CHARACTERIZATION AND PHYSICO-CHEMICAL TREATEMENT OF WASTE WATER IN OLUKU ABATOIR IN OVIA NORTH EAST, BENIN, EDO STATE

By

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Abstract

The problem of getting quality water is increasing as untreated effluents are discharged into water bodies. The study aims at characterization and physicochemical treatment of waste water in Oluku abattoirs, Benin-City, Edo State, before discharged into the environment. Water samples were collected from Oluku abattoirs point source, oluku abattoirs middle flow and Oluku abattoir discharge pint. The collected water samples were analysed for physical and chemical parameters, using standard methods: anaerobic-aerobic treatment, the Dicromate method, etc. the water quality parameters/values measures before treatment; pH: 4.50 – 4.90; EC: 898-970 mg/l: TDS: 502.80-543.20 mg/l, TSS: 128.44-131.86 mg/l, Cl_2 : 120.7-127.8 mg/l, SO_4^{2-}: 29.84-35.10mg/l, DO: 2386.00-2587.00 mg/l, BOD: 336.00-358.00 mg/l,

COD: 524.00-558.00 mg/l, Heavy Metals, Fe:183.72-191.04 mg/l, Zn:53.34-61.50 mg/l, Total Hardness, 427.76-558.34 mg/l, Alkalinity:136.00-188.00 mg/l, Salinity:226.90-240.30 mg/l, Turbidity:258.00-287.00FTU. After treatment, pH:5.50-5.80 mg/l, EC:244.00-276.00 mg/l, TDS:136.60-154.60 mg/l, TDS:136.60-154.60 mg/l, TSS:17.49-18.04 mg/l, Cl_2:35.50-37.50 mg/l, SO_4^{2-}:3.58-4.70 mg/l, DO:272.00-284.00 mg/l, BOD:22.00-26.00 mg/l, -COD:34.30-40.60 mg/l, Heavy Metals, Fe:15.48-17.96 mg/l, Zn:1.95-2.18 mg/l, Total Hardness:33.46-38.58 mg/l, Alkalinity:24.40-25.50 mg/l, Salinity:66.74-70.5 mg/l, Turbidity:5.80-7.60FTU. The result of the study revealed that after treatment the concentrations of the physicochemical parameters were drastically reduced to the permissible limits of both the WHO and FEPA standard wastewater effluent. Pollution of ground and surface water through discharge of waste is an evidence of the concentrations of pollution indicators and trace metals above the acceptable limits. It is recommended that government should set up treatment plants at every abattoir to treat their effluents before being discharged into the environment.

Keywords: Abattoir, Pollution, Quality, Waste water.

Water is a marvellous substance flowing, rippling, swirling around obstacles in its parts, seeping, dripping, trickling, constantly moving from sea to land and back again. Water can be crystalline, icy green in a mountain stream, or black and opaque in a cypress swap (Cunningham E,Mutapha.H.I,and Abdul Gafar H.B, 2005). Water which is a universal resource because of its free nature, is often subject to abuse, especially in the third world nations where information is not disseminated to society. Water can be gotten from everywhere, but safe and clean water are hard to come by in almost all parts of the world. (Omole and Longe, 2008). Water, the second most important necessity of man performs three roles of regulating the body temperature, transporting body nutrients to other vital organs, and carrying waste out of our internal body organs (Akaninyene , Peavy , Rowe, and Tehobanoglous, 2000).

Water resources are used in various ways including direct consumption, agricultural irrigation, fisheries, hydropower, industries production, recreation, navigation, environmental protection, the disposal and treatment of sewage and industry effluents. Water resources refer to the supply of ground water and surface water in a given area. Water resources may also refer to the current or potential value of the resource to the community and the environment. The maximum rate that water is potentially available for human use and management is often considered the best measure of the total water resource of a given region. Approximately, 30% of the world

fresh water is in liquid form and therefore, potentially accessible for human use and management at any given time. The rest is either locked up in polar or glacial ice or water vapor. Of the 30% of fresh water in liquid form, almost all is held in groundwater. (Medalye and Hubbart, 2008). The value of usable to future generations is hard to quantify and define and requires considerations of quantity, quality, timing and accessibility. As well, the value of water in particular uses depends crucially on its location, quality and timing. Its location determines its accessibility and costs. Its quality affects whether it can be used, and what treatment cost it will require. The time when it is available governs its reliability and its relative value for power, irrigation, environment or portable uses. (FAO, 1995).

Materials and Methods

Study Area

The Study area of Oluku Abattoir, Akaninyene E, Peavy H.S, Rowe D.R, and Tehobanoglous G (2000). $6^{o}26'00.8"N$ and $5^{o}35'52.0"E$ in Ovia North East Local Government Area Edo State.

Sample Collection/Pre-treatment

Two (2) litres plastic bottles was used to collect the abattoir effluent waste. The effluent was collected at three points namely the (1) point source (2) middle flow and (3) discharge point. One (1) litre of each of the effluent was accurately transferred into two (2) litre beaker mounted on top is the magnetic stirrer. 25_g Fe_2Cl_3 was added into the (3) beakers containing the sample and stirred for two 2 hours, and allowed to settle down (precipitate). Collect the natant and discard the solid part. To the semi-clear solution, 25_g Hl_2Cl_3 salt was added and stirred for another 2 hours, and allowed to settle down (ppt) and collect the natant. 50_g of activate charcoal was added and stirred. The collided solution was filtered with the aid of bucket or flask vacuum pump to obtain the clear solution for analysis.

Apparatus

I. Spectrophotometer
II. Bottles, Pipettes, Burettes etc.

Methods

Treated samples were analysed using standard methods- Soil *p*H was determined on 1:2.5 soil to water ratio by glass electrode method. Iron and zinc, were determined by using Atomic Absorption Spectrophotometer. Chemical Oxygen Demand (COD) the Dichromate Method etc.

Results and Discussion

Results

Before Treatment

	Sample Description	pH	mg/cm EC	Mg/l TDS	Mg/l TSS	Mg/l Cl_2	Mg/l SO_4^{2-}	Mg/l Total Hardness	Mg/l Alkalinity	Mg/l Salinity	Mg/l DO	Mg/l CO
1	A	4.70	970.00	543.20	128.44	120.70	34.76	486.54	136.00	326.90	2476.00	544.00
2	B	4.50	898.00	502.80	131.86	127.80	29.80	427.76	168.00	240.30	2587.00	558.00
3	C	4.90	958.00	536.50	129.49	120.70	35.10	558.34	188.00	226.90	2386.00	524.00
		Mg/l BOD	Mg/l Fe	Mg/l Zn	FTU Turbidity							
1	A	349.00	184.86	53.34	276.00							
2	B	358.00	183.72	54.33	259.00							
3	C	336.00	191.04	61.50	287.00							

After Treatment

	Sample Description	pH	mg/cm EC	Mg/l TDS	Mg/l TSS	Mg/l Cl_2	Mg/l SO_4^{2-}	Mg/l Total Hardness	Mg/l Alkalinity	Mg/l Salinity	Mg/l DO	Mg/l CO
1	A	5.70	276.00	154.60	17.49	37.50	4.64	36.84	25.50	70.50	284.00	35.45
2	B	5.50	244.00	136.60	18.04	35.50	3.58	33.46	24.40	66.740	268.77	40.60
3	C	5.80	258.00	144.50	17.83	35.50	4.70	38.58	24.40	66.74	272.00	34.30
		Mg/l BOD	Mg/l Fe	Mg/l Zn	FTU Turbid-ity							
1	A	23.00	17.96	1.95	7.60							
2	B	26.00	15.48	2.07	5.80							
3	C	22.00	18.24	2.18	6.90							

A= Oluku Abattoir source
B= Oluku Abattoir middle flow
C= Oluku Abattoir discharge point

Discussion

The results after treatment shows the pH ranged from 3.50-3.809 mg/l, falls below WHO standards of 6.5 to 8.5. However, pH played a significant role in determining the bacterial population growth and diversity in surface water. Microorganism frequently change the pH of their own habitat by producing acidic or basic metabolic waste product (Prescott, Harley and Klien, 1999).

The TDS of the value obtained, range from 136.60 to 154.60 mg/l, allvalues obtained fall below WHO standard of <1200mg/l. some of the individual mineral salts that make up TDS pose a variety of health hazard to living organisms. (Efe, 2001).

Electrical conductivity (EC) is the ease to which a substance allows free flow of electricity through the ions in electrolytes of water sample. The values EC range from 244.00 to 276.00 µs/cm, which within the permissible limits of WHO maximum permissible level of the conductivity of 900 µs/cm. This shows that the treated water samples are not saline, the concentration of salts dissolved in the water is minimal, and the salt content of the water body is determined by its ability to conduct an electric current. The higher the salt concentration, the more the current that can be conducted and the higher the EC of the water.

Any level above WHO standards can pose health risk of defective endocrine functions and also total brain damage with prolonged exposure. All the water samples had their EC values less than the highest tolerable values.

TSS values ranged from 17.49 to 18.04 mg/l, which falls within the WHO maximum permissible limit for TSS (30 mg/l). TSS relatively measures the physical or visual observable dirtiness of a water resource. Obtained for BOD from the analysis carried out range from 22.00 to 26.00 mg/l. the BOD has important water quality parameter and is very essential in water quality assessment. Growth of aerobic and facultative anaerobic bacteria will be enhanced by the presence dissolved oxygen in any water body. The values of BOD are within the permissible standard the WHO standard of 50mg/l for water. Ojekunle, Ufoegbune , Oyebamiji , Sangowusi, and Taiwo, *et. al.*, 2014).

The DO ranged from 268.00 to 284.00 mg/l, it is a measure of the degree of pollution by organic matter, the destruction of organic substances as well as self-purification capacity of water body. The standard for sustaining aquatic level is 5 mg/l. concentration below this value adversely affect aquatic biological life, why concentration below 2 mg/l may lead to death of most fishes, (Chapman, 1992). The higher the concentration of Do the better the water quality.

The COD value ranged from 34.30 to 40.60 mg/l which were within the permissible limits standard of 100 mg/l (WHO, 2006). High level of COD indicates the presence of chemical oxidants in the effluent while low COD indicates otherwise. High COD could

likely cause nutrient fixation in the soil resulting to reduce rate of nutrients fixation in the soil resulting to reduce rate of nutrient availability to plants. Chemical oxidants affects water treatment plants by causing rapid development of rust. (Chukwu, 2008).

From the result obtained from the analysis of total hardness ranged from 33.46 to 36.84 mg/l. all the values were within WHO permissible limit of 100mg/l. Abattoir wastewater contribute to the elevated total hardness values, exposure to hard water has been suggested to be a risk factor that could exacerbate eczema. The environment plays an important part in the etiology of atopic eczema. A suggested explanation relative to hard water is that increased soap usage in hard water results in metal soap salt residues on the skin (or on clothes) that are not easily rinsed off and that lead to contact irritation especially to local users.

The chloride values range from 35.50 to 37.00 mg/l, which falls within the WHO standard of <250 mg/l

The sulphate value obtained range between 3.58 to 4.70 mg/l. however the WHO recommends that a concentration higher than 450mg/l is unhygienic due to problems to the gastro intestinal tract. Iron concentration of the collected samples ranged between 15.48 to 17.96 mg/l and it is above the maximum levels of the iron content based on WHO of 0.3 mg/l. This implies that if the abattoir discharges its wastewater into other water bodies for drinking purposes downstream without treatment, it could be a contaminant and hence, hazardous to human health. Despite not being a healthy concern, high concentration of iron affects the quality of water, leading to bad taste and colouration of cooking utensils and food. These is no noticeable taste at iron concentration below 3.0 mg/l, although turbidity and colour may develop. This high iron content may probably be attributed to influx of waste blood.

The concentration of Zinc ranged between 1.95-2.18 mg/l, above the permissible limit of the WHO standard of 1.5 mg/l.

Conclusion and Recommendation

Conclusion

The treatment of abattoir waste before discharge onto the environment is very vital, as it drastically reduce concentrations of the physico-chemical parameters to permissible WHO limits, with the exception of Zn^{2+}, Fe^{3+} and DO respective concentration.

Recommendation

It is recommended that the government should set up treatment plants at every abattoir to treat their effluents before being discharged onto the environment.

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