dissolved Solids(mg/l),	**13**	Biological Oxygen Demand(mg/l),
6	Total Suspended Solids(mg/l),	**14**	Chemical Oxygen Demand (mg/l),
7	Chloride (mg/l),	**15**	Dissolved Oxygen (mg/l),
8	Sulphate(mg/l),	**16**	Escherichia coli and Total Coliform (cfu/100ml)

Source, field work, 2022

The results from the analysis of the water samples were later compared with the world health organisation recommendation for water quality. Equally, 150 structured questionnaires with closed and open ended questions were administered to individuals within the slaughterhouse vicinity through purposive sampling

[III] RESULTS

Laboratory Results On Collected Water Samples : How slaughterhouses manage liquid and solid wastes and how the wastes impacts on the physical, chemical and micro biological properties of water and human health is of cardinal importance. The physical, chemical and microbial properties of the liquid wastes were obtained after thorough laboratory analysis of collected water samples. The results obtained from the wastes slaughterhouse discharged into the environment were compared with WHO standards for water quality as presented on table 1.

Property	Samples													W.H.O water quality standard
	Buea road				Mambanda			Kosala 1			Kosala 2			
Electrical conductivity (µS/cm)	US	DP 1	DP 2	DS	TW	DP	DS	US	DP	DS	WW	DP	DS	400 (µS/cm)
	97	891	915	106	215	789	706	231	807	720	398	716	601	
Temperature (°C)	21.5	27.5	26.3	24.3	21	28	26.9	22	28.6	26.4	24	29.2	27.2	25^0C
Turbidity (Mg/L)	9	10.8	9	8	4.5	11	9.7	7	10.5	7.9	10	11	9.7	5
Ph	9	5.1	5	9	9	4	6	9	5	8.5	6	5	6	6.5 - 8.5
Total dissolved solids (Mg/L)	700	842	872	912	321	845	800	884	919	817	876	969	804	500
Total suspended particles (Mg/L)	8	7	7.9	8	3.9	8	7	5	8	8	7.5	9	6	50
Chlorine (Mg/L)	316.9	352.1	368.1	212	35	538	458	165	552.1	342	611.2	534	304	NA
Sulphate (Mg/L)	59	67.4	66	59	11	69	51	32	60	45.6	56.8	65	59.2	250
Phosphate (Mg/L)	21	65	68	49	13	64	56	13	62.4	32	23	55.8	33	0.3
Nitrates (Mg/L)	13	32.6	36.1	25	10	55.2	49	18	48	34.1	13.3	24.7	19.3	10
Sodium (Mg/L)	152.1	229.5	241.9	189.8	51	235.7	240	114	246.2	141.4	215	276	266.3	NA
Iron	2	5	5.6	4	0.6	4.6	3.2	2.8	3.2	2.7	2.7	3.1	2.9	0.3
E coli cfu/100ml	6	8	9.3	6	5	10	8	7	11	8	6	9	6	0
BOD (Mg/L)	6	56	45	12	15	55	34	7	45	22	12	38	24	10
COD (Mg/L)	10	19	24	18	7	21	17	12	21	16	16	23	17	10-20
Total coliforms (cfu/100ml)	5	10	14	7	4	12	10	7	12	8	8	12	7	0
DO (Mg/L)	25	8	7	20	35	5	25	36	7	22	7	5	3	6

US.. up stream, DS.. down stream, TW.. tap water, DP.. discharge point, WW.. well water, NA.. not available Source: field work 2022

Table 2: Duncan's test on physico-chemical analysis of water samples from four areas compared with WHO standards.

Chemical Propriety	Buea Road	Mambada	Kosala	Kosala2	WHO
Electrical conductivity (µS/cm)	509.25+44.56	706.00+28.63	707.00+302.60	689.00+146.03	400 (µS/cm)
Temperature (oC)	19.875+2.46	25.67+3.21	25.00+2.65	27.83+1.61	25^0C
Turbidity (Mg/L)	22.75+6.48	21.00+16.52	24.67+11.24	48.67+3.21	5
pH	4.525+2.03	6.93+1.79	8.67+0.58	6.33+1.53	6.5 -8.5
Total dissolved solids (Mg/L)	685.75+50.15	631.67+331.30	921.33+54.60	903.33+79.48	500
Total suspended particles (Mg/L)	13.25+8.10	14.67+9.45	9.67+2.89	28.73+19.92	50
Chlorine (Mg/L)	247.5+55.27	370.33+293.88	394.33+208.56	568.33+126.06	NA
Sulphate (Mg/L)	55+5.97	50.67+35.39	58.33+5.77	62.67+3.06	250
Phosphate (Mg/L)	38.5+21.52	44.33+27.43	36.00+25.24	37.33+16.92	0.3
Nitrates (Mg/L)	24+21.52	37.00+25.51	35.67+12.50	22.33+8.02	10
Sodium (Mg/L)	158+36.41	173.67+114.16	173.00+67.51	229.67+40.50	NA
Iron	4.25+2.06	3.67+3.21	3.67+1.15	4.33+0.58	0.3
E coli cfu/100ml	9.25+2.75	15.00+8.89	18.33+5.13	25.67+4.73	0
BOD (Mg/L)	36.5+33.15	43.00+34.04	39.67+24.01	36.33+14.64	10
COD (Mg/L)	16+5.06	14.00+8.89	16.33+4.51	18.67+3.79	10-20
Total coliforms (cfu/100ml)	60.25+46.34	11.33+6.66	68.00+50.09	88.00+35.51	0
DO (Mg/L)	6.75+2.63	6.33+4.16	13.00+7.94	7.33+2.52	6

The results of the Duncan's test to examined the different aspects resulted with significant difference as presented below.

Electrical Conductivity

Generally, electrical conductivity decreased after the slaughterhouses liquid wastes discharge points probably due to the discharge of effluent rich in organic contents. The result further revealed that a strong positive correlation (table 1.4) also exists between the electrical conductivity and TDS (r = 0.99).This was because of the deposition and decomposition of organic matter in the streams used by the slaughterhouses (Abrha, 2003). This result is similar to the findings of Abrha (2003) which indicated that higher levels of electrical conductivity results to the pollution of water bodies. The values of the electrical conductivity range for the different localities were 509.25+44.56 µs/cm for Buea Road, 706.00+28.63µs/cm for Mambanda, 707.00+302.60 µs/cm for Kosala cattle and 689.00+146.03µs/cm for Kosala hog slaughterhouses. The lowest range was recorded in Buea Road. Comparing with WHO standards, whose proposed or ideal level is 400 µs/cm. there were significant differences in the values of the electrical conductivity, although the samples were within the permissible limits of 1000 µs/cm of WHO maximum permissible limits for conductivity. Nevertheless, with respect to the electrical conductivity the results indicated that the water samples were polluted but their dissolved salt concentration were as little as possible.

Temperature

For the temperature results, the study found values ranges from 19.875+2.46, 25.67+3.21°C, 25.00+2.65 and 27.83+1.61 representing Buea Road, Mambanda, Kosala 1 and Kosala 2 respectively with the lowest range recorded in Buea Road with ranges of 19.875+2.46°C and highest in Kosala 2 of 27.83+1.61°C. The results were quite within the standards of WHO 25°C except for Buea road which was lower. The findings reveals that the values are within the WHO standard of the permissible limit of < 40 °C.

Turbidity (Mg/L)

The turbidity results revealed values range far higher than the acceptable. For instance, Buea Road had values of 22.75+6.48, 21.00+16.52, for Mambanda, Kosala 1 had 24.67+11.24 and 48.67+3.21 for Kosala 2. The values ranged far above the the acceptable limits of the WHO with Kosala 2 having the highest Turbidity in water substance.

PH

The pH ranged between 4.525+2.03 and 8.67+0.58 with the highest reported in Kosala2 and the lowest was Buea Road with 4.525+2.03. The values were a little lower compared to the stated range of the WHO. although there were not far away from the required except for Buea Road sample point. There were significant differences in the values of the pH although the values are, however, within the acceptable limits of the WHO. This is acceptable because the water would unlikely cause ailments such as acidosis. The implication of the PH is that it indicates the presence of microorganisms in the water resulting probably from the slaughterhouses.

Total dissolved solids (Mg/L)

The total dissolved solids ranged between 685.75+50.15 and 921.33+54.60 mg/L and the highest value was recorded at Kosala2 921.33+54.60 and the lowest at Buea Road. In the findings, we observed significant differences in the total dissolved solids compared with the permissible limits of 500 mg/L of WHO. This points to the conclusion that the slaughterhouses makes the water undrinkable especially for Kosala 2.

The pearson correlation coefficient on table 3 was used to test the relationship between the presence of slaughterhouses and the pollution of the water bodies in kumba. The correlation analysis were based on the laboratory results of the physico-chemical properties of the collected water samples.

Table 3: Pearson Correlation Coefficients Analysed Physico-Chemical Parameters

(**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

	EC (µS/cm)	Temp (oC)	Turb(Mg/L)	pH	TDS (Mg/L)	TSP (Mg/L)	Ch (Mg/L)	Sul (Mg/L)	Pho (Mg/L)	Nit (Mg/L)	Sod (Mg/L)	Iron	Eco/100ml	BOD (Mg/L)	COD (Mg/L)	TS (cfu/100ml)	DO (Mg/L)
EC (µS/cm)	1																
Temp (oC)	.897**	1															
Turb(Mg/L)	.727*	.817*	1														
pH	.901**	.941**	0.671	1													
TDS (Mg/L)	.839**	.949**	.850**	.921**	1												
TSP (Mg/L)	0.244	0.486	0.620	0.364	0.463	1											
Ch (Mg/L)	.711*	.824*	.933**	.731*	.860**	0.550	1										
Sul (Mg/L)	.825*	.918**	.842**	.860**	.975**	0.419	.849**	1									
Pho (Mg/L)	.857**	.911**	0.707	.814*	.847**	0.239	.741*	.897**	1								
Nit (Mg/L)	.746*	.776*	0.523	.820*	.802*	0.073	0.700	.842**	.865**	1							
Sod (Mg/L)	.820*	.934**	.929**	.831*	.955**	0.517	.942**	.967**	.890**	.785*	1						
Iron	.832*	.831*	.801*	.755*	.886**	0.329	.740*	.953**	.871**	.759*	.898**	1					
Eco/100ml	.783*	.879**	.937**	.823*	.900**	0.626	.970**	.854**	.721*	0.662	.934**	.743*	1				
BOD (Mg/L)	.910**	.742*	0.580	.750*	.729*	0.016	0.574	.797*	.852**	.798*	.730*	.882**	0.588	1			
COD (Mg/L)	.849**	.950**	.881**	.875**	.984**	0.479	.846**	.985**	.885**	.765*	.969**	.936**	.877**	.766*	1		
TS (cfu/100ml)	0.350	0.433	0.579	0.354	0.460	0.361	0.374	0.322	0.153	-0.095	0.386	0.269	0.484	0.059	0.460	1	
DO (Mg/L)	0.605	0.644	0.499	0.60	0.695	-0.122	0.596	0.606	0.574	0.646	0.604	0.458	0.599	0.468	0.618	0.495	1

correlation analysis shows very strong relationship between electrical conductivity and Temperature (.897),

very high between EC and Turbidity(Mg/L)(.727. For EC, the study registered a significant relationship with PH, TDS(.839); low insignificant relationship with TSP (Mg/L) 0.244; a significant semi strong relationship with Chrorine (Mg/L).711 and strong positive relationship with Sulphate (.825). In sum, most of the variables where highly correlated with EC registering low correlation for TS (cfu/100ml); and TSP (Mg/L) 0.244. On the whole, the correlation analysis reveals that, the presence of slaughterhouses in the study sites changes the water quality parameters which exposes the local communities making use of the streams water to severe health complications such as shown.

[IV] CONCLUSION

The Usage of the stream water for the direct discharge of slaughterhouse wastes exposes the inhabitants of the various study sites to a variety of health risks. This is because the unsustainable manner of discharging slaughterhouse wastes goes a long way to increase water parameters such as Electrical conductivity, TDS, COD, Iron, pH, Phosphates, Temperature, Nitrates, BOD, DO, E.coli, Chlorides and Total coliform higher than the WHO recommended limits. This calls the attention of the affected population to be prudent with the usage of the water sources and for the butchers to ensure the sustainable discharge of wastes from slaughterhouses. If this is done, good health of the users and that of the ecosystem will be ensured.

[V] REFERENCES

Abrha (2003). Characterization Of Wastewater And Evaluation Of Slaughterhouse liquid wastes. BMC Research Notes, 8(1). https://doi.org/10.1186/s13104-015-1822-4

Brackerhoff, (1995). Developing countries struggle with waste management policies. Waste Management & Research, 9(6), 491–494. https://doi.org/10.1016/0734-242x(91)90049-d

Chong, B. et al. (2010). Parasitic Contamination of Local Drinking Water Sources in Aba Metropolis, Abia State, Nigeria. Sultan Qaboos University Journal for Science [SQUJS], 26(1), 1–7. https://doi.org/10.53539/squjs.vol26iss1pp1-7

CONSTITUTION OF THE REPUBLIC OF CAMEROON Paix-Travail-Patrie Peace-Work-Fatherland. (n.d.). Retrieved from https://www.forestcarbonpartnership.org/system/files/documents/Cameroon_R-PIN_07-31-08.pdf

Debik, E., & Coskun, T. (2009). Use of the static granular bed reactor (SGBR) with anaerobic sludge to treat poultry slaughterhouse wastewater and kinetic modeling. Bioresource Technology, 100(11), 2777–2782. https://doi.org/10.1016/j.biortech.2008.12.058

Doudrick, R., Gupta, Abhishek. K., & Chowdhury, R. (2013). Conversion of slaughterhouse and poultry farm animal fats and wastes to biodiesel: Parametric sensitivity and fuel quality assessment. Renewable and Sustainable Energy Reviews, 29, 120–134. https://doi.org/10.1016/j.rser.2013.08.082

Ezeola, A. et al. (2000). Effect of slaughterhouse wastes on the water quality of Ikpoba River, Nigeria. Acta Tropica, 76(1), 15–19. https://doi.org/https://doi.org/10.1016/0960-8524(94)00139-R

Gaya and Abdullah. (2008). slaughterhouse Contaminated aquatic sediments. Water Environment Research, 80(10), 1791–1803. https://doi.org/10.2175/106143008x328806

Hu. (2017). Effect of Different Levels of Local Concentrated of Slaughterhouse Wastes on some productive Traits of Broiler. Muthanna Journal of Agricultural Sciences, 8(2), 141–147. https://doi.org/10.52113/mjas04/8.2/21

Hoddinott, (1997). Review of pre-treatments used in anaerobic digestion and their potential application in high-fat cattle slaughterhouse wastewater. Applied Energy, 155, 560–575. https://doi.org/10.1016/j.apenergy.2015.06.026

Mohammed and Musa. (2012a). Safe Disposal of Slaughter House Wastes. Approaches in Poultry, Dairy & Veterinary Sciences, 2(4). https://doi.org/10.31031/apdv.2018.02.000542

Mohammed and Musa. (2012b). Abattoir operations, waste generation and management in the Tamale metropolis: Case study of the Tamale slaughterhouse. Journal of Public Health and Epidemiology, 6(1), 14–19. https://doi.org/10.5897/jphe2013.0574

Nwanta et al.,. (2012). An assessment of the potential livelihood opportunity in sachet water vending in jalingo metropolis, taraba state, nigeria. Spanish Journal of Rural Development, 83–94. https://doi.org/10.5261/2012.gen2.08

Kim, S. T. et al. (2018). Effect of Various Industrial Wastes on the l Properties ofwater. International Journal of Mechanical

and Production Engineering Research and Development, 10(3), 3745–3754. https://doi.org/10.24247/ijmperdjun2020355

Luken, R.J.A. and Hesp, P.: (2002). Developing Countries Industrial Source Book, First edn., V.01-89605, UNIDO, Vienna, Austria.

Oyedemi, C. (2000). Water properties as influenced by abattoir wastes in Abakaliki and Ezzamgbo southeastern Nigeria. International Journal of Plant & Soil Science, 4(1), 94–99. https://doi.org/10.9734/ijpss/2015/12604

Saluato,. (1992a). Physical and Chemical Properties of Solid Waste. Tenside Surfactants Detergents, 29(6), 453–468. https://doi.org/10.1515/tsd-1992-290628

Saluato, H. (1992b). Assessment of anthropogenic activities impacts on the water quality of Asa river: A case study of Amilengbe area, Ilorin, Kwara state, Nigeria

Research from Africa benefits all of us

Bridging the Global Knowledge Divide

Improving the visibility of Africa i.e. developing African researchers' publications, allowing them to enter into mainstream research and knowledge activities and thereby raising their impact and credibility.

What is Africa Science?

Africa Science is a non-profit online publishing initiative dedicated to supporting the open dissemination of findings and peer-review articles from African countries. The goal is to facilitate a truly global exchange of ideas by improving the South to North and South to South flow of research knowledge. Its main medium is The International Journal of Advanced Studies and Research in Africa (IJASRA) whose scope areas covers all aspects of humanities, social sciences, life and applied sciences.

What problem is Africa Science addressing?

Due to financial and technical constraints, publications from African countries have limited local and international circulation and readership. As a result, a great deal of valuable research from different regions of Africa remains imperceptible to mainstream science. Since Science is global, we assume that lack of access to findings strictly limits our understanding of phenomena that Africa witnesses such as economic growth, emerging diseases, climate change, food security and biodiversity

What difference Africa Science makes?

The use of IJASRA articles from Africa Science has steadily increased since its launching; resulting in nearly 1.5 million downloads of full text in 2011. Users live and work in all parts of the world. Africa Science collaborates with indexes such as African Index Medicus and LATINDEX and web-based databases such as the Directory of Open Access Journals. Editors report improved quality of submissions and a larger number of submissions from international authors due to higher visibility of IJASRA outside Africa. Publishing with Africa is free of charge. Manuscripts are peer-reviewed by committed outstanding researchers.

How is Africa Science funded?

Laboratory of Sustainability of the University of Montréal and the University of Chicoutimi have nurtured Africa Science in its development stages. Presently, Africa Science is financially supported by personal revenue of its manager. That's why, Africa Science will make the transition to a long-term sustainable model supported by the worldwide community. Africa Science's future business model adds membership and sponsorship programs to our existing sources of support and revenue. Membership fees are only $500 per institution per year on an ongoing basis. Africa Science is also seeking the support and sponsorship of foundations and other organizations whose interests align with Africa Science. Sponsorship levels and terms are negotiated with the interests of the individual sponsor in mind. Africa Science will provide sponsors with documents to use for their tax income declaration.

No organizations have yet committed to sponsor Africa Science.

What should your organization or library support enable?

Africa Science is a strictly not-for-profit organization. Membership contributions will be used to directly support operations, including: server support, journal conversion costs, development of value added services (metadata enhancement, database linking, usage tracking), and basic daily operating expenses. Stable and additional funding will enable Africa Science to freely distribute hard copies of the journal to Community libraries