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## Development of microbial organic waste processing model in community of Sukasari Sub-District Bandung

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**Abstract.** Garbage problem in Bandung was an immediate problem to be overcome. Based on the type of waste generation in the city of Bandung is dominated by the type of organic waste. According to Damanhuri [7] the percentage of organic waste in Bandung reached 73.4%. Therefore, efforts were needed from various parties to provide solutions toward waste problems. Based on this, then conducted a research related to the model of organic waste processing microbially. The long-term goal of this research was to create a validated, economical, productive and environmentally sound of waste management model. Special target that wants to be achieved was to make the model of organic waste processing microbially and environmentally friendly (Year 1), implement dissemination of organic waste processing with examples and practices (Year 2), and development of organic waste processing business (Year 3). The research method used was Action Research or Project Based Research (project based research). This method used to find the development of organic waste processing microbial. This activities began with a preliminary study to identify waste management problems, design organic waste management models, and evaluate the organic waste management development model. The research progressed included the identification of the research location, the potential of organic waste generation at the location of the research and the development of microbial waste processing model still in the formed of description. The output of this research was the textbook of organic waste, patent and IPR.

### 1. Introduction

The problem of waste in urban areas is an environmental problem that is familiar to Indonesia especially in big cities. The problem lately needs to be taken seriously to see its increasing volume of days. The rapid growth of urban population has resulted in an increase in the amount of waste, as well as its variations and composition.

Bandung city is one of the cities experiencing the impact of the problem, the high production of garbage and the lack of carrier fleet causing garbage accumulation in several corners of the city.

The high production of waste in the city of Bandung requires a strategic solution because the waste problem will increase within the next few years. Until now the city of Bandung uses Sarimukti TPA as a place of final processing waste with landfill control system.

Garbage generation in Bandung based on Damanhuri [6] with population  $\pm 2,500,000$  people was  $\pm 1,500$  tons / day with average waste generation of  $+ 0.6\text{kg}$  / person / day. With the composition of 73.4% was organic waste.

Based on these conditions, serious attention is needed to overcome the existing waste problems and most important is direct community involvement either in planning or in the implementation of waste management. These efforts can be done by recycling waste, especially nonorganic through the strengthening of more intensive efforts or the formation of garbage Bank in every region and processing of organic waste with an emphasis on fast composting and other waste processing techniques. Garbage management system in the city of Bandung is supposed to be done comprehensively and integrated starting from upstream to downstream so that besides solving garbage problem it also give benefit economically, healthy for society, and safe for environment.

Processing organic waste into compost now also has been done in many areas, but it still takes a long time, with the fastest conventional composting method is 14 days, requires a very large area, the process is still issuing methane gas that can increase global warming.



Based on that, then in this research made breakthrough in organic waste management by using consortium microorganism as bacteria decomposer. Waste management by using consortium microorganism will accelerate the process of decomposition of organic waste, does not cause odor, does not cause methane gas so it is friendly to the environment.

## 2. Method

This research takes place in Sub-District of Sukasari Bandung. Where the District consists of 4 (four) urban villages of Isola, Kelurahan Gegerkalong, Sukajadi and Sukarasa. This research uses qualitative approach with Action Research or Project Based Research method. This method is used to find model of organic waste processing development for planting medium. Stoecker [13] in his book *Research Methods for Community Change* describes the steps of this project-based research. A project is a series of activities begun by diagnosing (selection), designing a business development model, implementing the model in the incubation process and evaluating its activities.

The steps taken are as follows:

### 2.1 Primary data collection

Data collection techniques in this study were conducted through interviews, discussions, observations, document studies and daily records.

- In-depth interviews were conducted to residents of Sukasari Sub-district and the community who conscious their environmental in the area. Interviews conducted in writing or face-to-face, the contents of interviews are about garbage issues, the management that has been done by the residents, the hope or the needs of residents for waste management, the possibility for the development of new methods of waste management.
- Focus Group Discussion (FGD) will be conducted with researchers, partners and residents of Sukasari both government apparatus and also the environmental community in the sub-district. This discussion is related to the possibility for the implementation of new methods in waste management and planting media.
- Observations are made to observe the places to be used for the test of waste management innovations, selecting participants / communities willing to cooperate in research.
- Documentation study is needed to observe the draft model development of waste management model, comparing between before and after use of waste management model conducted by Sukasari Kecamatan residents.
- Daily diary of the researcher and the subject under study. The researcher will make daily notes about what is done, observed, thought and planned. These notes will be made from the initial stage of needs analysis, discussion, modeling, model implementation and evaluation.

### 2.2 Secondary data collection

Secondary data are data obtained not directly from respondents, but from third parties. In this study, the secondary data used are as follows:

- Pre-existing data from Sukasari Sub-District of Bandung City or other related institutions such as the Environment Agency and the Ministry of Environment and others.
- Literature study, is a technique of collecting data by searching and collecting references from books or other scientific papers in accordance with the issues studied. In this study, reference books used are related to waste management, waste management technology and municipal management in waste management.
- Internet, to complete data that has not been obtained either directly or from reference books with careful consideration. Sources from the internet for example by visiting the official website of environment, government, service and non-governmental organizations engaged in the environment, especially waste processing.

### 2.3 Presentation of data

Data collected through interviews, observations, documnetation studies, diaries and FGDs are then presented in descriptive form.

### 2.4 Data analysis

Data analysis was conducted with triangulation of interviews, observations, documentary studies, diaries and FGDs to get answers to the research questions described above.

### 2.5 Writing Research Report

The first annual report contains a draft of Development Model of Organic Waste Processing Microbial In Community Sukasari Sub-District, Bandung, and textbooks waste also Development Plan.

## 3. Results and Discussion

### 3.1 Analysis of Waste Potential in Sukasari District, Bandung.

Geographically, Sukasari Sub-District has flat / wavy shape area of 85% of the total area, in terms of the height of the land. Sukasari Sub-District is located at an altitude of 500 m above sea level (mdpl), the maximum and minimum temperatures in Sukasari District range from 220 C, while viewed in terms of rain ranges from 1.807 mm / year. Sukasari sub-district consists of 4 (four) urban villages, 32 Rukun Warga (RW) and 219 Rukun Tetangga (RT).

The number of residents in Sukasari Sub-District based on BPS Bandung (2015) is 81 659 people, with the composition of males population as many as 40,644 people and 41,015 females. Sukasari Sub-District has an area of 6.27 Km<sup>2</sup> then the population density is 13,024 Km<sup>2</sup>. If compared with the average density of Bandung is 15.713 Km<sup>2</sup>, so the population density Sukasari Sub-District is still below average.

High population growth in urban areas and all life support facilities will eventually result in waste. Such rapid population growth in urban areas has resulted in an increase in the amount of waste generation. Based on the studies and evaluations that have been carried out, the main problems can be identified in the management of urban garbage, such as:

- Increased complexity of waste problems as a logical consequence of urban population growth.
- Increased population density also demands improved methods / patterns of waste management.
- The heterogeneity of the socio-cultural level of the urban population adds to the complexity of the problem.
- Funding constraints and relatively low handling priorities of local governments are a common / classic problem.
- Shift in food handling techniques, such as food packaging using non-biodegradable materials such as plastic or styrofoam. And the limited human resources that are appropriate and available in the area to deal with waste issues.
- Development of the design of waste equipment that moves very slowly, for example in producing a portable waste enumerator machine is still lack and waste separation machine is still to be imported from abroad.
- The participation of urban communities is generally lack and not well organized.
- The concept of waste processing that is sometimes unsuitable to be implemented, and the lack of possible modification of the concept in the field.

The increased population increases the activity that will increase the amount of waste. The problem of urban waste management in general is the limitations of equipment, land, and human resources.

To calculate the amount of potential waste generated by the population, then the standard according to SNI 19-3964-1995 is used as follows:

- Municipal solid waste generation units = 2 - 2.5 L / person / day, or = 0.4 - 0.5 kg / person / day
- Medium / small waste solid waste generation units = 1.5 - 2 L / person / day, or = 0.3 - 0.4 kg / person / day

Because of the waste generation from a city comes mostly from households, the assumption is that the waste generation unit can be considered to include the garbage incurred by everyone in various activities and various locations, whether at home, street, market, hotel, park, office and so on.

The bigger a city, the smaller the waste portion of the settlement, and added to enlarge the portion of non-residential waste.

Furthermore, the focus of the study is organic waste, the potential of organic waste according to Damanhuri [7] for the city of Bandung is 73.4% of the total waste generated. Potency of waste generation / volume Sukasari District Bandung City obtained by multiplying the number of residents, units of large urban waste piles and multiply by 73.4%. The result is:  $81.659 \times 0.5 \times 73.4\% = 29.968,853 \text{ kg / day}$  or rounded to 30 ton / day.

Based on the calculation, the average of organic waste generation in Sukasari sub district is 30 tons / day. Organic rubbish in general, to describe the rapidly degraded (quickly decomposed) waste components, especially those from food waste. Garbage is a waste that easily decomposes due to the activity of microorganisms. Thus its management requires speed, either in its collection, disposal, or its transport. This waste decay can produce unpleasant odors, such as ammonia and other volatile acids. In addition, other decomposition gases, such as methane gas and the like, contribute to global warming. This type of waste is potential to be processed with the help of microorganisms.

### *3.2 Organic Waste Processing System that has been done in Sukasari sub district, Bandung.*

Garbage management in sub-district of Sukasari, Bandung generally still use the principle of Gathering-Dispose-Flue and people do not sort waste. Efforts to manage cleanliness at the village level are carried out by the Gobar Team (culverts and cleaners). Every day carrying out clean picket picks such as cleaning the road, and collecting residents' garbage up to temporary dumping places (TPS). Not all urban villages have hygiene officers with the term of Tim Gobar, based on the observation results only in two urban villages namely Isola and Sarijadi urban villages. Other sub-districts only use the general term of the K3 officer (Cleanliness, Order and Security).

People in Sukasari District like Bandung society generally contribute in waste management in the form of garbage fee levy. Because they felt that they have paid the fee, the awareness of waste processing is low. Communities only collect garbage and wait for transport officers to bring garbage from settlements and stacked in polling stations. The condition can be seen from the TPS that most of them are unable to accommodate the garbage heap.

Heap of waste in TPS, besides it because of the addition of waste volume from the community is also caused by the process of transporting garbage trucks that are often late. Furthermore, the condition in the TPS in Sarijadi Village is not much different from the others. The observed condition of TPS has exceeded the capacity, it shows that community participation in waste processing in sub-district of Sukasari is still low. Without the participation of waste generating communities, all planned waste management programs will be in vain. Problems that occur related to the participation of the community in waste management, which are as follows:

- Uneven distribution of population.
- Has not institutionalized the desire in the community to maintain cleanliness of the environment.
- There is no SOP (standard operational procedures) for community development that can be used as guidelines for implementation.
- Hygiene managers who have not provided counseling in their programs.
- Management fears that community initiatives crash with existing management concepts.

### *3.3 Development of Microbial Waste Processing Model in Sub-District of Sukasari, Bandung.*

Based on the analysis of organic waste potential in Sub-District of Sukasari is reaching 30 ton / day, hence it is needed of fast handling. This is because the characteristics of organic waste quickly cause odor, invite flies, the liquid can contaminate the water and unsightly. To deal with these conditions, in this study then prepared a model of processing with microorganisms (microbes) developed by the research team.

Microbes developed by researchers are microbial consortium or consists of several types of microbes. This microbe is a liquid made from 100% bio-based cheese, pure milk, fruits and cow dung. This mirkoba has the ability to:

- Parse all pollution from chemicals, including B3 chemicals.
- The heat resistance (test run up to 100 degrees C) remains alive and unchanged.
- Reshape the food chain and the lower-level pyramid becomes intact.
- Microbes develop rapidly with 14 x per second.

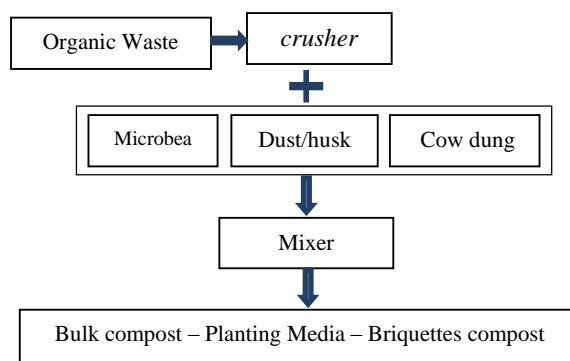
Microbes are useful and appropriate to treat and neutralize waste and chemical waste that exist in the soil and process them into materials that can be utilized to the maximum by the plant. Organic waste is chopped and mixed with fresh dung of animal in bahasa is well known by kotoran hewan (kohe) and microbial. In a short time the combination of these three components will decompose waste and chemical waste and elements in the soil into the medium of planting not just 'compost'. This planting medium is useful for the soil, enlivening microorganisms in the soil and existing food chains. Composting process occurs quickly, 1 day, not 14-30 days.

Microbial activity also produces food that can supply the necessary elements of the plant so that it can fertilize the plant. The amount of organic matter and cow dung introduced to the soil is positively correlated with crop productivity, so the 'more' the input of both, the more the number of harvests. This is the secret and the main key of course in addition to the quality and characteristics of its microba. As we know that organic matter and cow dung in agricultural areas are abundant and easy to obtain.

The processing microbial by utilizing 'kohe' cow would be a solution to overcome the pollution in the area of cattle farms where during this day it had still thrown the waste of 'kohe' cow into the river. Furthermore, methane gas from cow alteration that left cattle will be controlled if processed microbial. So organic microbial waste processing works also to reduce global warming.

To apply microbial model of organic waste processing, a controlled demplot is required with adequate supply of organic waste and a source of animal dung (kohe) of cattle that are not too far away. With various considerations, the Command Headquarters (Mako) Student Regiment (Menwa) Mahawarman Battalion 11 UPI located in Isola Village became an option.

The conceptual model that will be applied in the demonstration plot can be seen in the schematic below.



**Figure 1.** Microbial Organic Waste Processing Model

Based on the picture of organic waste in the form of foliage and or household waste from kitchen were chopped with crusher machine, then mixed with animal dung (kohe) cow, microbes and hygroscopic materials. All the ingredients were mixed with mixer machine after mixed, it can be packed in the form of compost bulk, planting media or compacted into compost briquettes.

Microbial organic waste processing model test is done in two times (2) by differentiating the amount of organic material mixed, the amount of kohe and microbe mixed. This is intended to see the effectiveness of processing that is done. The model of waste processing is then carried out on the demonstration plot.

In this demplot all campus of organic waste were collected, in which every day it reaches an average of 6-8 m<sup>3</sup>. Based on the calculation result of leaf waste (organic), organic garbage type (leaf waste) 40 kg / m<sup>3</sup>. To make the planting medium, it takes about 7 kg of organic waste for the size of 50 cm polibec.

Based on the table, the amount of organic fertilizer (compost) produced microbial in campus of UPI was ranged between 240 - 320 kg / day and if processed by microbial will produce 34-46 planting media polibec with weight of every polibec 7 kg on that day. Because organic waste is produced every day, this waste must be processed microbially, which can then be stored in the form of bulk, briquettes and planting medium.

Based on the discussion above it can be said that the processing of organic waste microbial can accelerate the process of organic fertilizer that can be directly planted. The addition of animal dung (kohe) of cow in this process is also a solution of waste cattle farms that during this day it had been dumped into the river. So this microbial processing is a breakthrough for organic waste processing from household and also cattle farm which directly at that time can be used as planting medium.

#### 4. Conclusion

Waste management in Sub-district of Sukasari Bandung is generally still use the principle of Gathering-Dispose-Flue and people do not sort its waste. The analysis on the potential of organic waste generation in Sukasari Sub-District is produced around 30 tons / day. Organic rubbish is rapidly degraded (rapidly decaying) waste, especially from food scraps. Garbage is waste that easily decomposes due to the activity of microorganisms. Thus its management requires speed, either in its collection, disposal, or transport.

This waste decay can produce unpleasant odors, such as ammonia and other volatile acids. In addition, other decomposition gases, such as methane gas and the like, contribute to global warming. This type of waste is potential to be processed with the help of a consortium of microorganisms developed by researchers.

Based on the results and discussion in the report of research progress, it can be concluded that the model of organic waste processing microbial is superior to existing methods of organic waste processing. Microbial processing of organic waste is a revolutionary waste treatment where at the same time organic waste can be directly planted, does not generate heat and no methane gas, so it is friendly to the environment. While the processing organic waste of other methods still require a long time, smelly, causing methane gas and carbokdioksida gas that can cause global warming (global warming).

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