Separating Drainage as the Alternative Small Municipality Water Treatment

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Abstract
Recently, almost the drainage system in Indonesia was use the mixing drainage, rain water and waste water drainage. The drainage system will directly connect to the river as the main drain. This condition will be affected to decreasing of the river water quality. The other way, while the flushing was not occurred by the rain water, the waste water, especially from the municipality, will be stagnant at the drainage channel, that will caused some odor and healthy problem in municipality area.

The research was conduct to maintain the waste water from the municipality by using the separated drainage system. Small new neighborhood was used as the pilot scale of the municipality as the application of the method. Method of the waste water screening by using the activated carbon or zeolith sand was used to removing the odor and the turbidity of the waste water.

The result was shown that the separated drainage was effective to reduce the waste water to directly flowing to the river, and the simple screening waste water was effective to use as the first treatment of the waste water in the small municipality to removing the odor and decreasing the turbidity of waste water.

Keywords: Separating drainage, waste water treatment, pilot scale

1. Introduction
The waste water from the municipality was the one problem that must be solved in Indonesia. Most of the municipality area in Indonesia has not the permanent waste water treatment. Waste water from the household was directly flowing into the drainage channel system. Usually, the main drainage of the drainage channel system will be flowing to the river as the main drain, and as the result of the untreated waste water that flowed, will be decreased the river water quality, where in the some chase, that river water was used as the raw water for the drinking water in the downstream area.

The drainage system in many areas in Indonesia was the mixing system, where the rain water and the waste water were flowed into the same drainage channel. Waste water will be diluted and flushed into the main drainage by using the volume of the rain water. The volume of waste water was usually only 1 – 2 % of the rain water volume. Problem was occurred when in the dry season, where there was not enough rain water available to flushing the waste water. Waste will be stagnant in the drainage channel. In the sloping area the problem was not high enough; other else

in the flat area, the problem was occurred. The stagnant waste water in several day will be caused the bad odor and the color will be change to be dark color with some flog that occurred at that waste water. This condition will be caused the decreasing of the health and esthetic level in the municipality. Usually, this condition occurred in the middle of the dry season and the waste water will be flushed after the rain came.

This condition was aggravated, where in the many municipalities in Indonesia have no waste water purification plant. That constrain were support with the unavailability of the budget and area to build the treatment. As the developing country, the municipality has a big population and the density of the population was very high. It was very difficult to finding the open area to construct the complex waste water treatment. While the government role, in this chases municipality government, was very few to support budget and effort to maintain such kind of this problem. It was very common to saw such as condition in many places. It was very important to find the method of the waster water treatment that fulfilling the conditions of the municipality. This method must be achieve the small, simple, inexpensive, and have sufficient easy maintenance.

2. Methodology

The research was conducted to achieve the solution of the small, simple, and inexpensive method that can be implemented at the municipality area. This research was conducted in Malang Municipality, East Java, Indonesia. This municipality was the one of the faster growing municipality in East Java. As the one of the higher education center in Indonesia, every year this municipality receiving more than 10,000 new students as the resident beside the 786.699 actual population of the municipality (until June 2006) that has 1.1% population increasing in every years (Malang Municipality Database, 2006) and the population density was 8,377 people in kilometer square area (Malang City in Figure, 2005). This research was the pilot scale of the waste water purification plant that implemented at the new neighborhood.

2.1 Separating Drainage

It was very common in the Indonesia municipality drainage design that using the drainage channel as the rain water drainage and the waste water drainage in one function. The drainage channel was designated to receive the rain water with 2 or 5 years return period and the waste water from the household that occupied the area. The design criteria of the drainage were shown that the waste water from the household was 75 – 80% from the water consumption of the household member in one day. Where, the water consumption for the municipality was approximately 150 litters per person per day.

There were two different drainage channels comes out from the household, one for the rain water and the other one for the waste water from the bathroom, kitchen and the other room of the household. While the rain water was flowed into the drainage system, the waste water from the household will be flowed into the pipe to the collecting storage that collect the waste water from the other household. But this pipe only receiving the waste water that not came from the toilet, the black soil will be separating from this waste water treatment. Waste water will be flowing by gravity to collecting storage. This pipe was design by the hydraulic uniform flow that prevents the back water that will occur at the pipe before entering the collecting storage. The pipe design was considered to the amount of waste and the time when the waste water will flow into this pipe.

This storage was placed underground, below the neighborhoods road to prevent the decreasing of the land use in the neighborhood area. This storage will be connected with the simple waste water treatment, that will treat the waste to reducing the odor and decreasing the turbidity before the waste water was flushing into the drainage system. The collecting storage dimension designed to store the waste in the half amount of the entire waste water. The assumption that used was the time of the waste water outflow occurred only in the peak time, in the morning and in the evening, where the water consumption using was very high for supplying the household member. Based on this assumption, storage dimension that available for this neighborhood was approximately 4 m^3.

2.2 Simple Waste Treatment

The waste treatment was placed to treat the waste water from the household before the waste water entering to the drainage system. This purpose of this waste water treatment was to reducing the odor and decreasing the turbidity in the waste water. Basically, the purpose of this waste water treatment, to remove the odor and reducing the turbidity, was very low. But as the early step to promoting the reducing of pollutant burden of the river as the main drainage system, this step must be obviously conducted. Main purpose of this research was introducing the simple system that can used widely in the municipality and can be placed at the small neighborhood that without using the wide area, easy to maintain and not expensive in the budget to construct.

This waste water treatment plant was consisting with the five small storages that allow the waste water flowing by gravity force trough the spillway that placed at the side of the storage. Waste water will be flowing to the lower storage after the upper storage was filled with the waste water. The storage was placed as the cascade storage. This section was allowing the waste water to settling the sediment that containing in the waste water into the bottom of the storage. The hydraulic retention time of these 4 storages was supporting the purification process of the waste water. The using of the 4 storages was formulated from the scale modeling of the waste water that showed that the effective number of the storage to reduce the odor and the turbidity was 4 storages. At the end of that cascade storage the active carbon or the zeolith in the sandy form screen was placed. This section was act as the slow sand filtration for screening the waste water. The use of the active carbon or zeolith sand was purposed to reducing the odor, and removing the sediment that still contain at the waste water. The use of this material was based at the scale modeling research that shown the material that suitable to reducing the odor and the turbidity. Pump must be installed in the end of this treatment plant in order to flow the treated waster the drainage channel if the drainage channel level was higher that the lowest storage after the screening process has conducted.

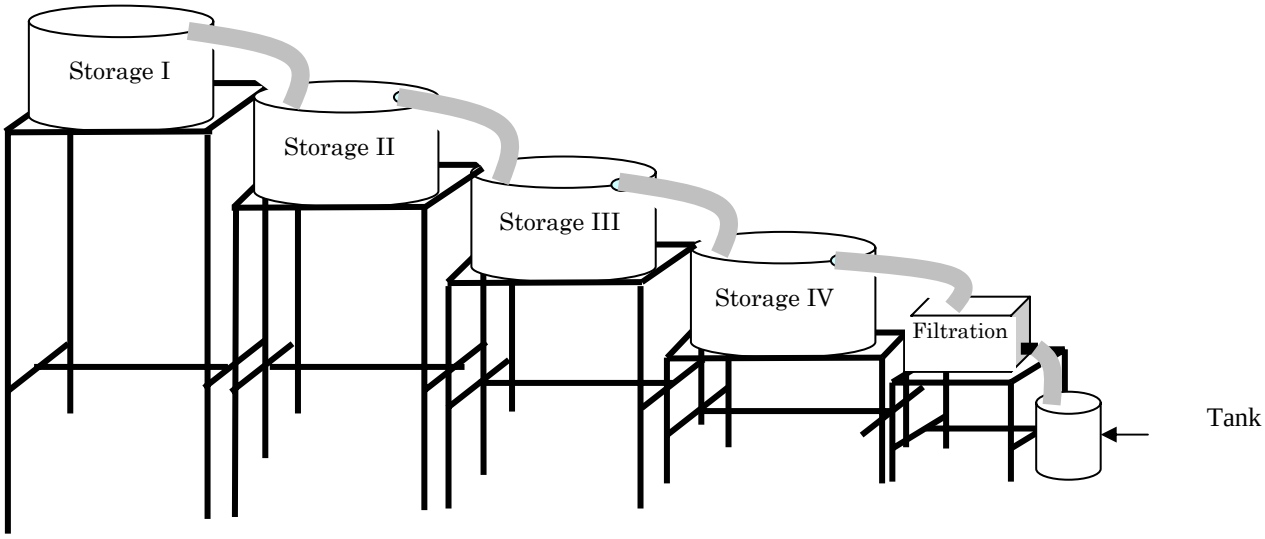

Figure. Cascade Storage and Filtration Method Scale Modeling

3. Result and Discussion

The research area was the new neighborhood in Malang Municipality that consisting by 15 household with the width of the area was 3,000 m^2. (Dini, 2006). The consideration that the research conducted at the very small pilot project was the organization of the municipality. The lowest organization in Indonesia municipality was "RT" that in assumption it was very easy to conduct the regulation of the separating drainage and communal waste water treatment in the small area that were regulated in one of authority. The rain water was calculating with the 5 years return period for the research area using the conventional Rational method. The waste water that produce from the household was calculated by using assumption that in every household was occupied by average 5 people. In the other hand that neighborhood was occupied by 75 people. The amount of the rain water that resulted from the Rational method calculation was 0.03 m^3/s while the amount of was 0.0001 m^3/s. The result shown that the amount of waste water was not has many influences to the municipality drainage design. In the other hand, the reducing amount of the waste water from the channel design has no influence to the standard of the municipality drainage system.

The combination between the cascade storage as the beginning process of the treatment and the active carbon or zeolith slow sand filtration at the end of process was resulting the suitable condition for water that will flowing into the drainage system according the scale modeling research. Result shown that the turbidity was decreasing from 45 Nephelometric Tubidity Unit (NTU) becomes 5 NTU, where the water quality standard for the drinking water for the turbidity was lower than 7 NTU. (Aulia, 2006; Robert, 2006). The odor of the waste water was removing and the taste of the water was become no taste. Physically property standard for the water was fulfilled before flowing to drainage system. The chemical property standard was not covered in this research, according to the aim of this research that the one purpose of this research was fulfill the removing the odor and for the esthetic standard.

As the developing country, Indonesia has facing the water environmental where about 56.16% of the household was disposed their waste water directly into the river or by flowing into the drainage channel system. This evidence was support that almost the entire river in Indonesia was indicated that the water quality not meet the water criteria class 1 (drinking water raw based on Regulation 82/2001). This condition can be decreased by decreasing the burden of the pollutant from the source of that pollution, the household. Separating the waste water from the rain water that flowing into the drainage channel system will decreasing the burden of the pollutant that will flow into to the drainage system.

The separating drainage was widely and the common system that used in the developed country. Opposite with that in Indonesia, especially in the small municipality at the remote area, the mixing drainage system was the choice of the planner. The mixing drainage was the cheapest and the fastest way to drain the exceeded water from the area. But in the other side this system was neglected the side effect that caused by mixtures the waste water and the rain water into the environmental decreasing level. The new idea of the separating drainage must be promoting widely as the solution to prevent the decreasing of the environmental level.

This research was the simple sample that can be conducted in the small neighborhood, where the separating drainage that used can be effectively implemented to prevent the decreasing of the environmental level. This system can widely used in the other small neighborhood in the municipal that organized by the lowest level of the government authorization. This system will be easily implementing because the management to maintain the system was no so complicated. The government role must be conducted, such as enacted the regulation, controlling the design criteria, etc, to promoting the using of this system widely.

As the solving problem to solve the waste water treatment, the simple cascade storage tank with the carbon active or zeolith slow sand filtration was the one of treatment plant that can be implemented. This simple plant can be removing the odor and decreasing the turbidity that containing in the waste water. Although the purpose of this waste water treatment was very low, as the simple waste water treatment solution in Indonesia, this system was suitable as the first stage to promote the water environmental awareness of municipality in Indonesia. Because the treated parameter was only for mainly fulfill for the esthetic criteria, the other parameter of the effluent standard that occurred must be observed more detail to achieve the standard of the treated water even though the treated water was only flowed into the drainage system.

The advantage of this system was could implement in the small neighborhood, that not needing the wide area to conduct the system and can be manage by the local people as the member of the neighborhood. The construction of the system was simple and not need the complicated maintenance. This system was not changing the drainage system design that was used widely in Indonesia recently, and the main consideration was that the system was inexpensive in budget. The disadvantage was the parameter that treated in this system was very limited according to the standard of the treated waste water.

4. Conclusions

As the first stage of the research, the implemented of the system was more carefully observed to obtain the more perfect result to promoting the water environmental awareness in the municipality. The following research must be conducted to achieve the standard of the treated waste water, and the effectiveness of the system must be compared with the other waster water treatment in the small municipality.

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