

Wastewater Analysis of X Slaughterhouse in Pontianak City

Analisis Air Limbah Rumah Potong Hewan di Kota Pontianak

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ABSTRACT

Livestock waste results from livestock activities in the form of solid, and liquid waste. Generally, waste is not utilized, causing environmental pollution. The Slaughterhouse is a place where cattle slaughtering activities are carried out usually leaving behind various wastes in the form of cow offal, cow blood, cow urine and feces, also skin, if it is not handled properly it will cause an unhealthy environment and can cause the meat to be contaminated by microbes that exist around the slaughterhouse environment. This research aims to analyze wastewater from the Pontianak City Slaughterhouse. The research parameters consist of Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Suspended Solids (TSS), pH, ammonia, fat, and oil tests. Data analysis uses quantitative descriptive analysis. The results showed that the wastewater produced from the livestock slaughtering process at slaughterhouse X Pontianak City was highly above the standard threshold of wastewater quality standards for BOD, COD, TSS, ammonia, and fatty oil, but the pH was within the standard. It can be concluded that the practice of processing wastewater produced by slaughterhouse X in Pontianak City was not optimal, the quality of wastewater was above the standard value of wastewater quality for slaughterhouse activities.

ABSTRAK

Limbah peternakan merupakan hasil dari kegiatan aktifitas peternakan berupa limbah padat, cair. Umumnya limbah tidak dimanfaatkan sehingga menyebabkan pencemaran lingkungan. Rumah Potong Hewan merupakan tempat dilakukan aktivitas pemotongan sapi dan biasanya menyisakan berbagai limbah berupa jeroan sapi, darah sapi, urine dan feces sapi, serta kulit, sehingga jika tidak ditangani dengan baik maka akan menyebabkan lingkungan yang kurang sehat dan dapat menyebabkan daging terkontaminasi oleh mikroba-mikroba yang ada di sekitar lingkungan rumah potong hewan. Tujuan penelitian ini untuk menganalisis air limbah rumah potong hewan X kota Pontianak. Parameter penelitian terdiri dari uji Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Suspended Solids (TSS), pH, ammonia, lemak dan minyak. Analisis data menggunakan analisis deskriptif kuantitatif. Hasil penelitian menunjukkan air limbah yang dihasilkan dari proses pemotongan ternak di rumah potong hewan X Kota Pontianak angka yang dihasilkan berada jauh diatas ambang standar baku mutu air limbah baik ammonia, BOD, COD, TSS, minyak dan lemak, yang sesuai standar hanya derajat keasaman (pH). Disimpulkan bahwa praktik pengolahan air limbah yang dihasilkan rumah potong hewan X di Kota Pontianak belum optimal dikarenakan belum optimal melakukan pengelolaan air limbah rumah potong hewan sehingga meningkatkan beban pengolahan air limbah. Kualitas air limbah berada diatas nilai baku mutu air limbah bagi kegiatan rumah potong hewan.

Kata kunci:

Limbah peternakan
Rumah potong hewan
Air limbah



INTRODUCTION

Cattle farming businesses generally produce waste in the form of livestock manure which can pollute the surrounding environment. The livestock waste produced can be waste from the slaughtering process such as blood, offal, water for cleaning the cage environment, feces, urine, both solid waste and liquid waste, and gas. This is different from domestic liquid waste which consists of 99% water and 0.1% solids which consists of organic materials such as 25% carbohydrates, 10% protein, and 85% fat, as well as organic materials such as salt, metal, and granules. The content of cow waste is more in terms of nutrient elements such as N (nitrogen), P (phosphorus), and K (potassium). Meanwhile, cow urine contains nitrogen (N), sulfur (S), ammonia (NH₃), copper (Cu), iron (Fe), urea (CON₂H₄), uric acid (C₅H₄N₄O₃), phosphate (P), sodium (Na), potassium (K), manganese (Mn), carbonic acid (HCOOH), calcium (Ca), salt (NaCl) (Sutapa, 1999). According to Sulistia dan Septisya (2019), domestic wastewater was wastewater comes from residential areas, restaurants, offices, commerce, apartments, and dormitories. Liquid waste during the livestock slaughtering process is usually just channeled directly into the drainage channel or thrown directly behind the pen without any prior processing.

In general, liquid waste from livestock still contains quite high amounts of organic material. Not only does liquid waste disturb the environment, but the odor produced from the livestock slaughter process also causes environmental problems. According to (Tunjung Murti Pratiwi et al., 2019) in processing liquid waste containing organic materials is to use a biological waste processing process. Apart from liquid waste, there is also solid waste.

Solid waste is all waste produced in the form of solids or the solid phase, such as livestock manure or livestock entrails resulting from slaughter. The gas waste is all waste in the form of gas or the gas phase, this is what causes the smell that arises from livestock slaughtering activities, causing odors in the environment around the pen and the livestock slaughtering area. Widia et al., (2012) state that microbial activity in the process of decomposing organic waste in water results in an increase in the concentration of Biological Oxygen Demand (BOD), Chemical

Oxygen Demand (COD), ammonia (NH₃), hydrogen sulfide (H₂S), changes in pH, and causes foul odors such as urea and sulfur. Regulation of the Minister of the Environment Number 11 of 2009 concerning Waste Water Quality Standards for Cattle and Pig Farming Businesses and/or Activities, the parameters that must be considered are BOD, COD, Total Suspended Solids (TSS), NH₃-N, and pH. Therefore, to reach good standards, the quality of waste must comply with the standards that have been set (Kementerian Lingkungan Hidup Republik Indonesia, 2009).

Slaughterhouses are usually able to slaughter around ten animals per day and this will increase when market demand is high, such as during certain celebrations such as Eid or other big holidays. Abattoirs that serve livestock slaughter are capable of producing quite a variety of waste, one day each cow can produce 100-150 liters of liquid waste. Based on the method, slaughter can be done in two ways, namely traditionally using simple tools such as a knife or machete and mechanical slaughter using an animal cutting machine (A. Sugandi, and H. Indra, 2023). Slaughterhouse X Pontianak City still uses traditional equipment in the process of slaughtering livestock with the resulting waste being disposed of in the ditches and behind the slaughterhouse building. However, slaughterhouse X Pontianak City already has a Wastewater Treatment Plant (WTP) to accommodate waste from slaughtering livestock such as wastewater, blood, offal, cow dung, and urine.

The amount of urine excreted by a cow weighing an average of 400 kg is 15 liters/day. A cow with a body weight of 400 ± 500 kg can produce solid and liquid waste of 27.5 to 30 kg/head/day. Normal urine in cattle is a clear, yellowish liquid (Vebriyanti, Arief, Salundik, & Dewi, 2022), with the composition of cow urine containing N, S, NH₃, Cu, Fe, CON₂H₄, C₅H₄N₄O₃, P, Na, K, Mn, HCOOH, Ca, NaCl, vitamins (Rohani, Sirajuddin, Said, Mide, & Nurhapsa, 2017).

Liquid waste processing slaughterhouse X Pontianak City where the WTP installation is adequate, is characterized by the presence of an inlet channel, a distribution tank, a receiving tank, and an outlet channel. Where the holding tank has been conditioned in an anaerobic condition. The presence of algae on the surface of the pond water causes anaerobic conditions even though the pond is not covered. In wastewater

treatment tanks, integration is carried out with catfish farming. The presence of catfish is an indicator that liquid waste is processed through the WTP with water conditions designed on a normal scale so that it is not dangerous when it flows back into the river. In summary, slaughtering activities at the slaughterhouse consist of receiving and holding, antemortem examination, preparation for slaughter, butchering, skinning, removal of offal, post-mortem examination, carcass splitting, carcass withering, and carcass transportation (Lubis, Soesilo, & Soemantojo, 2020).

Therefore, the aim of this research is to determine the contamination value of wastewater from slaughterhouse X in Pontianak City which includes BOD, COD, TSS, pH, ammonia, and oils and fats.

MATERIALS AND METHODS

The research was conducted from June to July 2023, at the Animal Husbandry Laboratory, Faculty of Agriculture and the Center for Standardization and Industrial Services, Pontianak, West Kalimantan Province. Wastewater materials were obtained from Slaughterhouse X Pontianak City. The parameters used in this research are physical analysis, namely TSS, and chemical parameters consisting of BOD, COD, pH, ammonia, oil, and fat. This research began with a literature study and initial observations regarding wastewater management and continued by taking wastewater samples after the first disposal process to test the quality of the wastewater in the laboratory. In general, this research uses a descriptive quantitative method that aims to obtain data related to abattoir wastewater management with the parameters NH₃, pH, TSS, COD, BOD, oil, and fat by taking one sample of slaughterhouse waste.

RESULTS AND DISCUSSION

Quality of Slaughterhouse Wastewater

Based on the results of wastewater analysis tests at the Pontianak City X slaughterhouse, the following data were obtained.

A slaughterhouse is a building consisting of several places to support all forms of livestock slaughtering activities in a sustainable manner. Generally, abattoirs have a main location for

carrying out animal slaughtering activities, so there are certain requirements as stated in the Minister of Agriculture's regulation concerning Requirements for Ruminant Slaughterhouses and Meat Cutting Plants Number 13/Permentan/OT.140/1/2010 the fourth part of Article 8 concerning Requirements for Layout, Design, and Construction of Enclosures (Permentan, 2010).

Wastewater of slaughterhouse X Pontianak City generally consists of urine excreted by livestock before slaughter, blood during slaughter, inedible fat from the skinning process of livestock, and water used for washing equipment and washing cages during cleaning, even water used for washing innards and cleaning up blood came out during the carcass division process. According to (Besse Mahbuba We Tenri Gading, Adib Norma Respati, & Edi Suryanto, 2021) animal slaughter waste that is not managed properly has the potential to pollute the environment. All wastewater was channeled and disposed of in the ditches behind the cages which were then channeled into the available holding ponds for further processing with WTP. The wastewater management process in the slaughterhouse X Pontianak city generally, consists of equalization, neutralization, coagulation, flocculation, sedimentation, chlorination, storage, measurement, and discharge into the Kapuas River.

Quality of wastewater produced from all series of livestock slaughtering processes at the slaughterhouse X Pontianak City was obtained from primary data, while the wastewater quality test parameters of the Pontianak City slaughterhouse X. It was referred to the Regulation of the Minister of Environment of the Republic of Indonesia No. 5 of 2014 (Kementerian Lingkungan Hidup Republik Indonesia, 2014) which consists of physical parameters, namely TSS, and chemical parameters consisting of BOD, COD, oil and Fat, ammonia, and pH as seen in Table 1.

Ammonia value in wastewater test analysis results in slaughterhouse X of Pontianak City was very different from the quality standards by the Minister of Environment Regulation Number 11 of 2009 concerning wastewater quality standards for cattle and pig farming businesses and/or activities. The Minister of Environment Regulation by (Kementerian Lingkungan Hidup Republik Indonesia, 2014) namely, from a standard of 25 mg/L the resulting product reached

Table 1. Results of measuring the quality of wastewater from the Pontianak City Slaughterhouse

No	Test Parameters	Unit	Test results	Quality standards
1	Ammonia (NH ₃)	mg/L	787	25
2	Acidity (pH)	-	7.21	6.0-9.0
3	Total Suspended Solids (TSS)	mg/L	381	100
4	Chemical Oxygen Demand (COD)	mg/L	568	200
5	Biological Oxygen Demand (BOD)	mg/L	164	100
6	Fat Oil	mg/L	101	15

787 mg/L. This was thought to be ammonia in wastewater was often formed due to natural chemical processes. In aquatic ecosystems, ammonia is usually found in the form of NH₄⁺ (ammonium) to NH₃ (ammonia). In aquatic areas, ammonia comes from the breakdown of organic nitrogen (protein and urea) and inorganic nitrogen found in soil and water. According to Bustillo-Lecompte & Mehrvar (2015) most of the contamination came from animal blood, and mucus from the stomach and digestive organs. According to Mu'iniina dan Windraswara (2021), slaughterhouses contained a variety of pollutant components depended on the processes carried out and specific water requirements.

The pH value in this study showed that it was still within the normal range. pH was able to indicate the fertility level of water because it influenced the life of microorganisms in it. According to Andayani (2005), if the amount of OH⁻ in the water increased, the pH value of the water would also be higher (alkaline) and vice versa, if the H⁺ ion content in the water is high, the pH of the water would be lower (acid). Pure water with a balanced H⁺ and OH⁻ ion content can be ensured that the resulting pH value is neutral or equal to 7.

Total Suspended Solid is a substance in the form of a solid that usually cannot dissolve in water, the TSS solids come from inorganic substances such as mud, sand, or soil. In this study, the TSS value was 381 mg/L. The resulting TSS value is greater than the quality standard value, namely 100 mg/L. The sampling process is carried out after slaughtering livestock so that it is indicated that there are suspended substances in the water that are carried from upstream to downstream. High TSS values can come from livestock manure and leftover feed which causes the continuous addition of waste (Wadiana, Purnaini, & Pramadita, 2024). If not handled properly, high pH and TSS content pollute the environment,

because it can affect physical changes in water, temperature, taste, smell, and turbidity and at the same time endanger human lives because it may cause disease and damage to the ecosystem in the environment (Sari, Moelyaningrum, & Ningrum, 2018).

Wastewater quality measurement results in Slaughterhouse X Pontianak City can be seen in Table 1 that the quality of wastewater in Slaughterhouse X Pontianak City still does not meet the quality standards that have been set. The COD quality standard was 200 mg/L, while the test results show 568 mg/L, this indicated that the high COD content in waters indicated the high level of inorganic waste contained therein. The higher the COD value produced, the higher the level of contamination because of the large amount of waste contained in it from other activities. The COD number is a measure of air pollution by organic substances that can naturally be oxidized through microbiological processes, resulting in a reduction in dissolved oxygen in the air (Olivianti, Abidjulu, & Koleangan, 2016).

The results of measuring the BOD value also exceed the quality standard, namely 164 mg/L compared to 100 mg/L. The lower value of oxygen dissolved in water indicates that the organic material in the water requires high levels of oxygen (Togatorop, 2009). The high BOD value indicated that the level of water pollution in this area was also high. A high BOD value is an accumulation of organic waste so that the decomposition process increases and causes the dissolved oxygen content to decrease. According to Dincer (2020) the BOD or COD ratio shows the biodegradability level of wastewater, the higher the ratio, the lower the biodegradability. According to Fadzy et al., (2021), BOD and COD values have an impact on reducing dissolved oxygen because microorganisms in the water will use up dissolved oxygen, which indicates that the water has been polluted. Aini et al.,

(2017) stated that the risks posed as a result of activities in slaughterhouses where wastewater management was less than perfect or there was no Wastewater Treatment Plant included the presence of disease-causing pathogenic bacteria, increased levels of BOD, COD, TSS, oil, and fat, pH, and NH₃-N.

The oil and fat content in this study was around 101 mg/L, higher than the standard quality standard for fatty oils, namely 15 mg/L. The high levels of oil and fat are thought to be due to the removal of fat waste when cleaning the inside of the rumen is carried out continuously and repeatedly. One alternative to reduce the value of fats and oils is by utilizing microbes which can be obtained by isolating fat degrading microbes from slaughterhouse waste. According to Aini et al., (2017) Fat-degrading bacteria work to decompose oil and fat in waste effectively and do not produce toxins or blooms because the microbes will die when there is no more oil.

CONCLUSIONS

Based on the results of wastewater testing of slaughterhouse X Pontianak City, it can be concluded that the quality of wastewater was above the standard value of wastewater quality for slaughterhouse activities.

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