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HYDROPHYSIO-CHEMICAL EXAMINATION OF WASTES WATER COLLECTED FROM EFFURUN ABATTOIR

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ABSTRACT

The purpose of this study is to examine the physiochemical qualities of abattoir wastewater. Weekly sampling of abattoir waste was done for four weeks. Standard laboratory procedures were followed in the analysis of sample wastewater, this is to ensure standard results. In this study, the pH of abattoir wastewater is in the range of alkaline region and also falls within the permissible levels of World Health Organization (WHO) for discharging wastewater. The dissolved oxygen (DO) is below the allowable limit of water while that of biochemical oxygen demand (BOD) is above the allowable limit set by WHO. The concentration of total nitrogen and phosphate in sample wastewater is above the standard limit set by WHO. The value of magnesium is quite higher when compared with the standard recommended by WHO. Therefore, the release of abattoir waste into the receiving water could lead to surface water pollution. The result of heavy metals in this research is below the permissible level of WHO, however the receiving water needs regular monitoring. Arising from the results obtained from this research, abattoir wastewater needs treatment before discharge into receiving water. It is also important for agencies of government to monitor surface water receiving abattoir effluents regularly.

Keywords: Wastewater, Abattoir, Dissolve oxygen, Biochemical oxygen demand

INTRODUCTION

Wasteswater has been regarded as one of the pollutants responsible for soil and surface water pollution throughout the globe. They also contribute to groundwater pollution particularly in a location with higher water table (Emegbetere et al., 2014., Ugbune et al., 2018., Becker et al., 2022), the pollution is severe if the soil texture is sandy soil. Waste water arising from domestic and production activities has been suggested as the major source of waste water in the rural and urban environment (Okhuarobo & Ugbune, 2023., Ugbune et al., 2023). Increase in population and drive to increase production especially in food and meat production for the protein requirement of man is also a contributory source of animal wastewater in the environment(Akpoghelie et al., 2024). Major animal wastewater in Nigeria is from slaughterhouse known as abattoir, abattoir is placed or slaughterhouse where animals are butchered for food and industrial needs (Edo et al., 2024). Abattoir business in Nigeria are poorly organized, they are generally sited near surface water bodies, this is to ensure easy access to water for their daily meat processing (Edo et al., 2024). The animal blood and the water used in washing the processed animals are allowed to flow to nearby surface water or pits which could cause pollution. The wastewater is organic matter in nature, which are in the form of proteins and fats (Ogheneoruese et al., 2022). Another constituents of abattoir waste are suspended solids and dissolved solids (Edo, 2023). Many researchers asserted that abattoir wastewater are released into surface water used for domestic activities (Khalid et al., 2018). The waste constitutes greater proportion of organic matter (Ugbune et al., 2021). The waste attract oxygen-consumed microbes which results in the depletion of dissolved oxygen (DO) and offensive odour. Another problem of abattoir waste is the presence of nitrogen, this nitrogen is converted to nitrate by nitrifying bacteria. The presence of nitrate in water lead to eutrophication. Another challenge arising from abattoir waste is the depletion of biochemical oxygen demand due to the use of oxygen in the breakdown of abattoir organic waste. Therefore this research seek to examine the effect of the physiochemical quality abattoir wastewater from Effurun river, this river served as domestic purpose to the inhabitant of the area and also for animal buchers in their daily meet production.

MATERIALS AND METHODS

Study area and samples collection

The abattoir wastewater used in this study were collected from Effurun abattoir located between latitude 5̊33′0''N and longitude 5̊ 47'0''E in Uvwie Local Government Area of Delta State for physiochemical examination. The wastewater samples were collected from the open drainage before entering into surface water. Abattoir operation in this locality is carried out daily. Abattoir wastewater samples were obtained in plastic bottles that were previously cleaned with deionized water and soaked with 10% HNO_3 for one day and finally rinsed with deionized water before usage. In the sampling location, sampling containers were rinsed with the wastewater before filling. The samples were coded before transporting to the laboratory for storage and analysis. The pH of the wastewater samples was analyzed in-situ. The dissolved oxygen (DO), chemical oxygen demand (COD), biochemical oxygen demand (BOD), chloride ion, total nitrogen and Phosphate were examined following standard methods for the examination of water and wastewater (Ma et al., 2020). The Concentration of iron, zinc, nickel, copper, magnesium and manganese was done using atomic absorption spectroscopy (AAS)

Quality assurance and processing of data

Standard laboratory-grade chemicals were used for sample analysis. Standard methods were adopted in wastewater sampling, this is to ensure quality and reliable results. Triplicate analysis was carried out on each sample while data presentations were carried out using relevant tables.

RESULTS AND DISCUSSION

Mean physiochemical properties of abattoir wastewater

The physiochemical properties of abattoir waste are presented in Table 1, the pH is in the range of alkaline region and lies in the allowable range of World Health Organization (WHO). Water in the alkaline region has been proclaimed by numerous authors to aid microorganisms in the breakdown of organic wastewater (Hashem & Qi, 2021). Dissolve oxygen (DO) is an important physiochemical property of water quality, elevated levels of DO increase the taste of portable water. The mean value of DO obtained in this study is below the permissible range of aquatic water, the DO of water below 5mg/l has been reported to cause aquatic stress and hypoxic conditions (Han et al., 2022). Chemical oxygen demand (COD), is the measure of the strength of water to utilize oxygen during the breakdown of organic waste, in this study, the COD is in the range of 432.10 to 752.00 mg/l, this value suggests that the abattoir wastewater constitute a high composition of biodegradable waste, therefore the waste will encourage high growth of microbes, the COD value is below 8.0 mg/l recommended for portable water, this is an indication of polluted water.

Table 1: Mean physiochemical properties of abattoir wastes water

	pH	**DO (mg/l)**	**COD (mg/l)**	**BOD (mg/l)**	**chloride ion (mg/l)**	**Total nitrogen (mg/l)**	**Phosphate (mg/l)**
WK 1	7.90	2.10	752.00	242.61	1176.85	90.54	451.23
WK 2	8.21	2.42	645.31	200.53	1175.97	78.45	543.54
WK 3	7.78	2.53	432.10	265.11	1167.34	86.56	464.24
WK 4	8.50	2.23	64.12	256.23	1182 32	98.34	397.23

Biochemical oxygen demand (BOD) measures the amount of oxygen utilized by microorganisms in the breakdown of organic waste in water. The BOD of this research is quite high, having a range of 265.11 to 200.53 mg/l higher than the 40 mg/l recommended by NESREA. The higher the BOD the faster oxygen is reduced in the water, which result in the suffocation of aquatic life and water odour. Total nitrogen is the addition of ammonical and organic nitrogen in effluents. The highest total nitrogen is found in the sample collected in week 4 (98.34 mg/l). Excessive total nitrogen in water has a detrimental impact on aquatic life due to the growth of blue-green algae (Sisman-Aydin & Simsek, 2022). High levels of phosphate increase the speed of natural eutrophication, the level of phosphate in this report is 451.23. 543.54. 464.24 and 397.23 mg/l for weeks 1,2, 3 and 4 respectively. Total phosphate in this report will encourage algae bloom, (Khosrovyan et al., 2023) asserted that phosphate concentration exceeding 0.01 mg/l encourages green algae bloom.

Mean level of heavy metals in abattoir waste

The level of heavy metals in the abattoir is presented in Table 2, the level of iron in the waste is quite low. A higher iron level in water is dangerous to health.

Table 2: **Mean heavy metals analysis of abattoir waste water**

	Iron (mg/l)	**Zinc (mg/l)**	**Nickel (mg/l)**	**Copper (mg/l)**	**Magnesium (mg/l)**	**Manganese (mg/l)**
WK 1	4.24	0.73	0.62	0.095	1610.00	0.45
WK 2	4.48	0.79	0.58	0.096	1599.71	0.43
WK 3	34.78	0.75	0.45	0.086	1621.34	0.46
WK 4	44.88	0.76	0.57	0.097	1592. 36	0.45

The concentration of zinc in the wastewater ranges from 0.73 to 0.75 mg/l. Extremely elevated concentration (above 675 mg/l causes intestinal irritants a bitter taste (Collao et al., 2022). The nickel concentration of this study is below the permissible limit 20 µg/l of water (Schrenk et al., 2020). However, there is a need to check the release of abattoir waste to the receiving surface water, this to avoid an increment in the concentration of nickel. Higher concentration of nickel have been documented to health (Nandomah & Tetteh, 2023). The mean concentration of copper as presented in Table 2 revealed 0.097 mg/l. This value is below the allowable limit of 1.00 mg/l of standard water (Ezez & Belew, 2023). Consistent intake of water with high concentration of copper could result in liver and kidney challenges (Obasi & Akudinobi, 2020). The magnesium level in the study wastewater ranges from 1592. 36 to 1610.00 mg/l, The concentration of magnesium in the sampling waste is above the 200 mg/l limit set by WHO (2003). The sample waste water could cause the taste and hardness of receiving surface water. The level of manganese in the sample waste water is below the 5.00 mg/l of water. However, the level of manganese in the receiving water need monitoring, water with high level of manganese is detrimental to brain development (Friedman et al., 2024).

CONCLUSION

The pH of the abattoir waste of this study is in the range of alkaline region and also lies within the permissible levels of WHO for discharge wastewater. The DO is below the allowable limit of water while that of BOD is above the allowable limit set by WHO. The level of total nitrogen and phosphate in sample wastewater is above the standard limit set by WHO. The value of magnesium is satisfactory when compared with standard recommended by WHO. Therefore, the released of abattoir in receiving water could lead to pollution. The result of heavy metals in this research is below the permissible level of WHO, however the receiving water needs constant assessment. Based on the results obtained from this research, abattoir wastewater needs treatment before discharge into receiving water. It is also important for agencies of government to constantly monitor surface water receiving abattoir effluents

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