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Analysis of Water Quality Status Based on Domestic Waste Parameters by Using Pollutant Index Method at Tabuk River, Central Kalimantan Province

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ABSTRACT

The study aims to analyze the quality of water at Tabuk River Status by using pollution index method and domestic waste pollution impact to human health. The experiment was conducted in Tabuk River at Barito Selatan Regency Central Kalimantan Province. The samples of water with physical, chemical and biological parameters were taken at 3 points in the morning in the withdraw and flood. After wards, they were compared with the standard quality of water class II based on Government Regulation Number 82 of 2001 and domestic waste pollution impact to human health description. The results of study revealed that the water quality of Tabuk River exceeding criteria based on BOD at 48 mg/L in the withdraw and 22,52 mg/L in the flood, COD at 61,4 mg/L in the withdraw and 47,47 mg/L in the flood, TSS at 338,3 mg/L in the withdraw and 157,4 mg/L in the flood and Faecal Coliform at ≥ 1898 MPN. Whereas based on the index value of pollutants, Tabuk River by the light polluted status of 3,33-3,97, except downstream of withdrawing is medium (pollution index 5,2). The domestic waste pollution negative impact to human health. Increased faecal coliform in Tabuk River at ≥1898 jml/100 mL (MPN) and 58,33% society coastal river area have diarrhea and itch

Keywords: domestic waste, water pollution, water quality, water quality status

1. Introduction

The habit of people throwing waste into any place without processing previously and supported by the existence of rivers in a low position makes the river potential as a place of disposal, especially for people living on the banks of the river. As the case on the banks of the Tabuk River in South Barito District, Central Kalimantan Province.

Tabuk River is one of the tributaries of the Barito crossing the city of Buntok and passing through residential areas. Along the river, there are no industrial or mining factories so that it has the greatest potential for contamination caused by domestic waste. Domestic wastewater is liquid waste originating from household activities such as bathrooms, kitchens, and laundry. If the quantity and intensity of domestic waste are still within normal limits, nature is still able to carry out chemical, physical and biological naturally. However, an increase in the human population has led to an increase in the quantity and intensity of domestic waste disposal, making the process of decomposing waste naturally

unbalanced. If this happens continuously there will be an increase in levels of organic compounds, BOD and COD in rivers and an increase in the number of coli bacteria (Sasongko, 2006).

Based on the Environmental Health Risk Assessment study report (2014) in South Barito District, waste management by being dumped into the river is 53%, defecation as much as 42% to rivers and open defecation behavior (BABS) of 54, 1%, where as the behavior of BABS is mostly carried out in rivers, ponds and other open places. This behavior was very detrimental to human health conditions and the conditions of the Tabuk river, so to prove the initial indication that research needs to be conducted on the status of water quality in Tabuk River whether it is in accordance with Government Regulation No. 82 of 2001 concerning Management of Water Quality and Class II Water Pollution Control and Impact pollution to public health. Until now there have been no studies related to the quality and quality of Tabuk river water.

2. Research Methods

This research was carried out in Sungai Tabuk, Buntok City, South Barito Regency, Central Kalimantan Province. The time taken for research is about 4 months which includes the preparation period, conducting research, processing data, and reports.

Water quality testing of physical and chemical parameters was carried out at the South Barito Regency Office of Environment Laboratory and Water Quality and Hydro-Bioecology Laboratory of the Faculty of Fisheries and Marine Sciences, Lambung Mangkurat University, Banjarbaru, while Biological parameters were carried out at the Banjarbaru Health Polytechnic Microbiology Laboratory.

Determination of sampling points was carried out by placing 3 stations, namely areas that are only occupied by several houses (upstream), areas with a population that was still rare (middle part) and densely populated areas (downstream) which were considered important to represent the entire Tabuk River. Each station was taken 3 points each at a distance of 1/4, 1/2, and 3/4 the width of the river which is homogenized (composite sample).

Sampling at each observation station was carried out with 2 repetitions at different times, which is when the water was inside and at low tide (there were significant differences in water discharge), in the morning after community activities taking into account the speed of water flow.

Measurement and sampling of water are carried out based on surface water sampling methods in accordance with SNI 6989.57: 2008 by direct observation and measurement in the field (in situ) and laboratory testing (ex situ).

Data obtained from the results of testing physical and chemical parameters of river water, both in the field and in the laboratory, then analyzed the quality of the Tabuk River water by comparing the results of testing with class II water quality standards based on Government Regulation No. 82 of 2001 concerning Water Quality Management and Water Pollution Control.

While determining the status of river water quality in this study was carried out using the Pollution Index method with the formula:

$$PI_j = \sqrt{\frac{\left(C_i/L_{ij}\right)^2_M + \left(C_i/L_{ij}\right)^2_R}{2}}$$

Lij = Concentration of water quality parameters included in the water quality standard (j)
Ci = Water quality parameter concentration (i)
Pij = Pollution Index for allotment (j)
(Ci/Lij)M = Maximum Ci / Lij value
(Ci/Lij)R = Average Ci / Lij value

Evaluation of PI values is:

$0 \leq PIj \leq 1{,}0$ → good condition
$1{,}0 < PIj \leq 5{,}0$ → mild pollution
$5{,}0 < PIj \leq 10$ → moderate pollutant
$PIj > 10$ → heavy polluted

Determining the amount of the impact on public health using techniques percentage calculations by the formula:

$$\text{Percentage} = \frac{\text{Frequency (f)}}{\text{Number of Respondents (n)}} \times 100\%$$

Next is the interpretation and interpretation of the data as follows:

0% - 33% = low
34% - 66% = medium
67% - 100% = high

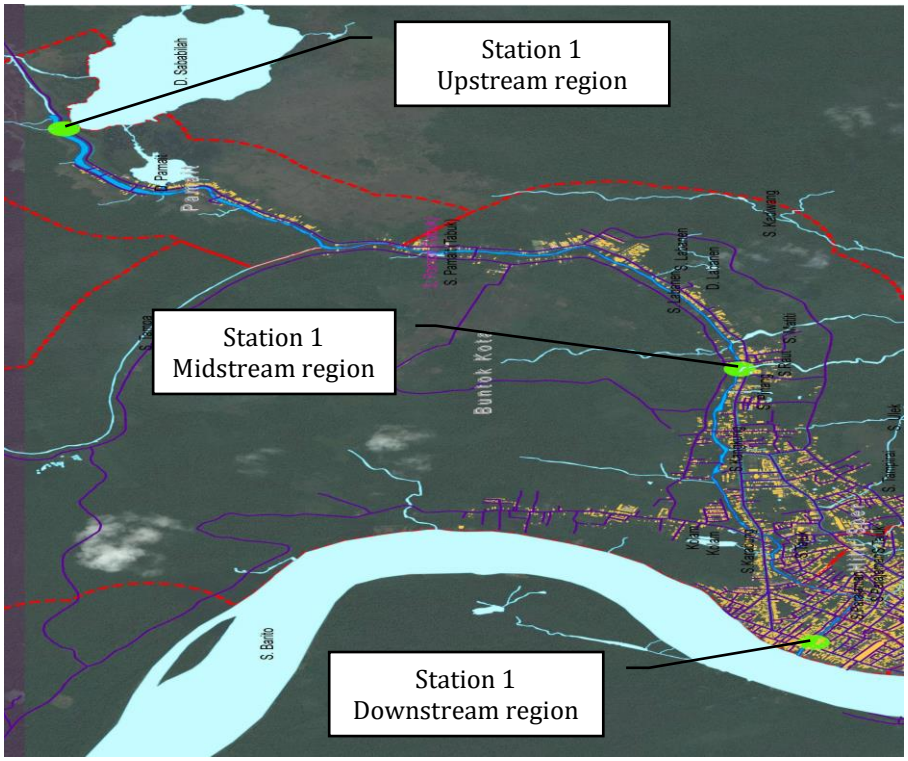

Figure 1. Sampling Point Location

3. Results And Discussion

Results

Table 1. Data on Laboratory Analysis Results for Low Tide Conditions

No.	Parameter	Unit	Sungai Tabuk			Quality Standards*
			Upstream	Midstream	Downstream	
1	Temperature	^oC	28	28,7	29	-
2	Debit (discharge)	m^3/s	1.68	1.68	1.68	-
3	pH	mg/l	5.01	5.87	6.9	6-9
4	DO	mg/l	6	5	4	4**
5	TSS***	mg/l	97.7	199.4	338.3	50
6	TDS	mg/l	117	201	844	1000
7	BOD***	mg/l	17	23	48	3
8	COD***	mg/l	37.5	48.3	61.4	25
9	NO_3-N	mg/l	0.3	1.7	7.9	10
10	NO_2-N	mg/l	0.005	0.005	0.016	0,06
11	NH_3-N	mg/l	0.1	1.25	2.1	-
12	Total Phosphate	mg/l	0.02	0.02	0.03	0,2
13	Fe	mg/l	0.9	3.1	2.8	
14	Faecal Coliform***	amount/ml	≥1898	≥1898	≥1898	1000

* Quality Standards according to PP No. 82 of 2003, Class II
** Minimum Limit
*** Exceeding the quality standards set

Table 2. Data on Laboratory Analysis Results for Inside Conditions

No	Parameter	Unit	Sungai Tabuk			Quality Standards*
			Upstream	Midstream	Downstream	
1	Temperature	^oC	27	27	28	-
2	Debit (discharge)	m^3/s	8.90	8.90	8.90	-
3	pH	mg/l	5.62	5.97	6.1	6-9
4	DO	mg/l	6	6	4	4**
5	TSS***	mg/l	67.9	133.6	157.4	50
6	TDS	mg/l	112	208	287	1000
7	BOD***	mg/l	15.32	20.72	22.52	3
8	COD***	mg/l	35.33	41.4	47.47	25
9	NO_3-N	mg/l	0.3	0.5	1.3	10
10	NO_2-N	mg/l	0.001	0.001	0.005	0,06
11	NH_3-N	mg/l	0.1	0.17	0.32	-
12	Total Phosphate	mg/l	0.01	0.01	0.075	0,2
13	Fe	mg/l	1.1	1.7	2.05	
14	Faecal Coliform***	jlh/ml	≥ 1898	≥ 14	≥ 6	1000

* Quality Standards according to PP No. 82 of 2003, Class II
** Minimum Limit
*** Exceeding the quality standards set

Table 3. Water Quality Pollution Value Based on Pollution Index

Sample Point	Pollution Index	Category
Hulu Surut	3.46	Mild pollution
Tengah Surut	3.97	Mild pollution
Hilir Surut	5.2	Moderate Contamination
Hulu Dalam	3.3	Mild pollution
Tengah Dalam	3.77	Mild pollution
Hilir Dalam	3.91	Mild pollution

Discussion

Based on the results of testing Tabuk river water samples, the parameters that exceed class II water quality standards were TSS, BOD, COD and Faecal Coliform both low and deep conditions. The highest TSS concentration was 338, 3 mg / L at low tide conditions and 157.4 mg / L in deep conditions, the highest BOD concentration was 48 mg / L at low tide conditions and 22.52 mg / l under deep conditions, the highest COD concentration was 61.4 mg / L at low tide conditions and 47.47 mg / L in deep conditions and highest total coliform concentration ≥1898 NPM at low tide and deep conditions.

The results of the calculation status of the Tabuk River water quality using the Pollution Index method indicate that the water quality of the Tabuk River was in a mildly polluted status, except in the downstream conditions with a moderate polluted state. The level of pollution obtained is indeed higher in low tide conditions than inside conditions because when the water has a high water discharge and high rainfall causes dilution which decreases the level of pollution, while at low tide conditions have low water discharge and direct household waste streams enter the river body and will flow from upstream to downstream so that it is piled up in the downstream area before it enters the Barito river body thereby increasing pollution in the downstream area.

As a body of water that still has no research on the quality of the environment and water that still used by the community as the main water for bathing, washing, latrines (MCK), some even use it as raw material for drinking water and consume Tabuk river water directly, of course this quite dangerous, especially for health.

Although it was categorized as mild pollution, it was not in line with the estimates that the Tabuk river for the middle and downstream regions is moderately polluted, but the value of the Tabuk river water quality for key parameters such as BOD, COD, TSS, and faecal coliform has exceeded the specified quality standard. The concentration of iron and ammonia were also quite high, although there is no quality standard required for class II water. This was clearly a consideration in the use and management of the Tabuk river.

The high value of BOD, COD, TSS and faecal coliform is caused by community activities on the banks of the river and its surroundings. The habit of people bathing, washing and toileting (MCK) in rivers and

sewerage channels of houses located on the banks of rivers and the habit of people littering in rivers and surrounding areas is a major cause of Tabuk river pollution.

The pollution of the Tabuk river causes people to suffer from diarrhea and itching, especially people who live on the banks of the river.

The results of the recapitulation of public perception knowing the experiences of respondents about diarrheal diseases can be seen in table 4 below:

Table 4. Respondents' experience of diarrhea and hives, n = 24 respondents.

No	Pengalaman	f	%
1	Ya	14	58.33
2	Kadang-kadang	3	12.5
3	Tidak	7	29.17
	Jumlah	24	100

Based on Table 4, it is known that the people who said they had experienced diarrhea were 14 respondents (58.33%) / medium category, who said there were sometimes 3 respondents (12.5%) / low categories, and who said there were never 7 respondents (29.17%) / low category.

From these data, in general, people have experienced diarrhea. In the city of Buntok, the number of diarrhea sufferers in 2015 was 1,059 cases.

4. Conclusion

Based on the research that has been done, conclusions can be drawn as follows:

The status of the quality of the Tabuk river water in terms of domestic waste parameters using the pollution index calculation has experienced water quality pollution with mild pollutant status in the upstream and middle regions (pollution index 3.33-3.97) and moderate pollutant status in the downstream region (pollution index 5.2).

Pollution of domestic waste has a negative impact on public health characterized by the high faecal coliform content in the Tabuk river, which is equal to ≥1898 ml / 100 mL (MPN) and around 58.33% of the people on the riverbank have suffered from diarrhea and itching.

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