The Measurement Of Water Quality In Kalibaru Watershed By Using Storet Method

by Saiful Anwar

Submission date: 15-Oct-2021 08:34PM (UTC+0700)
Submission ID: 1674675535
File name: iCAST1.2018.8751565.pdf (118.04K)
Word count: 2740
Character count: 13212

The Measurement Of Water Quality In Kalibaru Watershed By Using Storet Method

Budi Hariono
Agricultural Technology
Politeknik Negeri Jember
Jember, Indonesia
budihariono1966@gmail.com

Rizza Wijaya
Agricultural Technology
Politeknik Negeri Jember
Jember, Indonesia
rizza.wijaya@polije.ac.id

Sugiyarto
Agricultural Production
Politeknik Negeri Jember
Jember, Indonesia
gyarto2002@gmail.com

Saiful Anwar
Engineering
Politeknik Negeri Jember
Jember, Indonesia
sanwar2512@yahoo.com

Nanang Dwi Wahyono
Agricultural Production
Politeknik Negeri Jember
Jember, Indonesia
nanangdwiw355@gmail.com

***Abstract*—Kalibaru watershed is one of the strategic watersheds located in East Java, especially on Banyuwangi Regency. The impact of land function changes in upstream, midstream and downstream decreased the quality of the water along the Kalibaru Watershed. This research aimed at finding out the extent of activity impact of society along the watershed on water quality. The method used was measuring the water quality at 3 observation stations, which were in the upstream, midstream and downstream in the period of January 2017 to December 2017. The result of the analysis showed that the quality of Kalibaru watershed in the period of 2017 used Storet method at the upstream observation station (Gambiran Village) for the quality of class I, II, III and IV were as much as -47; -34; -8; 0. The observation taken at midstream observation station in Glenmore Village for the quality of class I, II, III and IV were -53; -34; -16; -8. The quality of class I, II, III and IV observed at downstream observation station at Kalibaru Village were -44; -28; -18; -10..**

Keywords*— Kalibaru Watershed, Storet Method, Water Quality, 2017 Period, The observation stations in upstream, midstream and downstream

I. Introduction

Watershed (DAS) is a land that cannot be separated with the river and its tributaries whose functions are to accommodate, store and drain the water from the rainfall to the lake or sea naturally, the land boundary becomes the topographical divider and the boundary from the sea to the water area which are still affected by land activity [1].

The activity society along the Kalibaru watershed in upstream, midstream and downstream is intensive and the population is grown quite significant. The changes in land management, residential area that is growing impacted the entry of pollutant. Its sources are from domestic waste, industrial waste, agricultural waste and livestock waste.

Water pollution is defined as the waste from human activity which is in the form of living organism, energy or another component that are brought in the river and it makes the water quality drops as the water is not functioned suitable with its design [2]. The polluting materials of the river are in the form of poisonous substances, suspended solid, oxidized and rised water temperature will change the ecology condition of the water and the quality of biota [3].

The pollutants are resulted from the community activities who produced detergent waste, BOD, COD, DO, solid, nitrogen, phosphorus, calcium, chloride and sulfate. Meanwhile, agricultural activities spread the pollutants through the waste of pesticide, heavy metal and poisonous gas. Industrial activity produced the waste coming from phosphorus, temperature, poisonous substances, turbidity, BOD, COD, DO, pH, TDS, oil/fat, urea [4].

All kind of pollutions can cause: 1) organism life interference because of the lack of oxygen; 2) the rapid growth of algae and aquatic plant population; 3) and, the siltation of a river because of erosion [5].

Based on these problems, it is necessary to conduct research on how much influence from domestic and industrial waste on the quality of water quality in the Kalibaru watershed. Changes in the quality conditions of the water quality of the Kalibaru watershed were analyzed using the Storet method using physical properties parameters (temperature and TSS), chemical properties (pH, BOD, COD, PO4P, DO, NO3N, NH3N and NO2N) and microbiological properties (total coliform and Fecal Coli).

The aim of this research was to study the decrease of water quality along the Kalibaru DAS because of the human, livestock, farming, industry, and others activities. The water quality status research along the Kalibaru DAS was essential to be conducted in order to manage water environment conservation and also water utilization which was appropriate to its objective.

II. Methods

The research observation location was in the upstream, midstream, and downstream which was 8°02'36" LS and 114°00'33" BT at Karangdoro village Gambiran districts; 8°01'34" LS and 114°00'29" BT at Karangaharjo village Glenmore districts, and also 8°01'12" LS and 114°00'14" BT Kalibaru Manis village Kalibaru districts. The sample was taken from three observation posts. The data from January up to December 2017 were gotten from the government unit of Water Resources Management or UPT Pengelolaan Sumber Daya Air of Bondowoso Regency. Those data were then compared to the standard data of water quality I, II, III, and IV.

The water quality measurement was conducted by using Storet Method which was compared to the water quality classification from PP 82 year 2001 that established 4 categories, they are:

1. Class I, the allocation for raw water of daily consumption and/or to another usage with water quality standard of the same objective.
2. Class II, the allocation for entertainment facility, freshwater fish cultivation, livestock, irrigation and/or another usage with water quality standard of the same function.
3. Class III, the allocation for freshwater fish cultivation, livestock, irrigation, and/or to another usage under the requirement of the same mentioned function.
4. Class IV, the allocation for planting irrigation and/or to another usage with the same water quality requirement of the mentioned function.

The method in measuring physical, chemical and microbiological characters are listed in the Table 1. [6]

Table 1. The method of measuring physical, chemical and microbiological character

No	Parameter	Quality I	Quality II	Quality III	Quality IV
Physic					
1	Temperature	normal ± 3	normal ± 3	normal ± 3	normal ± 3
2	TSS	1000	1000	1000	1000
Chemical					
1	pH	6 s/d 9	5 s/d 9	5 s/d 9	5 s/d 9
2	BOD	2	3	6	12
3	COD	10	25	50	100
4	DO	6	4	3	<3
5	PO4-P	0.2	0.2	1	5
6	NO3-N	10	10	20	20
7	NH3-N	0.5	0.5	0.02	0.02
Microbiology					
1	TotalColi	5000	5000	5000	5000
2	Fecal Coliform	5000	5000	5000	5000
Organic Chemistry					
1	oil & fat				0.5
2	phenol				0.001

The Storet method stages were:
1. The measurement results of the sample are compared with the quality standard;
2. If the measurement result value < quality standard is given a score of 0,
3. If the measurement result value > the quality standard value is given a score. This stage can be seen in the flow chart like Figure 1. The samples used in each observation station is 3 samples (<10 number of samples) so that the assessment as shown in Table 2.

Table 2. The Value System Determination to Determine the Water Quality Status

Number of sample	Value	Parameter Physic	Parameter Chemical	Parameter Biology
<10	Maximum	-1	-2	-3
	Minimum	-1	-2	-3
	Average	-3	-6	-9

After being compared between the measurement of the sample and the water quality standard, then the classification of the status of water quality is in accordance with US-ESPA as in Table 3.

Table 3. classification of water quality status according to US-ESPA

Class	Category	Score	Status
Class A	Very good	0	according to quality standards
Class B	Good	-1 to -10	lightly polluted
Class C	Medium	-11 to -30	moderately polluted
Class D	Bad	≥ -30	heavily polluted

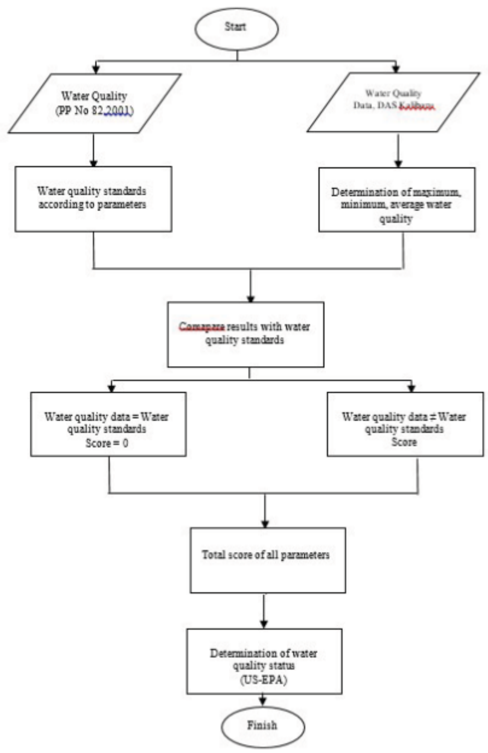

Fig 1. The Storet method stages

III. Result and Discussion

The Storet method can be used to determine the water quality status with a value system from US-EPA (Environmental Protection Agency) which classifies the water quality into four classes. In this research, several parameters such as physical character, chemical character and microbiological character were measured. Physical character such as: temperature and TSS. Chemical characters such as: pH, BOD, COD, phosphate, DO, NO3N, NH3N, and NO2N. Microbiological characters including: Fecal coliform and Total coliform. The results of the Storet method calculation on the upstream, midstream and downstream observation stations were listed in the Table 4, 5 and 6.

Based on the Tables 4, 5 and 6 above, there was a decrease in water quality from upstream, midstream and downstream sequentially for water quality class I, II, III and IV as shown in the Table 7.

The changing quality of water from the upstream, midstream and downstream for qualities I and II had not showed the linier pattern of quality degradation, even though at all observation stations showed that the quality of water was bad (value > -31). The water quality II showed that there was an increase of the water quality from bad (value > -31) to average (value > -28). This could not be explained in detail yet. The water qualities III and IV showed the linear pattern of water quality degradation in which from the observation stations in the upstream, midstream and downstream showed the changing quality of water. For the water quality III at the observation stations in the upstream, midstream and downstream was -8 (the water quality was good) became -16 (the water quality was average) and -18 (the water quality was average). For the water quality IV at the observation stations in the upstream, midstream, and downstream showed the water quality degradation as much as 0 (the water quality was very good), -8 (the water quality was good) and -10 (the water quality was good).

Table 4. The calculation results of water quality at the observation station, Gambiran Village, Kalibaru District in 2017

Parameter	Quantity	Quality I	Quality II	Quality III	Quality IV
Temperature	°C	normal ± 3	normal ± 3	normal ± 3	normal ± 5
TSS	mg/L	50	50	400	400
pH	-	6 sd 9	5 s/d 9	5 s/d 9	5 sd 9
BOD	mg/L	2	3	6	12
COD	mg/L	10	25	50	100
DO	mg/L	6	4	3	0
PO4-P	mg/L	0,2	0,2	1	5
NO3-N	mg/L	10	10	20	20
NH3-N	mg/L	0,5	0,5	0,02	0,02
NO2-N	mg/L	0,06	0,06	0,06	ta
TotalColi	jml/100ml	1000	5000	10000	10000
Fecal Coliform	jml/100ml	100	1000	2000	2000
Oil & fat	mg/L	0,5	0,5	0,5	0,5
Phenol	mg/L	0,001	0,001	0,001	0,001
Krom	mg/L	0,05	0,05	0,05	0,01
Copper	mg/L	0,02	0,02	0,02	0,02

Table 5. The calculation results of water quality at the observation station, Karangharjo Village, Glenmore District in 2017

Parameters	Quantity	Quality I	Quality II	Quality III	Quality IV
Temperature	°C	normal ± 3	normal ± 3	normal ± 3	normal ± 5
TSS	mg/L	50	50	400	400
pH	-	6 sd 9	5 s/d 9	5 s/d 9	5 sd 9
BOD	mg/L	2	3	6	12
COD	mg/L	10	25	50	100
DO	mg/L	6	4	3	0
PO4-P	mg/L	0,2	0,2	1	5
NO3-N	mg/L	10	10	20	20
NH3-N	mg/L	0,5	0,5	0,02	0,02
NO2-N	mg/L	0,06	0,06	0,06	ta
TotalColi	jml/100ml	1000	5000	10000	10000
Fecal Coliform	jml/100ml	100	1000	2000	2000
Oil & fat	mg/L	0,5	0,5	0,5	0,5
Phenol	mg/L	0,001	0,001	0,001	0,001
Krom	mg/L	0,05	0,05	0,05	0,01
Copper	mg/L	0,02	0,02	0,02	0,02

Table 6. The calculation results of water quality at the observation station, Kalibaru Manis Village, Gambiran District in 2017

Parameters	Quantity	Quality I	Quality II	Quality III	Quality IV
Temperature	°C	normal ± 3	normal ± 3	normal ± 3	normal ± 5
TSS	mg/L	50	50	400	400
pH	-	6 sd 9	5 s/d 9	5 s/d 9	5 sd 9
BOD	mg/L	2	3	6	12
COD	mg/L	10	25	50	100
DO	mg/L	6	4	3	0
PO4-P	mg/L	0,2	0,2	1	5
NO3-N	mg/L	10	10	20	20
NH3-N	mg/L	0,5	0,5	0,02	0,02
NO2-N	mg/L	0,06	0,06	0,06	ta
TotalColi	jml/100ml	1000	5000	10000	10000
Fecal Coliform	jml/100ml	100	1000	2000	2000
Oil & fat	mg/L	0,5	0,5	0,5	0,5
Phenol					
Krom	mg/L	0,001	0,001	0,001	0,001
Copper	mg/L	0,05	0,05	0,05	0,01

The biggest contributions which caused the water qualities III in the upstream, midstream, and downstream were the existence of BOD and NH3N as much as -10 and -8; -8 and -8 as well as -8 and 0. BOD source. The sources of BOD pollutions came from the food industry, beverage industry, printing industry, clothes industry, plastic industry, leather industry, hospitality, recreation, trade, settlement, land fisheries, and livestock [7]. BOD is the amount of oxygen to decompose organic material. According to [8] the BOD value described the organism activities in decomposing the organic material, while [9] the contaminant material which decreased BOD and caused the high need of oxygen, especially organic material and some inorganic materials such as human and animal waste, organic waste, industry waste, and so on. NH3N came from the food industry, printing industry, plastic industry, iron and metal industry, various industries of trade and plantation [7]. The biggest contribution which caused the water quality class IV in the upstream, midstream, and downstream as much as 0, -8, and -10 was the contamination of NH3N (ammonia).

Based on the explanation above, the existence of ammonia (NH3N) in DAS Kalibaru must be the main concern. Therefore, a depth study is needed of the industries which contribute NH3N contamination to the DAS Kalibaru.

Table 7. Water Quality Class I, II, III and IV

DAS	Village	Districts	Water Quality I	Water Quality II	Water Quality III	Water Quality IV
Upstream	Karangdoro	Gambiran	-47	-34	-8	0
Middle	Karangharjo	Glenmore	-53	-34	-16	-8
Downstream	Kalibaru Manis	Kalibaru	-44	-28	-18	-10

Table 7 showed the Kalibaru watershed in the upstream, middle and downstream sections of water quality I and II is categorized as polluted. for water quality III and IV can be categorized as water quality of the mildly polluted.

ACKNOWLEDGMENT

Our thank goes to Department of Agricultural Technology, Politeknik Negeri Jember, who has helped support for this research.

IV. CONCLUSION

The conclusion of this research were as follows:

1. The main pollutant sources of the DAS Kalibaru on the water quality class I and II in the upstream, midstream, and downstream were BOD, COD, PO4P, and NH3N.
2. The main pollutant sources of DAS Kalibaru on the water quality class III and IV were BOD and NH3N.
3. The water quality degradation of DAS Kalibaru on the standard I was there was no water quality degradation. The water quality in the upstream, midstream, and downstream were all bad.
4. The water quality degradation of DAS Kalibaru on the standard III in the upstream, midstream and downstream were good, average, and average.
5. The water quality degradation of DAS Kalibaru on the standard IV in the upstream, midstream, and downstream were very good, good, and good.

REFERENCES

[1] Law of the Republic Indonesia. Number 7 of 2004. About Water Resources. Jakarta. March 18, 2004.

[2] Regulation of the Minister of Environment No. 17 of 2009. Guidelines for Determining the Environmental Carrying Capacity in the Regional Spatial Arrangement of the State Minister for the Environment, 2009.

[3] Nugroho, "Evaluation the Water Quality of Ciliwung River in DKI Jakarta Through the Air-National Sanitation Foundation Quality Index Approach," Department of Forest Resource Conservation, IPB, Bogor, 2003.

[4] Sugiharto, "Basics of Wastewater Treatment," ed. Jakarta: UI Press, 1987.

[5] Walukow A. F, "Determination of Water Quality Status with the Storet Method in Lake Sentani Jayapura, Papua Province," Biological News, vol. 10, pp. 277 - 281, 2010.

[6] Hariono, B., Riskiawan, H.Y., Sugiyarto and Anwar S, "Determining the Status of Water Quality of the Kalibaru Watershed Storet Method," Proceedings of Sentrinov 2017. Volume 3 - ISSN: 2477 – 2097, 2017.

[7] K. L. Taufik, "Water quality of the Upper and Middle Ciliwung River, Bogor Regency, West Java. Essay," Faculty of Fisheries and Marine Science, IPB, Bogor, 2003.

[8] APHA, "Standard Method for Examination of Water and Wastewater," APHA, Inc, New York, 1976.

[9] S. Fardiaz, Air and Water Pollution. Yogyakarta: Kanisius, 1992.

The Measurement Of Water Quality In Kalibaru Watershed By Using Storet Method

ORIGINALITY REPORT

15%	2%	19%	2%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	B Hariono, R Wijaya, M F Kurnianto, Sugiyarto, M J Wibowo, S Anwar. "Mathematical Model of the Water Quality in Kalibaru Watershed", IOP Conference Series: Earth and Environmental Science, 2018 Publication	6%
2	M J Wibowo, W Winarno, B Hariono, R Wijaya. "Evaluation of Kalibomo watershed water quality using the storet method", IOP Conference Series: Earth and Environmental Science, 2021 Publication	4%
3	Saiful Anwar, M Joko Wibowo, Sugiyarto, Budi Hariono, Rizza Wijaya. "Determination of Water Quality Status of Stored Method in Tlogo Ampel Watershed", IOP Conference Series: Earth and Environmental Science, 2018 Publication	2%
4	S Sugiyarto, B Hariono, R Wijaya, P Destarianto, A Novawan. "The impact of land	2%

use changes on carrying capacity of sampean watershed in Bondowoso Regency", IOP Conference Series: Earth and Environmental Science, 2018
Publication

5	es.scribd.com Internet Source	2%

Exclude quotes	On	Exclude matches	< 2%
Exclude bibliography	On		