EFFECT OF RICE BRANON CONTINUOUS ORGANIC WASTE DECOMPOSITION PROCESS

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Abstract - Microbial decomposition process is considered as an environmentally friendly way to treat organic waste. However, during the early stage of continuous input waste decomposition process, some problems often occurred. This study intended to observe the effect of rice bran as an activating agent in organic waste decomposition, to minimalize the problem. Reactor weight, temperature, moisture content, pH and microbe number were used as the parameter to observe the rice bran addition effect in decomposition process. Through the addition of rice bran as the activating agent, decomposition process showed better rate than normal composting which was confirmed by the total waste reduction during the process.Trypticase-soy liquid medium was used to observe the composting microbe growth, with and without rice bran. The microbe number in the medium with rice bran addition was higher than the medium without rice bran. Some material in rice bran is considered having influence in composting microbe growth.

Keywords - Continuous Composting, Decomposition Process, Organic Waste, RiceBran.

I. INTRODUCTION

Household waste disposal has been a study topic for a long time. It is because of its large amount in total domestic waste and the difficulties to treat [1]. Most of domestic waste in Japan is treated with incineration process, which has financial burden [2]. While in Indonesia mostly landfill treatment is used, which generates environmental and health problem [3].

United Nations, Food and Agriculture Organization stated that global quantitative food losses and waste per year are about 30% [4]. Moreover, food waste has been considered as the major content in household waste [5]. Reflect on its large amount in household waste and the organic content, microbial garbage treatment system is considered as an alternative way for household waste disposal [6]. Nevertheless, in the development of this system another problem happened, such as low decomposition rate in the early stage of the process and decreasing of decomposition rate when overloading phenomena occurred [2].

In the previous study in our laboratory, rice bran has been reported having a good effect on reducing the side effect of microbial garbage treatment process. It was assumed that the changing of bulk density increased the efficiency of the process. However, Chang and Chen stated that rice bran was not a bulking agent in food composting process [7]. Therefore, another approach to understand this effect is needed. This study intends to observe rice bran effect in microbial activity during microbial garbage treatment process.

II. EXPERIMENTAL PROCEDURES

2.1 Materials and Method

Dog food as a model organic waste was used as the input with rate 40g/(L.day) and moisture content 70%. Waste was inputted to a static-type of garbage treatment system, which has been developed in our laboratory. As a bulking agent 10 L leaf mold was used. Rice bran was added in the first day only, with ratio 1:8 to the leaf mold weight. The rice bran moisture content was adjusted to leaf mold moisture content, before addition. Manual mixing by hand was performed once in a day when waste was inputted to maintain the aerobic condition and the system mixture.

2.2. Measurement of Physical Parameters

Physical parameters measurement was done twice a day, before inputting waste and 6 hours after inputting. Temperature, reactor weight and moisture content was measured everyday for 7 days. Sample pH was measured every 2 days.

2.3. Analysis of Microbe Number

This analysis was done for every 2 days with trypticase-soy medium as the medium. Microbe was inoculated from 3 g sample and 27 g distilled water. The mixture was homogenized for 10 minutes with 10,000 rpm. Then the solution was diluted with factor 10^7 and 10^8 before inoculation. Microbe number was counted after 7 days of inoculation.

2.4 Analysis of Microbial Growth

A mixture consists of 88 ml trypticase-soy medium, 2 ml extracted microbe from leaf mold and 10 ml extract rice bran was prepared. Another mixture used 10 ml sterilized water instead of rice bran, as the

negative control. The mixture was cultured under temperature 40°C for 12 hours. Sample was taken at 6, 9 and 12 hours, then optical density value was measured using spectrophotometer with 610 nm wavelength.

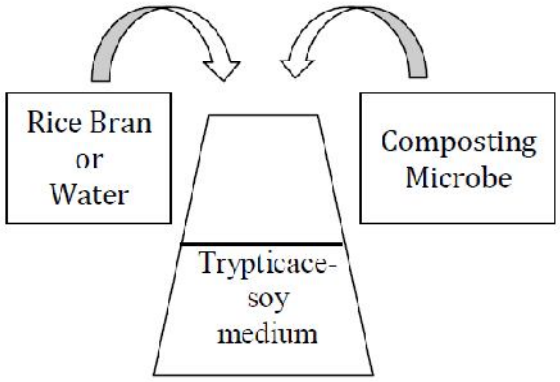

Fig. 1 Analysis of Microbial Growth

Extracted microbe was obtained from pure leaf mold sample without any organic waste input. Three grams of leaf mold was sampled and 27g distilled water was added. The mixture was homogenized for 10 minutes with 10,000 rpm. Then the solution was diluted with dilution factor 10^4.

Extract rice bran was prepared by dissolving 10 g rice bran powder in 100 mL sterilized water and the mixture was stirred for 10 minutes. Then the extracted material was separated using centrifuge for 30 minutes with 8000rpm speed. The supernatant fluid was taken as rice bran extract.

III. RESULTS AND DISCUSSION

3.1. Comparison of Normal Composting and Rice Bran Addition Composting

The comparison of the reactor weight between normal composting and rice bran addition composting to the total input weight is shown in Fig. 2. From this graph, the reactor weight of rice bran addition composting decreased more than normal composting. The good effect of rice bran addition to composting process can be observed from the difference in weight reduction.

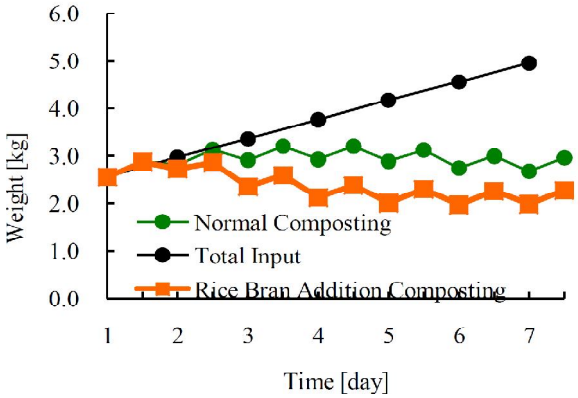

Fig. 2 Comparison of Reactor Weight Between Normal Composting and Rice Bran Addition Composting to Total Input Weight

3.2. Physical Parameter Change

a. Temperature Change

The temperature change during the composting process between normal composting and rice bran addition composting can be seen in Fig. 3. Normal waste decomposition process is an aerobic oxidation of organic compounds, which generates heat from exothermic reaction process [2]. Therefore, reactor temperature is a good parameter to know about the decomposition process in the reactor. In rice bran addition composting, temperature rose within the first day and reach the highest temperature in six hours after waste inputted in the second day. Before waste was inputted the temperature was lower than six hours after input. It was observed that the decomposition process happened after the waste was inputted. On the other hand, the temperature of normal composting rose in the second day wand was not as high as rice bran addition composting.

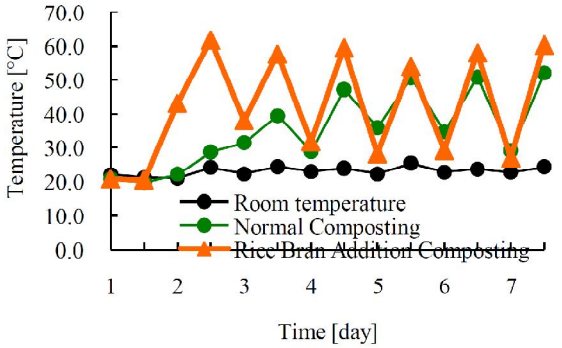

Fig. 3 Temperature Change During Normal Composting and Rice Bran Addition Composting Process

b. Moisture Content Change

The moisture content change during the process is shown in Fig. 4. During the composting process, the moisture content of rice bran addition composting decreased more than normal composting. The higher temperature and greater bulk density in the rice bran addition composting affected to the

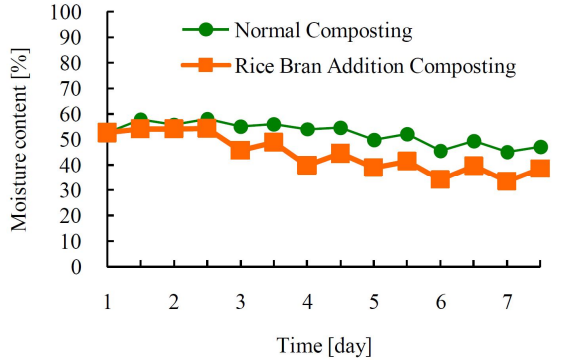

Fig. 4 Moisture Content Change During Normal Composting and Rice Bran Addition Composting Process

water lost during the composting process.

c. pH Change

The pH change during the composting process is displayed in Fig. 5. Both pH of normal composting

and rice bran addition composting did not showed significant drop. During decomposition process, various organic acids are produced if the anaerobic condition occurred, resulting in pH drop [2]. The aerobic condition was maintained during both composting process.

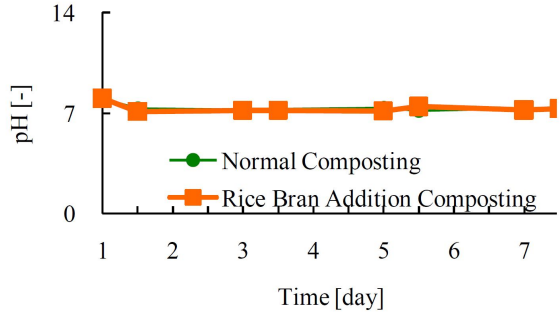

Fig. 5 pH Change During Normal Composting and Rice Bran Addition Composting Process

3.3. Analysis of Microbe Number

Microbe number of normal composting and rice bran addition composting is shown in Fig. 6. Six hour after the first input, microbe number in rice bran addition composting was increased rapidly, while the temperature of the process was not increased. There is a possibility that in the early stage of rice bran addition composting, some materials in rice bran affected the microbe reproduction enzyme. Therefore, if the reproduction process happened in rice bran addition composting, the greater number of microbe will be easily decompose the same amount of waste compare to normal composting. It was observed that the rice bran addition temperature on the second day before input was high which indicated that decomposition process happened.

Fig. 6 Microbe Number Change During Normal Composting and Rice Bran Addition Composting Process

3.4 Analysis of Microbial Growth

The growth of composting microbe in liquid medium is shown in fig. 7. Microbial growth in the trypticase-soy medium with rice bran as a supplement, showed higher optical density value compare with negative control. Means that the microbe number in the medium with rice bran was more than the medium without rice bran. The significant increasing was observed between 6 and 9 hours after inoculation

It was confirmed that rice bran has a good effect in increasing microbe number. Therefore, the activation of early stage of composting with rice bran was possible because of the plentiful amount of microbes were present in the decomposition process.

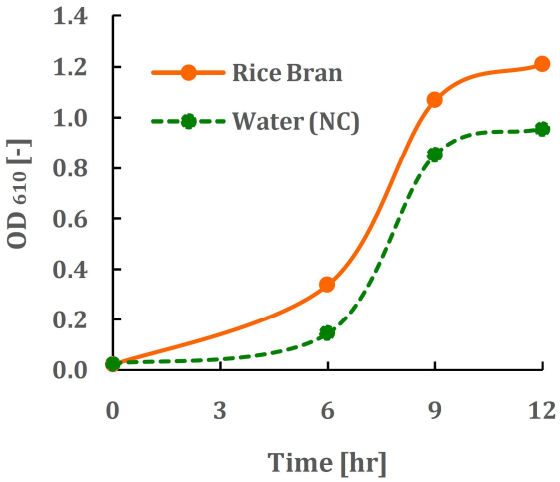

Fig. 7Growth of composting microbe in 12 hours measured with optical density method

CONCLUSION

It was observed that rice bran addition in composting process could activate the early stage of decomposition process. Within one day the decomposition process started. The activation process was concluded as the effect of rice bran addition to the microbial community in the composting process. Some materials in rice bran are considered having influence in composting microbe reproduction process. However, further study is needed to prove this assumption.

Since in the early stage, the activation of decomposition process in rice bran addition composting happened, the weight of waste reduction in the process was larger than normal composting.

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