

The Implementation of Sanitation Behavior Through Introducing and Training on Establishing Decentralized Wastewater Treatment and Waste Management in Malang

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Abstract—The degree of understanding about sanitation in Malang is very low which is only 4% of the total population in Malang. This article aims to explain the implementation of the societal plan in Kebalen Wetan, Malang on how to create a prototype of decentralised wastewater treatment (DWT) including the systems related to it and to increase the understanding about sanitation. This project was implemented in Kampung Kebalen Wetan, Malang by collaborating with youth association in the targeted community. The collecting data used in this project are field observation, questionnaire for 30 respondents from the targeted population, and the laboratory test for treated wastewater quality (pH and BOD). Following the stages of the process, the first is the screening stage, the process of removing odors, then the process of removing heavy metals contained in waste water and the existing sediment deposits will be processed automatically into fertilizer. Laboratory analysis showed the average pH at the inlet and outlet was 4.6 and 7.55, respectively. The BOD removal efficiency is 64% where DWT produces 1L of liquid compost in one week. The positive impact

of this project is that it can increase public awareness of their understanding of sanitation behavior, the application of DWT, and can increase community insights on composting and e-commerce. Analysis of the results of the questionnaire was 100%, 93.33%, 100%, and 93.33% respectively for each indicator.

Keywords: *sanitation, DWT, compost*

I. INTRODUCTION

Malang is located on the altitude around 440 – 667 meters above the sea level. This city is one of the tourism destinations in East Java due to its nature and weather. Based on data of Rencana Pencegahan dan Peningkatan Kualitas Permukiman Kumuh Perkotaan (RP2KP-KP) in 2016, Malang has 29 of slum areas which spread over the city in which Bandungrejosari, Kotalama, Pandanwangi, and Tanjungrejo sub-district are the four larger slum areas. From those, Kota Lama sub-district is the worst area and specifically in Kampung Kebalen Wetan. This

condition influences severe impact to the human's living and human resource quality which cause declination of the future nation's productivity [1]. As an urbanised city, Malang suffers from massive migration from other cities, and therefore developing of slum area is inevitable. People created illegal housing under the bridge, the train railway, and the riverside which generate slum areas in the city [2].

Although Malang is a tourist destination, services at sanitation facilities especially for decentralized domestic wastewater management are still low and there are still people who do open defecation (ODF) in rivers. Furthermore, there are still many communities have a toilet without waste management [3]. Besides that, the empowerment of the kampong leader and youth association (Karang Taruna) in Kebalen Wetan RT 10/RW 4 becomes an essential program. Based on testimony from Saniman, the kampong leader, the participation of youth association (Karang Taruna) in sanitation program is low as they more focus on the other applications such as community services and Independence Day events in August annually.

As a tourism destination, Malang should be able to solve the problem of slum area and low-service of sanitation. To improve hygiene in the city, the Office of Public Works and Spatial Planning (DPUPR) of Malang campaigns Free Slum Areas in Malang 2019 and Malang Zero Waste 2019[3]. However, the implementation of sanitation facilities should be supported by community empowerment in the target area to sustain the sustainability of the infrastructure. This youth association has the potential power to be empowered to achieve sustainable sanitation services. Thus, this youth association can be encouraged as a role model in implementing sanitation and environment management. The empowerment will be more beneficial when completed by training on entrepreneurship of by-product from domestic wastewater management.

That consideration leads to the program of the implementation of sanitation behaviour in Kampong Kebalen Wetan through empowerment and training on the construction of a decentralised urban wastewater treatment prototype and waste management in Malang. The application of this innovation in wastewater management will help the target community in this highly populated area to build DWT that suitable for shortages of land. This program is also to improve the treated wastewater quality. Moreover, the empowerment program will accelerate the realisation of Malang as zero waste tourism destination, and youth association in Kebalen Wetan becomes the community role model in waste management and agro entrepreneur.

II. METHODS

This study applies an experimental research design, with the research method used questionnaire 30 respondents, Interview of the Head of RT & observation of public health behavior for

background research, and analysis of the results of processed wastewater with 2 samples of pH & BOD (influent & effluent).

A. Schedule and Research Location

This program was conducted in RT 10/RW 4, Kebalen Wetan, Kota Lama sub-district, Malang, East Java. The duration of this program was five months in total.

B. Research Preparation

This stage consists of raw and treated wastewater analysis which conducted in Perum Jasa Tirta laboratory. This analysis was followed by a field survey to observe the polluted area caused by public toilets. Administration requirement was also prepared to conduct the research.

C. Program Implementation

1) Creating Module

This module is used as the media to support the program. Technically, the module consists of texts and pictures that help the people and target community to understand the program efficiently. The module explains about DWT system, operation and maintenance, and agro entrepreneurship in producing and marketing the compost product from domestic wastewater.

2) Socialisation

The socialisation as done to give an understanding to the target community of the program. The contents of this socialisation are about how to construct DWT, produce liquid-compost, improve the sanitation, and market methods. This socialisation was conducted in Kota Lama hall by inviting the head of Sukun District, the kampong leader of RT 10/RW 04 Kebalen Wetan, youth association (Karang Taruna), and the Kebalen Wetan people.

3) Training on establishing DWT prototype

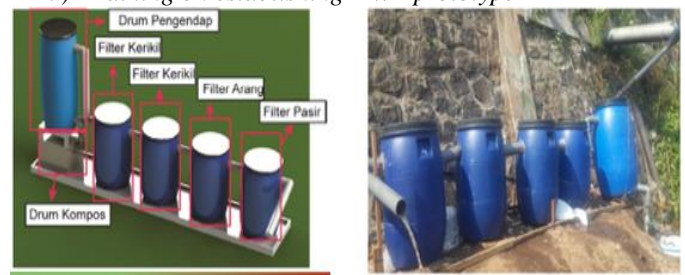


Fig 1. Design and implemented DWT prototype

The construction was done by local youth association and the research team. The outlet pipes from local people's houses were connected to one sewerage pipe. The DWT was equipped with waste sediment storage. In the storage chamber, wastewater will be separated from faeces, and they remained as fermented sediment in the fermentation tank controlled by a valve periodically. When the wastes have been stored in the fermentation tank, the EM4 bacteria will be added to help the acceleration of the fermentation process [4].

The other product from sedimentation was supernatant [14]. It flew to the first filtration process in which two steps of filtration occurred. A coarse filter (± 5 cm sized stones) and fine filtration (± 1 cm sized gravel) were applied for this stage. The result of the first filtration process stored in the temporary storage tank until this tank was full. Then, the water pumped upward to the second filtration process [8].

Active carbon and alován were used as media filter in the second filtration process. The active carbon used to reduce the smell of wastewater, and the alován (volcanic mud) used to absorb the heavy metal in the water [5]. The control process of the pump and valve were done automatically from the control panel. There were indicator lamps on the panel to inform wastewater parameters.

The best aspects of the DWT prototype design are automatic compost processing, four steps of filtration, low-cost, sophisticated, no suction tank is required, and can be built in the highly populated area.

4) Training in Producing Compost Starter.

This training helps the community to produce the compost starter. The starter for the compost was EM4[7]. Organic waste were generated from the nearby traditional market. The waste was ground and added by coconut sugar and coconut water before added with EM4 bacteria[10]. This mixture of compost starter should be kept in a closed tank for one week[11]. After a week, this starter is ready to be used in compost production by adding it into fermentation tank in DWT system[12].



Fig 2. Training of Compost Production

5) Cooperation with BSM (Solid Waste Bank of Malang)

Kampong Kebalen Wetan is the worst slum area in Malang due to less awareness of the local people about the importance of hygiene for their health. It is acerbated by less number of waste bin availability in that area and therefore leads them to throw away the waste into the river. In this program, we trained them to involve with BSM management to reduce the volume of waste and recycle them. BSM collected the recycle waste regularly and pay the waste proportionally.

III. RESULTS AND DISCUSSION

A. Water Quality Identification

The average pH was measured from a triplicate sample of the inlet and outlet. The average of pH in the inlet was 4,6 and in the outlet was 7,55. The low pH in the inlet may indicate that the substrate has undergone to hydrolysis process into the simple organic substrate[6]. The BOD test showed that the efficiency of DWT in BOD elimination was 64%. By inserted an innovation of the automatic sensor in the sedimentation tank, the process of sediment suction could be diminished. This innovation leads the target community attracted and agreed to establish DWT in their zone.

B. Compost Agro Entrepreneurship Program

During the program, based on our test results with a direct measure of the drainpipe citizens, the target community has produced 2 litres of liquid-compost in 2 weeks and 8 litres of liquid compost in a month. They obtained 1 litre of black water from faeces sedimentation in seven days then it mixed with 1 litre of compost starter by ratio 40 % EM4 bacteria and 60 % organic waste. The production of 8 litres compost was equal to 16 bottles of fertilizer with the volume of 500 ml each. Based on the agriculture shop survey, The price per bottle was Rp 20.000, which means that the empowered community obtained Rp 320.000 per month from compost production. If the Office of PUPR realise this program, each house can produce 0,6 litre of black water per day. Thus this community can produce 900 litres of black water. That amount of black water can produce 1800 litres of compost. These results show the economic potential from by-product from domestic wastewater is very important for the sustainability of the program.

C. People Participation in Sanitation Program

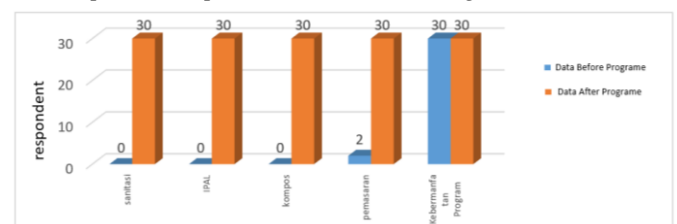


Fig 3. Local people participation in the program

The feedback from the target community for this program was very positive, and the people were very enthusiastic to involve in the program. Figure 3 shows that there was significantly increasing of people participation during the program. It is because residents feel of sanitation and environment quality in Kampong Kebalen Wetan is very low, but this program can encourage the local people to improve their environmental quality. The cooperation of local youth association (Karang Taruna) also help the program to be accepted by the people in developing their understanding to the importance of sanitation and wastewater management.

D. Marketing Training

The training focused on the marketing method that used to distribute the compost product produced by DWT system. The result of this training was very satisfying. The empowered community can distribute the compost product to the Fertilizer Store (Sri Rejeki) which open the cooperation with the local youth association of Kampong Kebalen Wetan. Furthermore, the empowered community has successfully done e-commerce through online business in Tokopedia. Thus, this training could empower the community to advertise and distribute their compost product by using online media.

E. The Improvement of Environmental Quality

Before the program was conducted, the local people had been found to dump their household waste into the river. During the program training on improving environmental quality through wastewater and waste management, the team has encouraged the local people how to maintain and sustain the environment, including the elimination of behaviour to dispose the waste into the river. To support these activities scientific method to treat the organic waste and domestic wastewater have delivered to the people. In addition to this program, training on recycling waste management has also managed to increase the people involved in BSM management. After the program finished, the local people have separated their household waste from organic and recycled materials and sell the recycle waste to BSM. Moreover, domestic wastewater also treated through DWT, and it was reduced the water pollution in the river.



Fig 4. Environment condition before and after the program

IV. CONCLUSION

In our program by applying a direct approach and practice of making a DWT system, it is able to improve the knowledge and behavior of citizens towards sanitation. The DWT prototype was implemented in Kampung Kebalen Wetan. The system achieves 64% BOD removal efficiency. This achievement can effectively reduce pollutants in the river and produce byproducts as liquid compost.

from the research programs that we have implemented in Kebalen Wetan can be developed for the government in approaching the community using a direct approach and the

application of real applications so that the community understands the function of government programs specifically in the field of sanitation.

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