

SYSTEMATIC METHOD OF FOOD WASTE IN COMPOSTING PROCESS

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ABSTRACT

Basically, increasing highly volume of food waste in Malaysia is under critically worsened and need to take seriously further action. In parallel with Act 672 that required waste separating, composting is the best method to treat food waste. Currently, food waste composting was not so well known. It also takes a long time to complete. Thus, this study was done to enhance the composting process and also reduce time to complete it. The by-product of this process also can be used as fertilizer or as a soil amendment. The food waste collected will undergo drying and grinding process before starting the composting process. The drying step was done to decrease the moisture content and the grinding process was done to increase surface area for microbial activity. During composting process, the food waste will be stirred for 3 days with the set time interval. Parameters chosen for the data analysis are temperature, pH and moisture content. After 3 days, the food waste turnout to be compost. The mature compost should have a pH of 6 to 8, moisture content between 30% - 70% and temperature below 20°C. A pH of 6 to 8 indicates that the compost is neutral; meaning it is not harmful to human. Moisture content between 30% - 70% indicate that the compost not too dry or not too wet; meaning it is easy to use. Temperature below 20°C indicates that no more microbial activity; meaning the compost is already stable able to use.

Keywords: Composting; food waste; pH; moisture content.

INTRODUCTION

Solid waste is one of the problems that can be crucial to the environment and also human if not properly manage. Solid waste can be divided into inorganic and organic waste. Inorganic waste mostly consists of recyclable materials while organic wastes majority consist of food waste. Every year, 1.3 billion tons of food is discarded worldwide, represents one third of the global yearly food production [1]. In Malaysia, the volume of food waste reached 15000 tons per day from total 38000 tons of municipal solid in 2015 (SW Corp 2016). However, food waste can be valuable resources when it is managed properly and effectively. Waste that has been managed properly reducing the impacts on the environment [4]. Clearly, the way to limit the impact on the environment is by reducing the amount of waste that is generated, or the waste must be recycled composted or reused. There have been many studies on treatment of municipal solid waste. Due to simple operation management and high economic efficiency, composting becomes popular method to treat solid waste [7]. As a major composition in municipal solid waste stream, food waste has a high moisture content, salinity, organic and oil content [5]. This problem must be solved to produce high quality compost. Therefore, the paper aims to design a systematic method of food waste in composting process. To achieve this aim, an experiment was conduct to provide physical data that can be used and analyse to design the system.

METHODOLOGY

Firstly, the food waste will be collected at the selected restaurant. Before starting the composting process, pre-processing will be done. It is to ensure the composting process can be enhanced. After that the composting process can be start. During composting process was conducted, physical parameter such as compost pH, compost temperature and compost moisture content. It will be recorded in hourly basis except for moisture content which is in daily basis. After 3 days, the process will be stop. The data from physical process will be collected and analyzed. Finally, based on data analysis, a recommendation to enhance and improve the waste management system can be suggest. Figure 1 below show the framework for the research process.

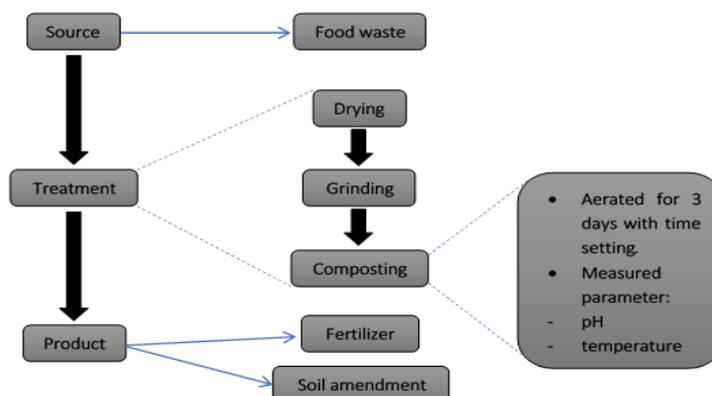


Figure 1. Research Framework.

RESULT AND DISSCUSSION

All the parameter recorded in hourly basis for 3 days except for moisture content which is every 24 hours, continuously. Based on Table 1, there are 73 data recorded for the compost temperature (°C), and compost pH. However, compost pile temperature depends on how the heat produced by microorganisms is offset by the heat lost through aeration or surface cooling. Compost temperature (°C) recordings were taken per hour by inserting the probe of the digital thermometer at a depth of 3 inch's depth inside the pile. Temperatures were recorded after 15 seconds of inserting the thermometer. Compost temperature recorded for minimum and maximum is 24°C and 37°C, respectively. During the days, temperature recorded is much higher compared during night. It indicates that sunlight also plays an important role during composting. Yu et. al (2007) indicated that minimum compost temperature for proper disinfection of waste materials from animal and plant pathogens is 55°C [8]. The result show that the highest compost temperature recorded is 37°C. This may be due to the less volume of waste and high surface area that results in heat loss.

The pH readings were measured with pH meter in hourly basis. The pH of the compost sample was determined by a sample/deionized water ratio of 1:5. Therefore, 10 g of sample was diluted in 50 ml of deionised water (ratio: 1:5). Next, the probe was dipped into compost mix and the reading was recorded. The minimum and maximum pH recorded is 5.47 and 6.37, respectively. Compost pH starting to increase pH neutral at 34th hours. Increasing value of pH maybe due to the degradation of acids and/or alcoholic compounds along with organic content and production of humic substances [1].

Table 1. Data recorded during composting process.

Time (Hours)	Compost Temperature (°C)	Compost pH
0	31	6.01
1	32	5.92
2	32	5.94
3	37	5.47
4	34	5.79
5	31	5.73
6	28	5.79
7	27	5.82
8	25	5.84
9	25	5.88
10	25	5.85
11	25	5.92
12	25	5.98
13	25	5.87
14	25	6.02
15	25	6.15
16	25	5.96
17	25	5.90
18	24	6.02
19	24	6.06
20	24	6.14
21	25	5.98
22	27	6.09
23	30	6.04
24	32	5.94
25	31	5.86
26	32	5.88
27	34	5.90
28	34	5.82
29	30	6.01
30	28	5.93
31	27	5.94
32	26	5.88
33	26	5.93
34	26	6.00
35	26	6.02
36	26	6.05
37	26	6.04
38	26	6.09
39	25	6.09
40	25	6.07
41	25	6.11

42	25	6.16
43	24	6.21
44	25	6.15
45	26	6.14
46	28	6.13
47	32	6.21
48	35	6.13
49	35	6.03
50	33	6.12
51	37	6.08
52	36	6.08
53	29	6.07
54	29	6.12
55	27	6.14
56	27	6.19
57	26	6.19
58	26	6.21
59	26	6.26
60	26	6.23
61	26	6.28
62	26	6.22
63	25	6.27
64	25	6.35
65	24	6.30
66	25	6.30
67	24	6.32
68	24	6.35
69	24	6.29
70	27	6.36
71	29	6.37
72	32	6.35

Moisture content is the measure of the quantity of water present in compost product. Overly dry compost (< 35% moisture) can be dusty and hard to handle, while very wet compost (55-60%) become clumpy and difficult to uniformly apply. The ideal moisture content needed in compost is 35-55%. Iqbal et. al (2010) state that moisture content acts as transporting medium of nutrients for microbial activity [3]. Inadequate water will hinder diffusion of soluble molecules and microbial activity. In this research, the moisture content of the compost was measured every 24 hours. As shown in the table 2, the starting value of moisture content in the compost before process already below 35% which is 5.91%. This happen because of the drying process before starting composting process has decreased water content in the compost. Besides that, the rate of water loss in the compost is slightly same because of the same amount of sunlight received during composting process.

Table 2. Moisture content of the compost every 24 hours.

<i>Time</i>	<i>Before</i>	<i>After</i>	<i>%</i>
0	60.4462	56.8728	5.91
24	61.3549	58.0938	5.32
48	58.5370	55.7457	4.77
72	59.7447	57.8714	3.14
Total Loss			2.77 (46.87%)

Table 3 below shows total weight reduction of food waste after completing composting. With aeration, the reduction of food waste can be achieved around 31%. Pre-processing of the food waste before starting composting process play important role to reduce the total weight. The drying process throw out the excess water and grinding process caused faster degradation of food waste.

Table 3. Total weight reduction of the food waste.

<i>Time (Hours)</i>	<i>Compost Weight</i>
0	20 kg
72	13.8 kg
Loss	6.2 kg
Reduction Percentage	31 %

CONCLUSION

Results from this study can be used to design a systematic method of food waste in composting process. Using the designated system, composting process can be done in 3 days only with the help of aeration time given to the compost. The pH and temperature recorded still in between range. Besides that, the total weight reduction can be achieved approximately 31%. As landfill site decrease, this designated method definitely suitable to be used to prolong the lifespan of landfill. Furthermore, this compost was produced using 100% of food waste and consequently it is suitable to be used as fertilizer or as a soil amendment. As agricultural practices continue to deplete soils and organic matter, this compost will be important source in maintaining soil fertility. This compost also plays an important role in more environmentally regulated and environmentally aware agricultural systems. Compost and composting may be the best choice as well as opportunity for added income. So, with this enhance composting process methods, food waste problem can be solved, longer lifespan of landfill and environmental friendly to human and environment.

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