OPTIMUM CONDITIONS FOR TANGERINE PEELS COMPOSTING

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Abstract - This research paper conducted on optimum conditions for tangerine peels composting. The composting experiments were included in three processes design. The first experiment was tangerine peels compost by turning and un-turning compost pile method. The second experiment wastangerine peels compost with porous materials by turning and un-turning compost pile method..The third experiment was tangerine peels composting with bio-fermented tangerine peels and porous materials by turning and un-turning compost pile method. The frequency of turning of compost pile was 0, 2, 5 and 10 days. From the second experiment result found that the lowest pH value of 4.5 appeared in the first week and the highest temperature of 39°C occurred during the composting process. Furthermore, change of color of raw materials was faster than other two experiments. The turning compost piles process could enhance more aeration in compost piles than the porous materials.

Keywords: Composting process; Tangerine Peels; Composting Conditions

I. INTRODUCTION

Composting is an alternative solid waste management system. It can use for the recycling of organic matter into useful products. This process considers as the most efficient and environmentally safe. The finished compost could apply as a soil conditioner, organic fertilizer as well as containing high nutrients for the soil. The microbial community in compost, which are bacteria, fungi, and worms, can also stabilize the degradable organic matter.Composting is a treatment process in which the organic constituents of bio solid are biologically decompose under controlled conditions. The product of compost is a material rich in organic matter and nutrients that can be marketed as a soil amendment for agricultural and horticultural use. Composting occurs by the activity of a mixed microbial community (Ingrid et al, 2014). Besides that the characteristics of the microbial population depend on the substrate and physical conditions. The physical conditions which are the moisture, temperature and aeration of where composting takes place. The rate at which aerobic decomposition takes place increases as the particle size decreases. However, extremely small particles may reduce the oxygen movement within the pile, thereby reducing the composting rate (Jinyi et al, 2016). The performance of the composting process also will depend on the characteristics of the waste.

There are many ways to do composting, which have different method and results in different effectiveness .ts opmoc foObjectives of this study would like to compare the three different conditions. The first experiment was tangerine peels compost by turning and un-turning compost pile method. The second experiment was tangerine peels compost with porous materials by turning and un-turning compost pile method.The third experiment was tangerine peels composting with bio-fermented tangerine peels and porous materials by turning and un-turning compost pile method.

In composting, optimal conditions or ideal conditions for measuring the compost pile are as shown in Table 1 (Rynk, 1992).

Condition	Ideal	Acceptable
C/N ratio	25-35:1	20:1 to 40:1
Moisture content	45-60% by weight	40-65%
Available oxygen concentration	>10% or more	>5%
Particle size	Variable	< 1 inch
pH	6.5-8.0	5.5-9.0
Temperature	54-60^{o}C	44-66^{o}C

Table 1: Optimal conditions for aerobic composting

II. DETAILS EXPERIMENTAL

All of the experiments were tangerine peel composting that had different conditions for 3 months.

- Tangerine peel using as raw materials in a composting process
- Bio-fermented water using as microorganisms in the composting process
- Porous material using as media to add aeration to the compost pile

The recommended value of moisture contentis about of 50-60%. For all experiments, water was added into the compost pile for 30 mL by spraying water on the compost pile surface every 4–5 days depending on how humidity of the environment around the compost piles.

2.1. Tangerine peels compost by turning and un-turning compost pile method

The experimental process was consisted of the step to prepare the composting process. The first method that decided to use was turning and un-turning by using 8 baskets which have a different day in order to turn the composting pile by 0,2,5,10 days.

2.2.Tangerine peels compost with porous materials by turning and un-turning compost pile method.

This experiment hada similar method in the first experiment,however, added of porous materialsduring the composting process. The porous materials designed to use a plastic bottle of 155 mLby drilling holes around the plastic surface that airflow could inlet into the compost pile.

2.3.Tangerine peels composting with bio-fermented tangerine peels and porous materials by turning and un-turning compost pile method.

This experiment had a similar method in the first experiment, however, added of bio-fermented water during the composting process. This process done by feeding the bio-fermented water 7.6 mL then adding water 152 mL with sugar 7.6 g. Stirred all materials until mixed well and poured to the tangerine peels compost.

In each experiment, the composting pile was monitoring and collected data for 3 months based on the following parameter as shown in Table 2.

Parameter	Method
pH and temperature	Solid meter (QT-95)
Moisture content	Digital hygrometer

Table 2:Parameter and measurement method

III. RESULTS AND DISCUSSION

The dynamics of major composting process parameters were followed over 90day period. This initial thermophilic phase was maintained for about two months and then followed by a less intense process (mesophilic phase) during which the temperature gradually decreased to below 40°C. This trend represents the typical self-heating pattern expected for a regular composting process (Miller, 1996).

3.1. Temperature

The tangerine peel composting had an average temperature of 29.2°C and for the mesophilic phase, during the 2 months the temperature was around 25-40 °Cas shown in the Fig.1.After 3 months, the composting pile turned into the thermophilic phase and temperature should to increase to 50-70 °C (Miller, 1996). But for this experiment, it was not increased to that point and stay at 25-40 °Cdue to the open system composting and small size of composting the environment temperature can also affect the composting temperature.

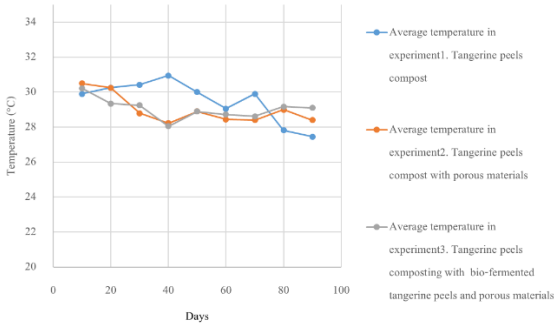


Fig.1. Temperature of tangerine peels compost

3.2. pH

The pH of tangerine peels constantly decreases during the first 30 days of composting, until leveling off at around 7.5 because of the degradation and mineralization of organic compounds. In fact, the alkaline conditions are conducive to bacteria, which are involved in degrading complex organic compounds and promoting the humification process (Heerdenet al., 2002). The tangerine peels composting had a different pH in each experiment as shown in the Fig.2.Bio-fermented water that designed to add in the compost pile to allowed the raw materials in the composting process finished faster related to the objective thatto compared the difference between compost pile with the addition bio-fermented water and without addition bio-fermented water.

The composting process is relatively insensitive to pH, within therange commonly found in mixtures of organic materials, largely because of the broad spectrum of microorganisms involved. A pH range of 6 to 7 is generally most favorable for plant growth because most plant nutrients are readily available in this range. However, some plants have soil pH requirements above or below this range (USDA, 2020).

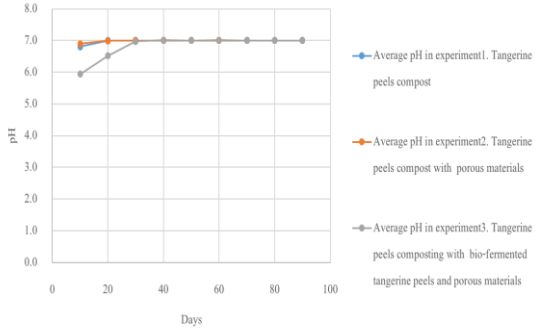


Fig.2. pH of tangerine peels compost

3.3. Moisture Content

The tangerine peels composting in all experiments had a moisture content average of around 64% as shown in the Fig.3.Due to all experiments designed to add water 30 mL every 4-5 days due to the moisture content that had monitoring and maintained about 60-70%. Sometime the environment around compost pile had a low temperature such as rainy day that would effect to moisture content and showed a bit higher than average moisture content.

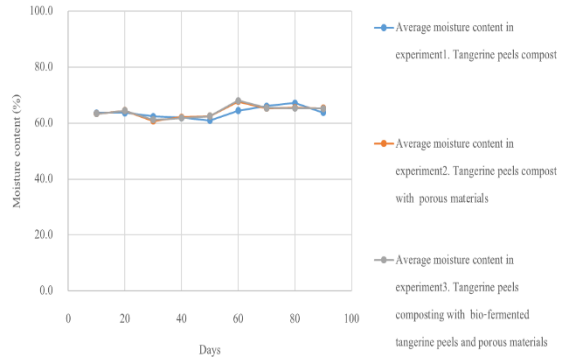


Fig.3. pH of tangerine peels compost

IV. CONCLUSIONS

- Temperature of compost in experiment 1, 2 and 3 were29°C, 32°C and 32°C, respectively. For experiment 3 showed the higher value of 39°C at the mesophilic phase than experiment 1 and 2. At the end of the process could record the temperature as 26°C, 30°C and 30°C in experiment 1, experiment 2 and experiment 3, respectively.
- For pH values could measure the initial pH of 6.5, 6.4 and 4.5 in experiment 1, 2 and 3, respectively. All 3 experiments showed a pH about 7 after the first month of composting .ssecorp
- Moisture content value in all experiments could control on a recommended range of 60-80%. The results showed63%, 65% and 66% in experiment 1, 2 and 3 after finishing the composting process.
- In experiment 3 which added bio-fermented water and porous materials showed the lowest pH value of 4.5 in the first week and the highest temperature was 39°Cduring the composting process. Change of color of materials was faster than the other 2 experiments as compared in the condition of without bio-fermented water.

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