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Microbiological and Water Quality Status of Cibanten River

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***Abstract*—The Cibanten river is very important for life aquatic organisms and human survival. The purpose of this study was to determine the water quality status and microbiological analyses involved Total Coliform (TC) and estimation of Fecal Coliform (FC) of Cibanten river. Water sampling was conducted along by Cibanten river from up to downstream at six (6) stations for a period from March-October 2017. The number of total and faecal coliform was analysed using the Most Probable Number (MPN) method and STORET method for determining water quality status. Total coliform counts varied from 2400-9200 MPN/100 ml. The maximum total coliform is found in upstream of station 1 (Pabuaran village) 9200 MPN/100 ml was recorded in March-May 2017. Fecal coliform counts varied from 1300-6400 MPN/100 ml. The maximum fecal coliform is found in station 1 (Pabuaran village) 6300 MPN/100 ml was recorded in August-October 2017. Based on STORET method showed that water quality of Cibanten river in moderately polluted. In some situations, even stricter requirements and policies are necessary to achieve sustainability of water quality and ecology in Banten Province.**

Keywords—microbiological, Cibanten rivers, water quality status

I. INTRODUCTION

The Cibanten river flows from Karang mountain Pandeglang pass through Serang district with river length is 35.89 km. The Cibanten river is very important for life aquatic organisms and human survival. [1] The Cibanten river serves to support sustainable development and to support economic growth in the urban and industrial areas. Increased settlement activities along the river banks, exploitation of agricultural land and the poor living behavior of the people that produce domestic waste make the pollutant burden in Cibanten river.[2]

Water contamination with pathogenic microorganisms represents a seriously increased threat to human health. [3] Fecal pollution is the major cause of waterborne disease, since most of the pathogens associated with transmission reside in human and warm-blooded animal faeces. [4] Water borne diseases reported such as diarrhoea, typhoid fever and bacillary dysentery normally result from infections by pathogenic microbes, which implies the microbial pollution has an effect on public health. [5] At present, the most widely used water quality indicators include *Escherichia coli*, total and fecal coliforms, as well as intestinal *Enterococci* [6]. The assessment of microbiological water quality should aim to protect human beings from illness due to the consumption of water that may contain pathogens contributing to waterborne disease.[3] Determine influential water quality factors affecting the concentration of coliform bacteria at Cibanten river analyses in order to ultimately lay a foundation for efficient future water quality management.

II. METHOD

A. Water sampling stations

Water sampling was conducted along the Cibanten river from up to downstream at six (6) stations: Pabuaran village (Station 1), Telaga kencana (Station 2), Sumber abadi (Station 3), Kampung serut (Station 4), Kaujon bridge (Station 5), Kaibon bridge (Station 6). Grab sampling procedure was adopted as recommended by standard method for microbiological analyses. [7]

B. MPN method

The number of total and fecal coliform was determined using the most probable number (MPN) method using the double tube method. In the double tube method, the three basic steps to detect the presence of coliform bacteria in water are presumptive, confirmed and completed tests. The tests are performed sequentially on each sample.

Presumptive coliform test: Inoculation on lactose broth medium. Five broth tube series the first series containing five double strength broth tubes and the remaining two series comprising 10 single strength broth tubes were inoculated with 10 ml, 1 ml, and 0.1 ml of water (ratio 5:5:5), respectively. If there is bubble formation, continue to confirm the test. [8,9]

Confirmed test: Inoculation on brilliant green bile lactose broth (BGLB). To calculate the total coliform, the inoculated BGLB tubes were incubated at 35 ± 0.5° C for 48 hours, while for fecal coliform, the inoculated BGLB tubes were incubated at 44.5 ± 0.2° C for 48 hours. Calculate the MPN of coliform based on the proportion of confirmed gassing in BGLB tubes for 5 consecutive dilutions.[8,9]

The MPNs at different sampling locations were tabulated and compared to the MPNs in requirement of water quality status based on [10] Government regulation No. 82 of 2001 concerning the management of water quality and water pollution control. (Table 1).

TABLE I. CLASSIFICATION OF MICROBIOLOGICAL STATUS

Microbiological	Class			
	I	II	III	IV
Fecal coliform (count/100 ml)	100	1000	2000	2000
Total coliform (count/100 m)	1000	5000	10000	10000

C. *STORET method*

STORET methods for water quality status. Data were analysis based on STORET as well as Indonesia Government regulation No. 82/2001 (class II), water quality of infrastructure,water recreation facilities, freshwater fish culture, animal husbandry, and irrigation on Cibanten river.[11]

STORET is intended to point out contamination level (Minister of Environment Decree No. 115/2003). [8] STORET is determined for a particular purpose (class II). Determination of criteria is based on the score at Table 2.

TABLE II. STORET SCORE AND WATER QUALITY STATUS

Class	Score	Status
A	0	Meet quality standards
B	-1 to -10	Slightly polluted
C	-11 to -30	Moderately polluted
D	< -30	Heavily polluted

III. RESULTS AND DISCUSSION

A. *Microbiological count*

Microbiological analyses involved Total Coliforms (TC) and estimation of Fecal Coliforms (FC). The results of total coliform found fluctuations both upstream and downstream at six monitoring site along the Cibanten river. Total coliform counts varied from 2400-9200 MPN/100 ml. The maximum total coliform is found in upstream of station 1 (Pabuaran village) 9200 MPN/100 ml was recorded in March-May 2017. The results of the total coliform are shown in (Figure.1). Fecal coliform counts varied from 1300-6400 NPM/100 ml. The maximum fecal coliform is found in station 1 (Pabuaran village) 6300 MPN/100 ml was recorded in August-October 2017. The results of the total coliform are shown in (Figure.2). This might be explained by the effect of domestic, agricultural and industrial waste disposal from the urbanized surrounding area. [9] Water borne diseases reported such as diarrhoea, typhoid fever and bacillary dysentery normally result from infections by pathogenic microbes, which implies the microbial pollution has an effect on public health.[4] In general, the water in Cibanten river is not recommended to be used as drinking water. However, the result using microbiology parameters showed that the water still can be used as clean water, but more the water treatment needed to produce clean water.

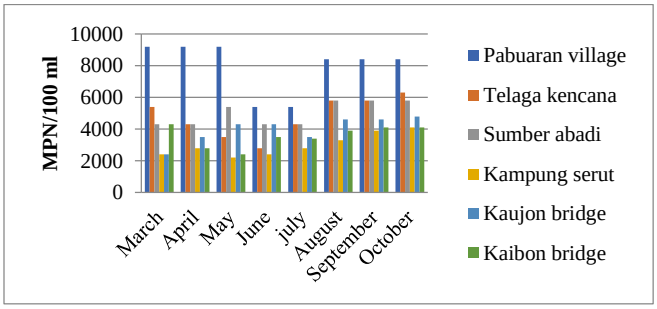

Fig. 1. Total coliform for each sampling sites.

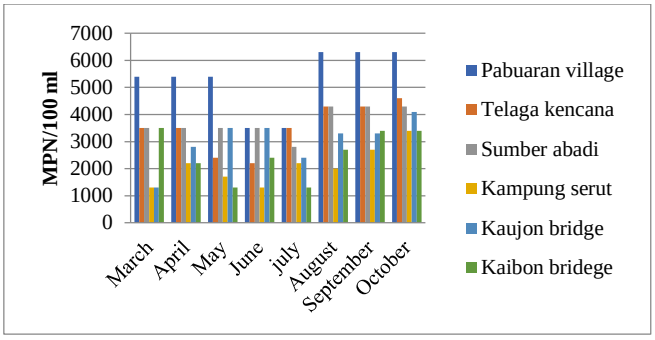

Fig. 2. Fecal coliform for each sampling sites.

B. *Water quality status of Cibanten river*

Water quality management refers to the STORET method can give suggestion assessing the water quality and take action to improve water quality when quality decreasing occurs due to water pollutants.[11] The assessment of river water quality based on STORET method shows that the water quality of the Cibanten river in moderately polluted. Industrial waste seems to be the main source of pollutants, especially in developing countries like Indonesia. Urbanization leads to overpopulated growth, which is the main contributor to water pollution. The organic waste discharged from factories may contain a variety of chemical substances, as in raw sewage, interrupting the ecosystem food chain of the river and expected to be the reason for water quality indices. [12,13] Thus, chemical and organic waste from factories must be treated before being discharged to the rivers. However, it is feasible to irrigate agricultural land according to the government regulation which categorized the river water quality as 2nd class water. (See table 3).

TABLE III. WATER QUALITY STATUS OF CIBANTEN RIVER

Location	Score	Status
Pabuaran village	-18	Moderately polluted
Telaga kencana	-20	Moderately polluted
Sumber mulya abadi	-20	Moderately polluted
Kampung serut	-20	Moderately polluted
Kaujon bridge	-20	Moderately polluted
Kaibon bridge	-20	Moderately polluted

C. *Equations*

The equations are an exception to the prescribed specifications of this template. You will need to determine whether or not your equation should be typed using either the Times New Roman or the Symbol font (please no other font). To create multileveled equations, it may be necessary to treat the equation as a graphic and insert it into the text after your paper is styled.

IV. CONCLUSION

It can be concluded that all the monitoring stations in the Cibanten river is not recommended to be used as drinking water. However, it is feasible to irrigate agricultural land according to the government regulation which categorized the river water quality as 2nd class water. In some situations, even stricter requirements and policies are necessary to achieve sustainability of water quality and ecology in Banten Province.

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