

ANALISIS KUALITAS GREYWATER PADA SISTEM DRAINASE DI HILIR TEPI SUNGAI CITARUM

QUALITY ANALYSIS OF GREYWATER ON DRAINAGE SYSTEM IN DOWNSTREAM OF CITARUM RIVERBANKS

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Abstract. Greywater generated from household activities in the riverbanks settlement is flowed directly into the drainage system. This research was conducted to analyze the level of pollution due to greywater flowed into drainage system in Citarum riverbanks, Kabupaten Karawang. Research was carried out on the drainage channel around settlements in 6 villages. The parameters analyzed were TSS, COD, BOD, Oil and Grease compared to the standard Minister of Environment Regulation No.68 of 2016. The TSS parameters was 11-292 mg/L, COD 28.8-441.6 mg/L, BOD 18.01-298.36 mg/L, Oil and Grease 1.9-13 mg/L. Parameter of TSS at all sampling points were exceed the quality standard, while parameters of COD and BOD were exceed in the 4 villages. Parameter of Oil and Grease at all points was above the quality standard in February, while in April, it was below the quality standard. High pollution on drainage system could be caused by the entry of greywater into the drainage channel that would contribute to pollute the Citarum River. This was occurs due to low level of knowledge and awareness in communities about pollution in the riverbanks and that there was not a proper treatment of greywater, whether in scale of household nor communal.

Keywords: greywater, drainage system, Citarum River, riverbank, water quality

INTRODUCTION

The Citarum River is one of the longest rivers in West Java, flows from upstream in the Wayang Mountain area in the south of Bandung to the north and empties into Karawang with a length of about 270 kilometers that flows through a hollow area and passes three dams (PD Melayu, 2016). The Citarum River flows to the rice fields which are 270 km long and have important functions not only for the settlement in the riverbanks, but also as the main air source for Jakarta (Coleman, 2018). The Citarum River watershed is grouped into 3 parts, namely upstream, middle and downstream. (1) The upstream part of the Citarum River Region has an elevation ranging from 625-2,600 masl consisting of segment 1 through segment 8 with land use in the form of agriculture, settlements and industry. The middle part of the Citarum watershed has various elevations between the plains (elevation 250-400 masl), hills (elevation 200-800 masl), and steep hills (elevations 1,400 – 2,400 masl) consisting of

segment 9 through segment 15 with land use of plantations and agriculture. The downstream Citarum watershed has elevation between 200-1,200 masl consisting of segment 16 through segment 20 with land use of agriculture, industry, settlements and ponds. Citarum River has a high level of pollution 9 times higher for COD parameter (Haskoning, 2012). The rapid growth of industries and settlements on the riverbanks make the Citarum River a place for disposal of wastewater from industries and settlements without threaten first by sewage treatment (Asian Development Bank, 2013). Rapid growth of population and land use cause increase pollution from the domestic, agricultural, and industrial sectors (Ginkel, 2015). The Citarum River Basin segment 18 consisting of 7 urban villages has a typical housing in the form of unregulated settlements and the settlement has not been equipped with a communal Waste Water Treatment Plant (WWTP). Knowing potential contribution of domestic greywater that impact the water quality of the Citarum River, segment 18, was an important initial stage to analyze pollution load and solution to overcome quality decreasing along the Citarum river.

RESEARCH METHOD

The research was conducted in the Citarum riverbank segment 18 at the downstream, focus on the biggest main drainage channel in 6 urban villages namely East Adiarsa, West Adiarsa, Nagasari, Sukaharja, Puseurjaya, and Telukjambe, located in riverbanks of the Citarum River, segment 18. Secondary data needed was a map of land use and population demographics, while the primary data was the quality of domestic greywater. Sampling of domestic wastewater from the drainage channel was taken based on the grab sampling method. Water samples are taken by using a water sampler and measured several parameters in situ, then water samples were inserted into a 5 liter size bottle equipped with a name label according to the sampling location and placed in an ice box/ Styrofoam and preserved using ice gel, then analyzed at Environmental Laboratory, Environmental Engineering Department, Universitas Trisakti. Sampling was carried out in two times which were the morning of 06.00 - 09.00 AM and the afternoon at 15.00 -19.00 PM based on the peak water consumption time in household activities, in February and April 2019. The parameter that tested were TSS, COD, BOD, and oil and grease to be compared with quality standards based on

Minister of Environment Regulation No.68 of 2016 concerning Domestic Wastewater Quality Standards. The data were then tabulated and analyzed descriptively.

RESULTS AND DISCUSSION

Geographically, Karawang Regency was located at $107^{\circ} 02' - 107^{\circ} 40' \text{ 'EL}$ and $5^{\circ} 56' - 6^{\circ} 34' \text{ 'SL}$. The Citarum watershed, segment 18 covers 3 sub-districts consisting of 7 villages in Karawang Regency. The study area conducted along the Citarum Riverbank segment 18 as shown in **Figure 1**. In **Figure 2**, it could be seen the six research village while Figure 3 showed the location of sampling points.

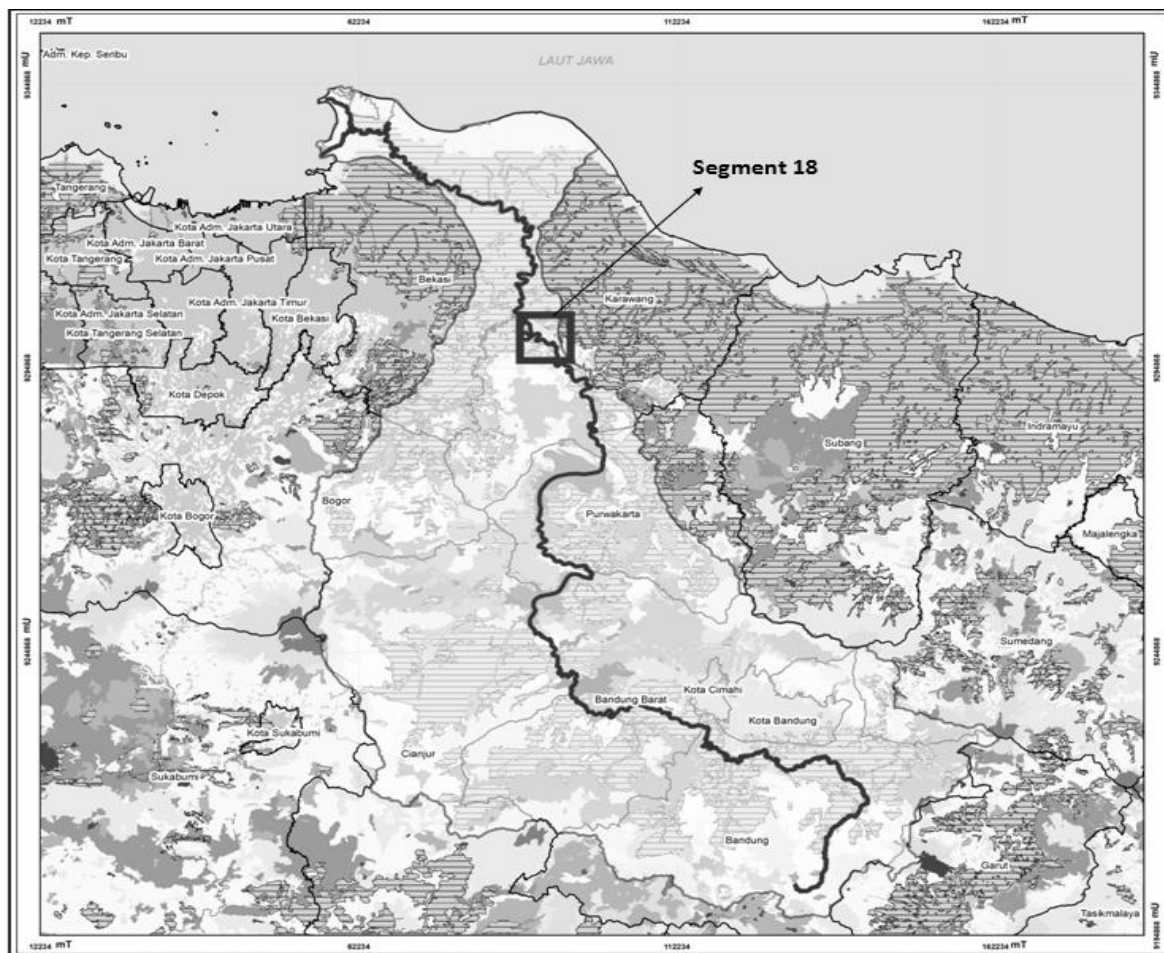


Figure 1. Map of Citarum River

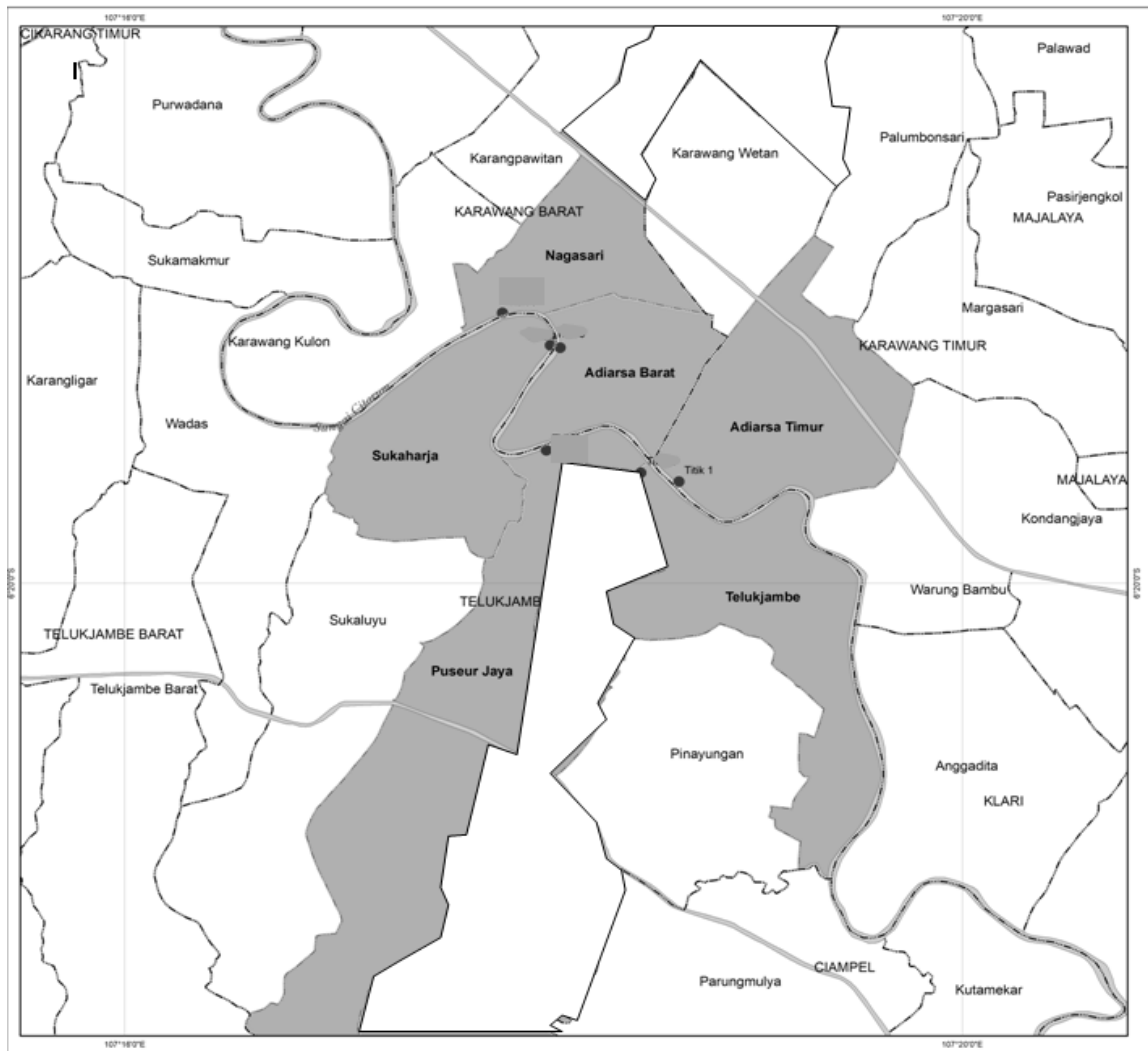


Figure 2. Map of Research Villages

Pollutant sources in 6 urban villages generated from household activities which increase greywater that entered the drainage channel and directly flowed into the Citarum River without any treatment. The condition of the drainage channel in the East Adiarsa, West Adiarsa and Telukjambe villages was in good condition and was well maintained but was surrounded by garbage from the settlements, while the condition of the drainage channel in Nagasari, Puseurjaya, and Sukaharja villages was in a poorly maintained condition and there was garbage in the drainage channel.

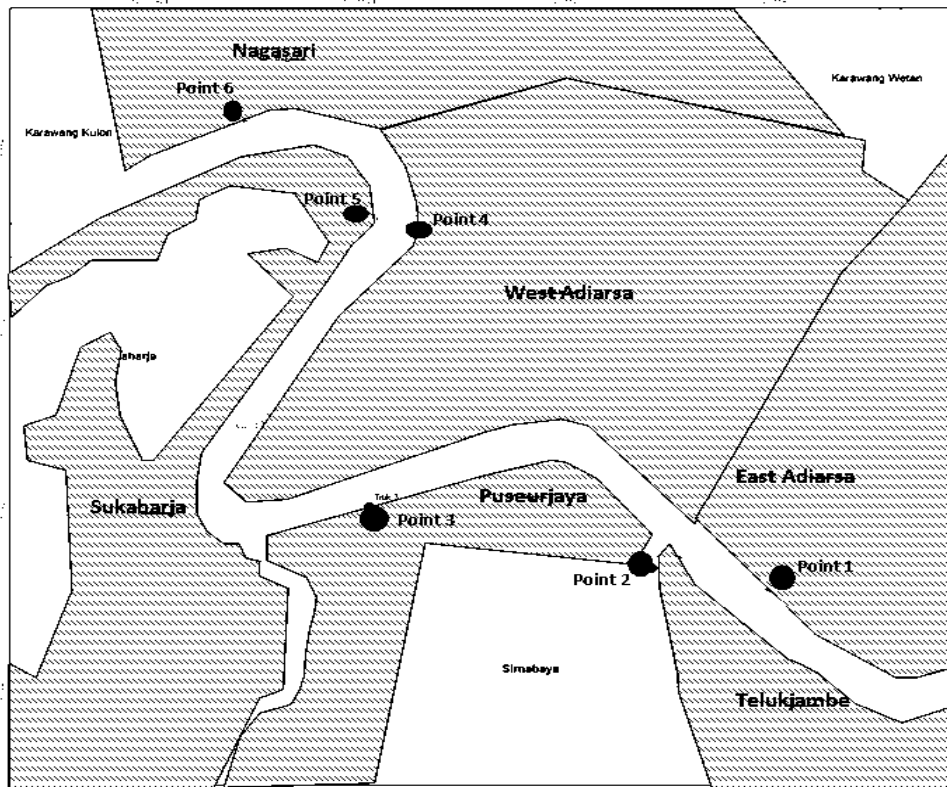


Figure 3. Map of Citarum River Sampling Points

The results of the water quality test in the drainage channel in **Table 1** shows that the TSS parameters in almost all sampling locations were exceeded the quality standard except in the West Adiarsa at February and in the Puseurjaya at April. TSS value in river water caused by domestic wastewater has exceeded the quality which was 52 mg/L-84 mg/L (Suprihatin, 2014). The COD parameter at February in all sampling location were exceeded the quality standard while at April in the locations of Telukjambe and East Adiarsa were still below the quality standard. Higher COD concentration shows that the organic content cannot be degraded biologically (Suharto et al, 2019) The BOD parameters in all sampling locations at February and April showed exceeding quality standards.

Figure 4 and **Figure 5** showed the parameters of BOD and COD in February and April at all sampling points compared with quality standards according to the Minister of Environment No.68 of 2016. COD parameters in the Karang Anyar river have exceeded 1.8 to 3.5 times that of the river water quality standard due to the

inclusion of domestic wastewater wastewater (Puspita et al, 2016). Overall oil and grease parameters in the sampling location in February were exceeded the quality standard while in April as a whole still below the quality standard.

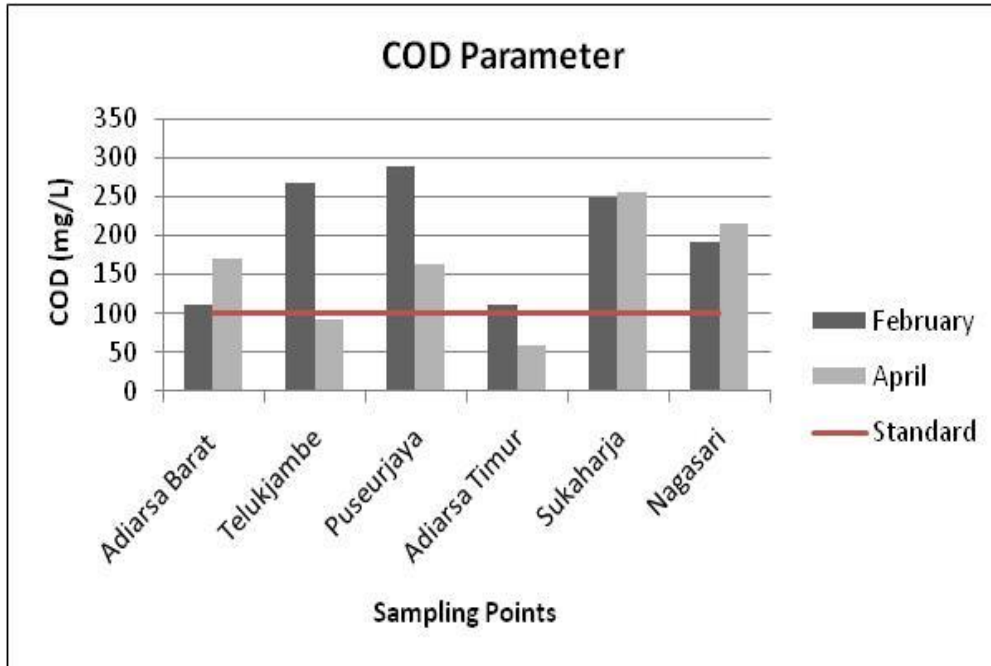


Figure 4. The value of COD concentrations of greywater

Table 1. Water Quality

Months	Parameter	Standard	Location					
			West Adiarsa	Teluk jambe	Puseur jaya	East Adiarsa	Sukahar ja	Nagasa ri
February	TSS (mg/L)	30	24.5	221.5	90.5	131	182	288.5
	COD (mg/L)	100	110.4	267.2	288	110.4	248	192
	BOD (mg/L)	30	132.125	274.3	180.17	69.065	205.975	172.16
	Oil and Grease (mg/L)	5	5.35	8.3	11.5	6.3	5.285	3.1
April	TSS (mg/L)	30	117	85	34	111.5	72	76
	COD (mg/L)	100	169.6	92	163.6	58.4	256	216
	BOD (mg/L)	30	106.095	57.51	102.345	137.605	59.005	135.125
	Oil and Grease (mg/L)	5	4	2.7	2.5	3.7	2.35	1.95

Quality Standard: Minister of Environment Regulation No.68 of 2016

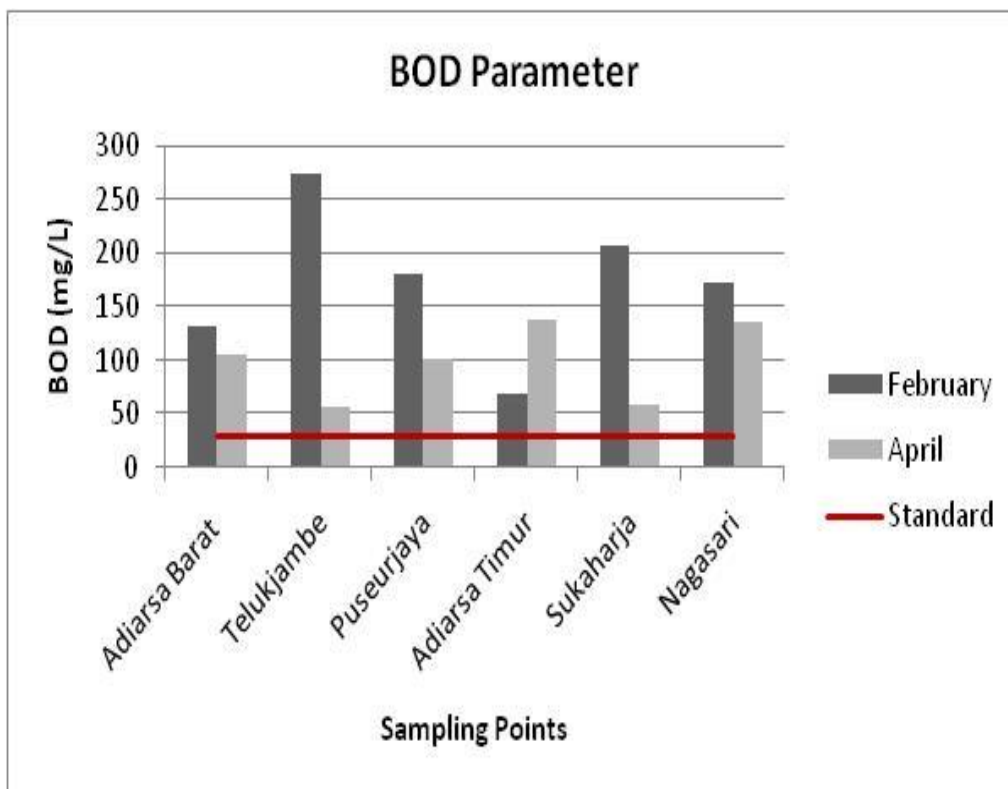


Figure 5. The value of BOD concentrations of greywater on drainage

During the 2 months sampling, it was seen that the COD and BOD parameters which had high concentrations and exceeded the quality standard according to the Minister of Environment Regulation No.68 of 2016 were found in the villages of Telukjambe, Puseurjaya, Sukaharja and Nagasari. The high value of COD and BOD concentrations on drainage in the 6 research villages shows the occurrence of water pollution due to activities from households that directly dispose of waste water to the drainage channel on the banks of the Citarum River. The high value of BOD5 indicates the presence of high organic matter in the wastewater which originates from kitchen sink as well as partially treated septic tank (Ling et al, 2012). The BOD value was likely to be the same as the COD value, but the BOD value may not be greater than the COD value. So in outline COD describes the amount of organic matter in water (Atima, 2015).

Domestic wastewater that generated from sinks and dishwasher contribute the most of biodegradable organic substance (Wijaya and Soedjono, 2018). The high COD concentration causes the dissolved oxygen content in the water to be low (Kartika, 2012). If the dissolved oxygen level decreases, the animals that occupy these waters will

die. And if the levels of BOD and COD increase causing the waters to become polluted (Zulkifli et al, 2009).

Drainage channels with direct flow into the river can have an impact on pollution of the river body (Iskandar, 2016). Pollution on the drainage channel caused by community activities that do not maintain sanitation can cause disease, especially in the riverbanks. In maintaining the quality of drainage water that enters rivers, a control scenario in the form of communal wastewater was needed which requires active participation from the community in maintaining environmental quality and managing communal WWTPs.

CONCLUSION

Result of water quality on drainage cTSS parameters in almost all sampling locations exceed the quality standard except in February at the East Adiarsa village and in April at the Puseurjaya village. The COD parameters in February as a whole at the sampling location exceeded the quality standard while in April at Telukjambe and East Adiarsa village were still below the quality standard. The overall BOD parameters at the sampling location in February and April showed exceeding the quality standard. Oil and fat parameters in the sampling location in February as a whole exceeded the quality standard while in April as a whole still below the quality stone according to Minister of Environment Regulation No.68 of 2016. COD and BOD parameters that have high concentrations and exceed raw are found in the villages of Telukjambe, Puseurjaya, Sukaharja and Nagasari. Pollution on drainage channels caused by community activities that do not maintain sanitation can cause disease, especially in the riverbanks.

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