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Impact of chicken livestock waste on the quality of sail river in Pekanbaru City, Riau

Abstract

This is research using a survey method, to analyze the impact of waste on the Sail Farm water quality. The sampling location was carried out at five points that are in the chicken farm (T3), 25m (T1) and 10m (T2) leads to the upstream before the drain pipe and 10m (T4) and 25m (T5) downstream after livestock waste disposal pipes. The results showed that the Sail River Water Quality was not met by the standards at T3, all parameters were observed both pH, nitrite, nitrate, ammonium, TDS, TSS, DO, BOD, COD in not meeting government requirements in PP No. 82 of 2001 concerning water quality standards. In other locations (T1, T2, T4, and T5), it is known that the Sail River water quality still meets the applicable regulations.

Keywords: water quality, sail river

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Introduction

Water is a natural resource for many people, even by all living things. Therefore water resources must be protected so that they can be utilized properly by humans and other living beings.[1] One of the water sources that are widely used to meet the needs of life and other living things are rivers. Rivers are ecosystems that are very important for humans. The river also provides good water for humans for various activities such as agriculture, industry and domestic.[2]

River water coming out of springs usually has very good quality. But in the process of flowing the water will receive various kinds of pollutants.[3] Increasing domestic, agricultural and industrial activities will affect and impact the conditions of river water quality, especially domestic activities that provide input of the greatest BOD concentration to river bodies.[4]

Sail River, which is in the city of Pekanbaru, is children of the Siak river. Around the Sail River, there are many chicken farms that are ±10m away from the Siak river and sewage disposal pipes directly to the river. The stench of chicken farm waste is very disturbing to the residents around the farm and the river water becomes cloudy and smelly. Waste generated from chicken farming is a form of chicken manure and unpleasant odors and wastewater. Wastewater comes from laundry places for feeding and drinking chicken and other domestic needs. Chicken manure consists of leftovers and undigested cellulose fibers. Chicken manure contains proteins, carbohydrates, fats, and other organic compounds. Proteins in chicken are a source of nitrogen besides other forms of inorganic nitrogen.[5] The government itself has set a regulation through PP No. 82 of 2001 concerning River Water Quality which regulates pollutant load quality standards that affect river water quality. Based on these matters, it is necessary to analyze the water quality of the Sail River, so that the extent of pollution that occurs in the river is known. This is a village based on physical and chemical properties in accordance with PP No. 82 of 2001 concerning the quality of river water.

Material and method

Location and time of research

This research was conducted at the Waste Processing Technology Laboratory, Faculty of Fisheries and Marine Sciences, University of Riau, in May-June 201 8. Sampling locations are carried out on the Sail River City of Pekanbaru at five points. Distance measurement for sampling points is centered on livestock waste disposal pipes. The first point (T1) is 25m upstream before the disposal pipe waste; the second point (T2) is 10m up to the third point (T3) which is located in the sewage pipe. For the fourth point (T4) spaced the 10 m downstream after the sewage pipe and the fifth point is 25 m downstream after the fourth point (Figure 1).

Figure 1 Location of sampling in Sail River Kelurahan Kulim Kota Pekanbaru.

Tools and materials

The material used in this study was river water, aquades, sulfanilate acid solution, naphthyl ethylenediamine dihydrochloride solution, 1M hydrochloric acid solution, phenol solution, sodium nitro preside solution, manganese sulfate solution, azide alkaliodide solution, concentrated sulfuric acid, solution 0.025M sodium thiosulfate, 0.03M potassium permanganate solution, 0.05M oxalic acid solution, 0.01M sulfuric acid. The equipment used in this study was the Uv-Vis spectrophotometer, pH meter, oven, analytic balance, and Gooch cup, paper filter with 0 pore size, 45µm, and beaker.

Research methods

Determination of nitrates: In the 50mL pipette, the water sample is inserted into the 100mL Erlenmeyer. Then add 1ml of 1M HCl solution, stir it and leave it for ±10 minutes, then the absorbance is measured by a spectrophotometer at a wavelength of 275nm.

Determination of ammonia: In the 25 mL pipette of the water sample, put into 50mL Erlenmeyer, 1mL of phenol was added solution, 1mL of sodium nitro preside solution and 2mL of oxidizing solution. Then the sample is closed and left for 1 hour of measured absorption at a wavelength of 640nm.

Determination of TDS: The sample was homogenized with a pipette of 50mL and filtered with porous filter paper 0,45µm. After the samples are filtered, the filter paper is rinsed with water flute. All filters are transferred into a cup that has a fixed weight. The filter in the saucer is evaporated to dryness with a water bath. The cup containing dissolved solids was dried into the oven at 180˚C for 1 hour, cooled in a desiccator and weighed.

PH determination: In the 150mL cup, 100mL of sample was inserted, then dipped in electrode from the pH meter, and read the pH value on the instrument.

Nitrite determination: In the 50mL pipette, the sample is put into 100mL Erlenmeyer. Then 1mL of sulfanilic acid was added, then 1ml of ethylenediamine dihydrochloride naphthyl acid was added, stirred and left for ±10 minutes, then measured the absorbance in the spectrophotometer at a wavelength of 543nm.

TSS determination: Samples were homogenized, no pipette of 50ml and filtered through a porous filter paper, 45µm using a cup Gooch. The Gooch Plate contains a filter containing paper and residue which was put into the oven and dried for 1 hour at 103˚C-105˚C. The cup was removed from the oven, cooled in a desiccator and weighed.

Determination of DO: In the 50mL pipette sample, 1mL of $MnSO_4$ and 1mL of alkaline iodide azide were added, closed and homogenized, it was allowed to settle for 5 minutes to 10 minutes and added 1mL of concentrated H_2SO_4, closed, homogenized until the sediment dissolved completely. S is further titrated with $Na_2S_2O_30$, 025M with starch indicators until the right blue color is gone.

Determination of BOD: The sample was put into a Winkler bottle, then incubated for 3-5 days in an incubator at a temperature of 20˚C. In the 100 mL pipette sample was inserted into the Erlenmeyer, added 1mL of $MnSO_4$ and 1mL of iodide azide alkaline, closed and homogenized, allowed for 5 minutes to 10 minutes and added 1mL concentrated H_2SO_4, closed, homogenized until the precipitate dissolved completely, then titrated with 0.02MM $Na_2S_2O_3$ with starch indicator until the blue color is gone.

COD determination: In the pipette 50mL sample into Erlenmeyer, added 0.5mL 0.01M sulfuric acid, added 1mL 0.03M Potassium permanganate, heated to boiling. After leaving it for 2 minutes, a solution of 0.05m oxalic acid was added to it. The sample is titrated in hot condition with 0.03M potassium permanganate solution until the solution is pink.

Results and discussion

The degree of equality (pH) is an illustration of the amount of activity in hydrogen waters.[6] In general, the pH value describes how the level of similarity or basicity of water. Waters with a pH value=7 are neutral, pH<7 is said to be acidic, while pH>7 is said to be alkaline water condition.[7] At five sampling points, the pH values range from 6, 62-7.19. The lowest pH at point 3, which is the point in the waste disposal pipe. While the highest pH is at point 2 which is 10m before the drain pipe. The pH value at all points still meets the quality standard, namely pH 6-9.

Because it oxidizes Fe2 + in hemoglobin. In this form, the ability to increase oxygen is greatly reduced.[8] The mechanism of toxicity of oxygen is transported in blood and tissue damage.[9] Nitrite values ranged from -0.0013mg/L-0.01140mg/L. The highest nitrate value is located at point 3 which is the waste disposal pipe which is equal to 0.1140mg/L. This value does not meet the nitrite quality standard, which is 0.06mg/L. Increased nitrate points are related to organic matter present in livestock wastewater. Among them is decomposition of organic matter by microorganisms that require large amounts of oxygen (Table 1).

The measurement results of nitrate at five sampling points ranged from 4.0145mg/L-17.9761mg/L. The biggest value is at T3 which is 17.9761mg/L, this is the place where the wastewater falls are from the drain pipe. This is not the PP quality standards set out in PP RI. 82 of 2001 of 10mg/L. This feed flows through the drain pipe. While another point, the measured nitrate value still meets the quality standard.

High nitrate levels can be reduced because it can reduce oxygen dissolved in water can reduce fish populations. The cause of high blood pressure is the decay of dead plants and animals, human waste is becoming increasingly rivers and livestock manure.[10] Utami[11] stated that nitrate is the main form of nitrogen in the waters and is the main nutrient for plant growth and algae. Nitrogen nitrate is very soluble in water and is stable.

Ammonia comes from the oxidation of organic matter microbiologically derived from industrial wastewater, household waste, agriculture, and livestock waste. High ammonia levels indicate pollution in the waters.[12] The high ammonia value was T3 which was 3.6417mg/L. The high value of ammonia at the point of reference was organic impurities that came from livestock and leftover animal feed from chicken farm waste.[13] The direct effect of high ammonia will cause tissue disfigurement to be removed in fish, where it will be disrupted. As a consequence, in chronic conditions, biota normally lives longer lives.[14]

Based on RI Regulation No. 82 of 2001 concerning River Water Quality, the maximum dissolved solids (TDS) is 1000mg/L. The measurement results for total dissolved solids at five points as a whole are below 1000mg/L. Thus the results of the TDS tests for river water are still below the required quality threshold standard. The highest value for T3 is T3 which is the point of drainage with a value of 600mg/L. This is because there is a buildup of dissolved solids

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from the remnants of animal feed and livestock waste in the form. of inorganic materials and organic matter. While the second is the highest point is 340mg/L at T4, which is 10m after the sewage pipe, this is because it receives a flow of T3 which still contains a lot of TDS. The total value of dissolved solids (TDS) in river water is higher than the total suspended solids (TSS). This illustrates the solidity of the river in the form of small solids found in the river is dominated by solids derived from organic wastes.

Table 1 Results of Water Quality Analysis of the Sail River

No.	Parameter	Unit	Quality standards	Point 1	Point2	Point 3	Point 4	Point 5
1	pH	-	6-9	7.12	7.19	6.62	6.75	6.85
2	Nitrite	mg/L	0.06	-0.0013	-0.0011	0.114	0.0013	0,0002
3	Nitrate	mg/L	10	4.0145	4.8021	17.9761	6.3796	4.5195
4	Ammonium	mg/L	-	0.0657	0.0529	3.6417	2.6417	0.0785
5	TDS	mg/L	1000	270	260	600	340	250
6	TSS	mg/L	50	10	10	30	20	10
7	DO	mg/L	4	10.44	10.04	2.25	5.65	10.62
8	BOD	mg/L	3	22.4	20.42	112.2	85.2	30.6
9	COD	mg/L	25	58	60	152	120	64

Source: Primary data (2016), water quality standard refers to PP No. 82 of 2001

TSS values at all points still meet quality standards. The standard set for TSS based on PP RI No. 82 of 2001 was 50mg/L. The biggest value is at T3 which is 30mg/L. This occurs because of the buildup and increase in suspended matter. At T4 the value shown is 20mg/L, this is the flow of currents that carry and accumulates suspended solids from the T3 to T4 points. According to Weber-Scannell & Duffy,[15] suspended solids will reduce the entry into the water. High suspended solids (TSS) will affect turbidity and brightness of river water.[16] Therefore, the deposition and decay of organic materials can reduce water use value.[17]

The measurement results of dissolved oxygen at five points ranged from 2, 25mg/L-10.62mg/L. The lowest DO value is at T3, which is the sewage pipe with a value of 2.25mg/L. This quality standard for DO, which is 4mg/L. The point shows the low freshness of the water due to lack of oxygen in the water. Whereas at other points, the level of freshness is better than T3 and still meets quality standards. This is because oxygen consumption increases.

According to Salmin,[18] the amount of oxygen in water depends also on the photosynthetic activity of organisms in water. The more bacteria in water will reduce the amount of oxygen in the water. On the surface of the water, the oxygen levels will be higher, because of the process of diffusion between water and free water and the process of photosynthesis. With the increase in depth, there will be a decrease in dissolved oxygen levels because the process of photosynthesis decreases and the oxygen content is widely used and oxidation of organic and inorganic materials.[19]

BOD values ranged from 20, 42mg/L-112.2mg/L at five sampling points. This is the highest standard, which is 3mg/L. The highest BOD value is at T3, which is 112.2mg/L. The high BOD is the accumulation of organic waste so that the decomposition process increases and causes the dissolved oxygen content to decrease. The value is also shown in T4, which is 85, 2mg/L. This is the closest point to the drain pipe so that it receives water flow from T3 and the BOD value becomes large (APHA (American Public Health Association), AWWA (American Water Works Association), & WEF (Water Environment Federation), 2001).

COD or chemical oxygen demand for oxidizing organic substances in water. The COD number is a measure of water pollution which can naturally be oxidized through the results of reduced oxygen dissolved in water. The highest COD value is at T3, which is 152mg/L and T4 which is 120mg/L. Based on RI Regulation No. 82 In 2001 the maximum value of COD allowed was 25mg/L. All values at the sampling point were not met the quality requirements. This means that these waters have been polluted by organic materials. Based on the ability of oxidation, the determination of the value of COD is considered to be the best in describing the presence of organic matter,[20] whether or not biologically decomposed.[21–24]

Conclusion

From the results of this research that chicken waste has a poor impact on the water quality of the Sail River in Pekanbaru City based on physical and chemical properties in accordance with PP No. 82 of 2001 concerning River Water Quality, especially from the content of nitrite, nitrate, DO, BOD and COD on T3 (point 3), which are sewage pipes that lead directly to the river because of the analysis of these parameters does not meet the standard quality determined by the government. Whereas other points there are those that meet the quality standards and some standards in accordance with PP No. 82 of 2001 concerning River Water Quality.

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Conflicts of interest

The authors declared there is no conflict of interest.

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