Original Research

Journal of Advanced Veterinary Research
(2026) Volume 16, Issue 1, 167-169

Environmental impact analysis of wastewater from Keudah slaughterhouse in Banda Aceh City

Zikri M. Gaznur[1,2*], Wulan Amran[1], Muhammad Resthu[1,2], Fawwa Rahly[3], Cut A. Fitri[1,2], Hendra Koesmara[1,2]

[1]*Department of Animal Science, Faculty of Agriculture, Universitas Syiah Kuala, Banda Aceh 23111, Indonesia.*
[2]*Research Center of Aceh Cattle and Local Livestock, Universitas Syiah Kuala, Banda Aceh 23111, Indonesia.*
[3]*Animal Husbandry Department, Universitas Abulyatama, Faculty of Agriculture, Aceh Besar, Indonesia.*

ARTICLE INFO

Received: 02 October 2025

Accepted: 19 December 2025

*Correspondence:

Corresponding author: Zikri Maulina Gaznur
E-mail address: zikrimaulina@usk.ac.id

Keywords:

Wastewater, slaughterhouse, wastewater management installation, threshold

ABSTRACT

This study aimed to analyze the wastewater impact of Keudah Slaughterhouse in Banda Aceh City based on six parameters: pH, total suspended solids (TSS), biochemical oxygen demand (BOD), chemical oxygen demand (COD), ammonia, and oil and grease content. Furthermore, the analysis results were measured against wastewater quality standards regulated by the Regulation of the Minister of Environment and Forestry number 5, 2014. This study uses a quantitative descriptive approach that aims to describe the characteristics of wastewater impact based on the determined physical and chemical parameters. To increase data representativeness and control for natural variations that may occur over time, the sampling design was arranged based on a Completely Randomized Block Design, with sampling days as groups. Three different groups of days were randomly selected and on each day three wastewater samples were taken at the outlet point of Keudah Slaughterhouse. The results of this study showed that the COD level with an average value of approximately 277.19 mg/l exceeded the quality standard limit of 200 mg/l. Meanwhile, pH, TSS, BOD, ammonia, and oil and grease did not exceed the quality standard threshold. High COD levels in wastewater indicate high organic matter content and a suboptimal wastewater treatment installation system. The application of anaerobic biofilter systems combined with planted gravel filter technology is suggested as a potential strategy to reduce COD concentrations effectively. Overall, the findings highlight the need for improved wastewater management practices to minimize environmental pollution and promote sustainable resource management.

Introduction

A slaughterhouse is a building complex with specific designs and requirements used as a place for slaughtering animals for public consumption. A slaughterhouse plays a crucial role in ensuring the quality of sanitation and the halal status of meat before it reaches consumers. According to the Regulation of the Minister of Agriculture of the Republic of Indonesia Number 13/Permentan/OT.140/1/2010, slaughterhouse must meet certain technical and hygienic standards, including a sharia-compliant slaughtering system, the implementation of animal welfare, and a strict veterinary supervision system. As the demand for meat consumption in the community increases, activity at slaughterhouse also increases, thus directly impacting waste production, especially wastewater.

Wastewater produced by slaughterhouses generally originates from all operational activities, including slaughtering, carcass washing, equipment cleaning, and floor sanitation. Wastewater contains organic compounds such as blood, urine, rumen contents, fat, as well as inorganic compounds and pathogenic microorganisms, which can be polluting if not managed properly (Mahbuba *et al*., 2021). Slaughterhouse wastewater containing high levels of BOD and COD indicates potential environmental pollution, particularly affecting surface and groundwater quality. This is because organic compounds in waste can accelerate the decomposition process by microorganisms, which depletes dissolved oxygen in the water and disrupts the ecosystem's balance. This study aimed to examine the quality of wastewater standars at Keudah Slaughterhouse and to assess its potential impact on the surrounding environment.

Materials and methods

The study was conducted in February – March 2025 by collecting wastewater samples at Keudah Slaughterhouse, Banda Aceh City. This study used a quantitative descriptive approach that aims to describe the characteristics of wastewater quality based on the determined physical and chemical parameters. To increase data representativeness and control for natural variations that may occur over time, the sampling design was arranged based on a Completely Randomized Block Design, with sampling days as groups. Three different groups of days were randomly selected and on each day three wastewater samples were taken at the outlet point of Keudah Slaughterhouse. Wastewater parameter testing was carried out at Aceh Environmental and Forestry Testing and Development Center. The parameters tested included pH, TSS, BOD, COD, ammonia, and oil and grease.

The materials used in this study were distilled water, tissue, filter paper, duct tape, $K_2Cr_2O_7$, H_2SO_4, ferroin indicator, ferroammonium sulfate, $MnSO_4$, 0.025 N NaOH, aluminum indicator, alkali iodide adide, Na_2SO_4, anhydrous, iodine solution, 95% alcohol, HCL, N-hexane solution, MTBE and sodium sulfate crystals, standard ammonia solution 10 mg N/L, 90% phenol and alkali citrate solution. While the tools used are plastic bottles, gloves, masks, autoclaves, ovens, Erlenmeyer flasks, micropipettes, jars, hot plates, incubators, test tubes, pH meters, Gooch cups, furnaces, desiccators, analytical counters, spectrophotometers, separators, distillation flasks, titration tools, bunsen burners, glass, microscopes, measuring cups, thermometers, stands, micro pipettes, spatulas, pipettes, volume pipettes, glass, separators and rubber bulbs.

Results

The results showed that pH was 7.65, indicating a neutral to slightly alkaline condition; TSS value was 29.83 mg/L, below the standard limit of 100 mg/L; BOD was 66.83 mg/L, still under the threshold of 100 mg/L; COD reached 277.19 mg/L, exceeding the maximum allowable limit of 200 mg/L; ammonia concentration was measured at 0.30 mg/L, far lower than the limit of 25 mg/L; and the oil and fat content was 1.80 mg/L, also below the threshold of 15 mg/L.

Discussion

Measurement results indicate that the pH of the wastewater is in the

ISSN: 2090-6277/2090-6269/

neutral to slightly alkaline range, with an average value of 7.65. This value is still within the quality standard threshold of 6–9. Neutral pH conditions are crucial for maintaining the stability of biological reactions during the wastewater treatment process and supporting the survival of microorganisms in the wastewater treatment installation system. The pH that is too low (acidic) or too high (alkaline) can inhibit the activity of microorganisms in the biodegradation of organic matter and cause corrosion in the drains (Effendi, 2020). Therefore, the stable pH at Keudah Slaughterhouse indicates that the natural waste neutralization process is still running quite well.

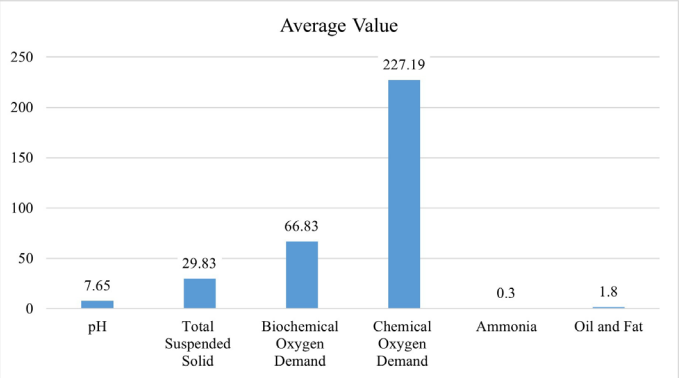

Fig. 1. The average value of wastewater compounds.

The TSS value is 29.83 mg/L, indicating that the TSS value is below the quality standard threshold of 100 mg/L. The low TSS level indicates that the content of suspended solid particles in the wastewater is still within safe limits and does not cause excessive turbidity or sedimentation in the receiving water body. TSS particles generally come from organic solid residues such as blood, rumen contents, and fat. The relatively low TSS value indicates that the solid and liquid waste separation system at the slaughterhouse is running relatively effectively, although it is still carried out in a simple manner. High TSS levels can prevent light penetration to underwater plants, leading to a decrease in physiological processes such as photosynthesis and respiration in aquatic organisms. Plants that are unable to photosynthesize will ultimately cause death and the decomposition process that requires more oxygen in the water (Rono, 2017). High TSS content can also cause a decrease in water clarity (Rahayu and JAR, 2019).

The BOD value produced was 66.83 mg/L, still below the standard threshold of 100 mg/L. This value indicates that the level of oxygen required to biologically decompose organic matter in the waste is still within normal conditions. However, the BOD value approaching the threshold indicates that the wastewater from Keudah slaughterhouse contains quite high levels of organic matter, which likely originates from blood, muscle tissue, and residual washing of internal organs. A high BOD value indicates the potential for pollution if the waste is discharged into waters without adequate treatment, as it can cause a decrease in dissolved oxygen and endanger the lives of aquatic organisms (Rono, 2017). The lower the amount of organic matter in the water, the lower the BOD value (Daroini *et al*., 2020).

The COD value was determined at 277.19 mg/L, exceeding the maximum quality limit of 200 mg/L. This value indicates that the wastewater from Keudah slaughterhouse contains high concentrations of organic and inorganic materials that are difficult to biodegrade. High COD levels are usually caused by blood, fat, protein, and other chemicals used to clean floors and equipment. High COD reflects a higher oxygen demand to break down organic and inorganic compounds present in the wastewater (Aini *et al*., 2017). Increased COD can also accelerate the growth of microorganisms in the water while reducing the amount of dissolved oxygen (Rono, 2017). This oxygen deficiency not only degrades water quality but also threatens the ecological balance of aquatic ecosystems and can cause fish mortality, loss of biodiversity, and disruption of nutrient cycles (Kholif *et al*., 2022). Furthermore, the presence of non-biodegradable compounds in wastewater hinders natural purification processes, highlighting the need for targeted treatment strategies.

The high COD levels also indicate that the wastewater treatment plant at Keudah slaughterhouse is not operating optimally. This is supported by observations and interviews that highlighted blockages in the installation pipes and a lack of routine maintenance. One way to reduce COD is through the use of biofilters, which are systems that use microorganisms to decompose organic and inorganic pollutants in liquid and gaseous wastewater George Tchobanoglous Tchobanoglous *et al*., 2003). These microorganisms grow on solid media such as rock, coal, gravel, or plastic and form biofilms that decompose pollutants as the wastewater flows through them. Previous research has shown that biofilter systems can effectively reduce BOD, COD, TSS, ammonia, oil, and grease in various types of wastewater, including domestic, industrial, and slaughterhouse wastewater (Suryani and Febrianti, 2019). There are two types of biofilters: aerobic, which use microorganisms that require oxygen, and anaerobic, which use microorganisms without oxygen to decompose organic waste. Saputra *et al*., (2020) showed that the application of longitudinal annular anaerobic biofilters to Banda Aceh slaughterhouse wastewater can reduce COD from 2,031.48 mg/l to 95.07 mg/l.

The ammonia concentration was 0.30 mg/L. Indicating that the ammonia concentration is far below the quality standard threshold with a maximum of around 25 mg/L. However, it is important to note that ammonia is toxic to aquatic organisms, especially at high pH where ammonia will be in the free form (NH_3) which is more toxic than its bound form (NH_4^+). The presence of ammonia usually comes from the decomposition of urine and protein. Ammonia is a toxic compound that can trigger eutrophication, namely the excessive growth of algae and aquatic plants that cause a decrease in oxygen levels in the water and threaten aquatic life. In addition, ammonia can also cause skin irritation and respiratory problems in humans (Brennan *et al*. 2021). Low ammonia concentrations indicate that the natural breakdown of organic nitrogen is quite efficient, and the volume of urine in the wastewater is relatively small. However, controlling ammonia concentrations remains important because it can cause toxic effects, especially if the wastewater is mixed with other wastewater containing detergents or other chemicals.

The results of oil and grease concentration of 1.80 mg/L, which indicates that the oil and grease concentration is far below the quality standard threshold limit with a maximum of around 15 mg/L. Oil and grease usually come from subcutaneous tissue such as stomach contents, and floor washing residue and cutting tools. Although low, the presence of oil and grease must still be monitored because it can form a film layer on the water surface, inhibiting oxygen exchange and can inhibit the activity of microorganisms in the degradation process (Chapman, 2016). Oil and grease can disrupt the activity of microorganisms and form a layer on the surface of wastewater, ultimately hindering the oxidation process under aerobic conditions. The oil layer on the water's surface can prevent sunlight from entering the water. Furthermore, the presence of the oil layer can also reduce dissolved oxygen levels in the water because it inhibits the entry of free oxygen. This can disrupt the balance of the food chain in the water (Hutagalung *et al*., 2024). The low concentration of oil and grease indicates that the solid and liquid waste separation system is still working well at Keudah slaughterhouse or because the waste is not directly discharged into the open stream.

Conclusion

Based on the research results, the pH, TSS, BOD, ammonia, and oil and fat values are still below the quality standards set by Regulation of the Minister of Environment and Forestry No. 5 of 2014. However, the COD level is higher than the wastewater quality standard limit, which is 277.19 mg/L from the limit of 200 mg/L. This indicates high contents of organic and inorganic chemicals in the waste. Slaughterhouse waste orig-

inating from blood, rumen contents, and washing residues are the main factors in the increase in organic content in wastewater.

Acknowledgements

Zikri Maulina Gaznur was in charge of planning, execution, checking of result and writing. Wulan Amran was in charge to take a data in Keudah slaugtherhouse. Also thank to the chief of Slaughterhouse, Heriansyah. Muhammad Resthu and Fawwa Rahly assist in planning, execution, checking of result and writing. Cut Aida Fitri and Hendra Koesmara who help with checking results.

Conflict of interest

The authors have no conflict of interest to declare.

References

Aini, A., Sriasih, M., Kisworo, D., 2017. Studi Pendahuluan Cemaran Air Limbah Rumah Potong Hewan di Kota Mataram. Jurnal Ilmu Lingkungan 15, 42.

Brennan, P., Healy, M. G., Morrison, L. 2021. The toxicity of ammonia to aquatic organisms: A review. Environmental Reviews 29, 438–450.

Chapman, D.V. 2016. Water Quality Assessments: A Guide to the Use of Biota, Sediments and Water in Environmental Monitoring (3rd ed.). London: E & FN Spon / UNESCO / WHO / UNEP.

Daroini, T.A., Arisandi, A., Kamal, K., Madura, B., 2020. Analisis Bod (Biological Oxygen Demand) Di Perairan Desa Prancak Kecamatan Sepulu, Bangkalan. Jurnal Ilmiah Kelautan Dan Perikanan 1, 558–566.

Effendi, H. 2020. Telaah Kualitas Air bagi Pengelolaan Sumber Daya dan Lingkungan Perairan. 6th ed. Yogyakarta: Kanisius.

George Tchobanoglous, Burton, F.L., Stensel, H.D., 2003. Wastewater Engineering Treatment and Reuse. Transportation Research Part B 25, 453–478.

Hutagalung, W.L.C., Jannah S.B.M., Rinaldi, R., 2024. Potensi Penerapan Produksi Bersih Pada Rumah Potong Hewan (Rph) Kota Jambi. Jurnal Bio-Geo Material Dan Energi 1, 23–28.

Mahbuba, B., Tenri, W., Respati, A.N., Suryanto, E., 2021. Studi Kasus : Permasalahan Limbah di Tempat Pemotongan Hewan (TPH) Amessageng Kota Sengkang. 12, 68–77.

Kholif, M.A., Rohmah, M., Pungut, Nurhayati, I., Walujo, D.A., Majid, D., 2022. Penurunan Beban Pencemar Rumah Potong Hewan (Rph) Menggunakan Sistem Biofilter Anaerob. Jurnal Sains &Teknologi Lingkungan 14, 100–113.

Rahayu, D., JAR, N.R., 2019. Penurunan Kadar Cod, Tss, Dan Nh3-N Pada Air Limbah Rumah Potong Hewan Dengan Proses Biofilter Anaerob-Aerob Menggunakan Media Bioball. Jurnal Purifikasi 19, 25–36.

Rono, A., 2017. Journal of Pollution Effects & Control Evaluation of TSS , BOD5 , and TP in Sewage Effluent Receiving Sambul River. Journal of Pollution Effects and Control 5, 1–5.

Saputra, M., Viena, V., Elvitriana., 2020. Efektivitas Biofilter Dari Media Sedotan Plastik Untuk Penyisihan Limbah Cair Rumah Potong Hewan Kota Banda Aceh The Effectiveness Of Pipettes Waste Biofilter Media For The Removal Of Slaughterhouse Wastewater In Banda Aceh. Jurnal TEKSAGRO 1, 30–38.

Suryani, E., Febrianti, D., 2019. Efektivitas Biofilter dalam Menurunkan Kadar BOD dan COD Limbah Cair Rumah Potong Hewan. Jurnal Teknik Lingkungan 25, 134–141.