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Technical Note

Study of domestic wastewater (Greywater) in the district of Tamalanrea the city of Makassar

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ABSTRACT

Greywater problem is the environmental issues that have not received much attention from the public and the government. Greywater is one of the main sources of water pollution that needs to be managed properly. This study aimed to describe the characteristics and greywater management system that is understood and applied by communities in urban settlements through case Tamalanrea District of the Makassar city in Indonesia. The results can then be used as a basis in determining a solution for the management and treatment of greywater. Data were obtained from field observation and interview techniques using a questionnaire. Samples were collected from the outlet pipe greywater disposal of household and the combined channel in residential areas, and then analyzed in laboratory. The results showed that the parameters of pH, BOD, COD and TSS greywater of community settlements in the District Tamalanrea largely exceeded the threshold of environmental quality standards. While the greywater management system held separately from blackwater in a way to flow into the drainage channel without being processed first. The management conditions provide convenience in greywater treatment efforts so that it can be reused. In addition, it can reduce environmental pollution and increase the availability of groundwater.

1. Introduction

The increase in population and the development of various urban facilities will have a negative impact on the environment. Environmental issues such as solid waste, waste water and the availability of clean water is a common problem that occurs in various places, including in Tamalanrea District of Makassar City. Of the three issues of the environment, the wastewater problem that has not received much attention from the public and government.

Domestic wastewater consists of blackwater and greywater. Blackwater is wastewater in the form of feces while greywater is wastewater in the form of water used to bath, wash clothes and used the kitchen sink. In general, greywater generated from community settlement has not been processed because of cost and lack of knowledge and experience of the community on this issue, especially in developing countries (Pathan, 2013). In addition, most people assume that the disposal of greywater directly does not cause environmental problems.

According to Idris and Azmin (2004), Greywater is one of the main pollutant source discharged from residential and commercial areas in the river without any treatment. Greywater causes aquatic life to be disrupted because oxygen dissolved in water is used by microorganisms to decompose organic matter contained

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there in. In addition, pollution of waters can also occur because of the nitrate content, microbial and heavy metals in greywater (Abeer and Theib, 2013; Saroj and Mukund, 2011). Water pollution, especially river water needs to be considered because it is a source of water for the community for various purposes.

Based on this, it is necessary to conduct research on the study of domestic wastewater, especially greywater generated by the people in urban areas through the case in in Tamalanrea District of Makassar City. The aim of this research is to know the characteristics and greywater management system which is understood by the local community so that the result can be used as a basis in determining the solution to manage and treatment of greywater before reuse or release to environment.

2. Methods

This research was conducted by field observation and interview technique using questionnaire. These activities include direct observation of the grey water management system and interviews with respondents as well as greywater sampling.

Greywater sampling was held in the morning at 07.30 – 08.30 am in July 2016 (dry season). Samples were collected from outlet pipe greywater disposal of household and the combined channel in residential areas followed by laboratory analysis process. The greywater samples were from community settlements in Tamalanrea (P1), Tamalanrea Indah (P2), Tamalanrea Jaya (P3) and Parangloe (P4). The location of the sampling is considered to represent the characteristics of greywater Tamalanrea District community.

3. Results and Discussion

The district of Tamalanrea being the location of this research is one of the districts in the city of Makassar with the condition lack of clean water during the dry season. Tamalanrea District has a total area of 31.84 km^2 and a population of 142,000 inhabitants. Tamalanrea District consists of six urban villages, three of them are areas with high population. The high population of residents has an effect on the amount of consumption of clean water and wastewater discharges. Approximately 60-85% of the total volume of clean water needs will be domestic wastewater (Metcalf and Eddy, 2004). According to Eriksson et al. (2001) that part of greywater is about 75% of the total volume of domestic wastewater.

The sample of this study was greywater collected from outlet pipe greywater disposal of household and the combined channel in residential areas. In general, the main content of greywater from community settlements is organic matter and detergents that contribute to the decreasing quality of waters. The parameters tested in the laboratory showed the characteristics of greywater from the community settlements in Tamalanrea District as follows:

3.1 Acidity (pH)

The result of pH observation showed that greywater from the community settlements in Tamalanrea District classified as alkaline with pH range 8.3 – 8.5. This is due to the use of cleaning agents in household activities such as detergents, soaps, shampoos and other alkaline cleaning agents.

The alkali properties possessed by greywater from the results of this study have in common with the results of other studies in India. The greywater collected from the residential area with a pH range of 8 - 8.5 (Iqbal et al, 2017).

The range of greywater pH from community settlements in Tamalanrea District still meets the standards that are allowed to be discharged into the waters of 6 – 9. pH < 6 and > 9 are not allowed to be discharged into waters as they may be toxic and cause death of aquatic biota.

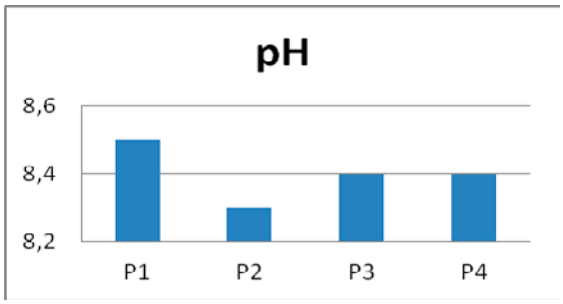

Fig. 1. Greywater Acidity (pH) of Community Settlement in Tamalanrea District.

3.2 Biochemical Oxygen Demand (BOD)

The results of the laboratory analysis of this study showed that the value of BOD is different for every area of sampling and exceeds the standard of domestic waste water quality based on the regulation PERMEN LHK No. 68/2016 that is 30 mg/L.

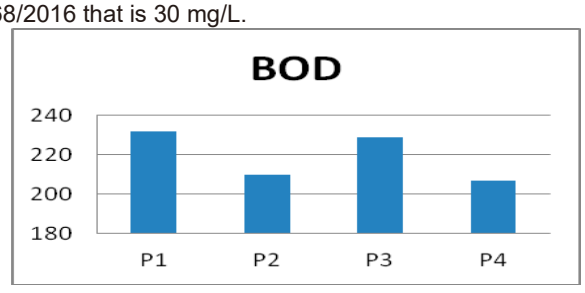

Fig. 2. Greywater BOD value of community Settlement in Tamalanrea District.

The value of BOD greywater from community settlements in Tamalanrea District ranged from 207 - 232 mg / l. BOD values are high and if flowing into the waters continuously will lead to pollution and decrease the quality of Tallo River water used by surrounding

communities as a source of clean water and fishery activities. The BOD value can be a reference as a description of the content of decomposable organic matter (Mukhtasor, 2007).

High BOD values indicate the abundance of organic matter in water. The higher the BOD, the lower the DO (dissolved oxygen). Decreased DO in water is caused by bacteria that use oxygen in the process of decomposition of organic matter.

3.3 Chemical Oxygen Demand (COD)

The results of laboratory analysis in this study show that the COD values were different for each sampling area. Similar to the BOD value, the COD value exceeds the effluent standard that has been determined that is 100 mg / L.

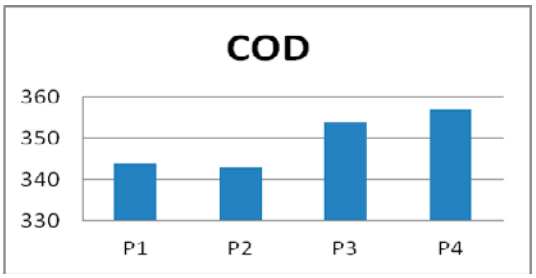

Fig. 3. Greywater COD Value of Community Settlement in Tamalanrea District.

Greywater COD values from community settlements in Tamalanrea District ranged from 343 - 357 mg / L. The value is high and if entering the waters continuously will Will cause pollution and reduce deteriorate water quality Tallo River.

3.4 Total Suspended Solid (TSS)

The results of laboratory analysis in this study showed that the value of greywater TSS sampled largely exceeded the effluent standard that has been determined that is 30 mg / L.

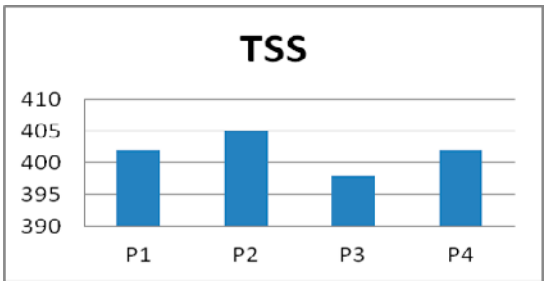

Fig. 4. Greywater TSS Value of Community Settlement in Tamalanrea District.

Greywater TSS value of community ranged between 398-405 mg/l. The high suspended solids caused by household waste water containing organic materials in large quantities in the form of leftover food from the kitchen and the use of detergents in the household. Organic matter in grey water accounted for 47%, 26%, 12% and 67% of the total composition of organic material, SS, TN and TP domestic waste water (Lindstrom, 2000 in Morel and Diener, 2006).

3.5 Greywater Management System

Field observation data show that the greywater management system implemented by the majority of people in Tamalanrea District (around 88%) is separate with blackwater. While the remaining 12% choose a management system that integrates with blackwater.

Separate greywater management is done by channeling greywater directly into drainage without processing. This suggests that the level of community knowledge about the management of greywater and the negative impact on the environment is still low.

Community knowledge on environmental conservation and proper management of greywater can be improved through socialization and assistance. The Buginese-Makassarese community, which is the majority of the population of Makassar City, including in the residential area of Tamalanrea District, is a relatively open society to receive, understand and apply a new technology such as information related to environmental management. The Buginese-Makassarese community understands certain cultural values that guide it in regulating lifestyle and behavior and applying in its environment. It is further said that they tend to understand public-oriented lifestyles such as being harmonious, fair, open and maintaining security together (Akil A. et al, 2014; Arifuddin and Darjosanjoto, 2011).

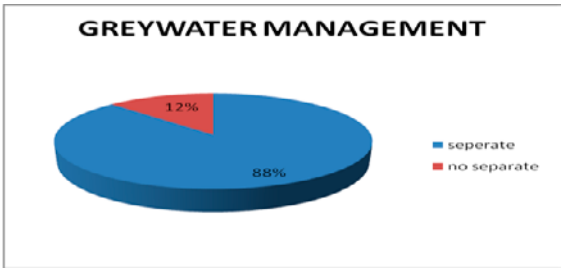

Fig. 5. Greywater management system of Community Settlement in Tamalanrea District.

3.6 Potential Utilization of Greywater

Greywater from community settlements in Tamalanrea District has the potential to be reused because the management system is separate with blackwater. This condition makes it easy to determine the type of processing. Greywater can be streamed to the treatment site before being reused or impregnated into the soil. Processing and reuse of gray water can reduce environmental pollution and increase water availability to meet household needs.

Percentage of the amount of water needed for non-drinking activities is 41% for toilet flushing, 37% for bathing and washing, 3% for house hygiene and 3% for watering plants (Fair et al., 1971). Greywater to be used for toilet flushing should be processed first because the detergent content in greywater can kill the decomposing microorganisms in the septic tank. The use of greywater for washing, house cleaning, watering plants and impregnation also require treatment because discharges from the activity may contaminate surface and ground water.

Processed greywater products can be used for various purposes such as irrigation, flushing toilets, car wash and watering the yard and for refilling aquifers (Rana et al., 2014). This reason is one of the basic needs of greywater recycling. In addition, reuse of greywater will reduce community dependence on taps that will have a positive impact on reducing the cost of providing clean water.

Greywater can be treated by various methods such as grit/grease trap, anaerobic-aerobic filter and constructed wetland (Morel and Diener, 2006). constructed wetland method are much in demand because of cheaper construction than other treatment systems and operational and maintenance costs low (Haberl and Langergraber, 2002).

Constructed wetland method are waste water treatment occurs in wetlands involving vegetation, especially Hydrophita, media and microorganisms in the recovery process effluent water quality naturally. This method utilizes a symbiotic mutualism plants and microorganisms in processing the wastewater so that the quality of processed products obtained better because of the cooperation between the two kinds of living creatures. The use of plants in this method also provides aesthetic value to the environment and increase the extent of green open space on a micro scale so that the needs of green open space in an urban area is sufficient.

4. Conclusions

Greywater characteristics of community settlements in Tamalanrea District include pH, BOD, COD and TSS were largely exceeded the effluent standard that has been determined. In general, greywater management systems are applied in this area seperate with blackwater by channeling greywater directly into drainage without processing.

Greywater treatment by the constructed wetland method is the right choice for addressing issues of greywater in Tamalanrea District because effective and efficient in the development, implementation and maintenance.

Processed greywater from community setlement in Tamalanrea District with constructed wetland, potential to be used again to meet the water needs of households. Besides, the problems of environmental pollution and water shortage in the dry season can be resolved.

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