# The Development of Mass Production Technique of Urban Dry Leaf Litter and Wet Garbage Biomass

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# The Development of Mass Production Technique of Urban Dry Leaf Litter and Wet Garbage Biomass

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***Abstract:*** *The existence of organic waste becomes an urban problem. The objective of the study is to develop composting techniques made from raw urban organic waste carried out massively. The research consists of two factorials; the treatment of factor I is the mixture of EM4 and urea, and factor II is the portion of market waste in the mixture of organic matter of dry and wastewater waste consisted of 0%, 20%, 40%, and 60%. The result of the study shows that there were biomass volume decline in the range of 25-70% and the change of pH which ran above 8 and after five weeks it was relatively stable under normal condition around 7. Moreover, there was high temperature change ranged from 40-50$^0$C and after six weeks it was stable of 35-40$^0$C. The discoloration also happened from the green fresh leaves or dry brown leaves turned to darkish brown. Based on the C/N ratio change indicator, the mixed treatment of 20%, 40%, and 60% with the addition of EM$_4$ starter and urea biomass has been composted at week 8 (for fifty days in fresh condition) and it can be used as a reference for the preparation of appropriate technology for mass composting.*

***Keywords****: dry leaf litter, wet garbage, mass composting*

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## I. Introduction

Garbage is one of the big problems faced by people, especially in big cities, including in Surabaya. The urban organic waste comes from household kitchen waste and market waste in the form of leftover pieces of vegetables, fish, fruit or food (rice) that has been damaged, as well as dried leaf litter that comes from sweeping garbage on the road or from the harvest of trees that are felled for damage, efforts to rejuvenate and regulate plant canopies. The potential of organic waste, especially from densely populated urban areas is very high. As an illustration, in a city with a population of 1 million people, the waste pile is roughly equivalent to 500 tons/day. This organic waste is generally biodegradable, which can decompose into simpler compounds by the activity of soil microorganisms. The decomposition of this organic waste will produce material that is rich in the elements needed by plants, so it is very suitable used as organic fertilizer in agricultural activities (Sulistyawati and Nugraha, 2011).

The composting process will be better and faster if the raw material has a smaller size. Therefore, materials that are large in size need to be chopped or ground first so that the size becomes smaller. Small-sized biomass will be easily decomposed due to increased surface area and simplify the activity of reorganizing microorganisms. The existing composting technologies are less effective and less efficient when used for large quantities of biomass materials because of the need for labor and equipment and considerable time to reduce the size of biomass and energy to stir and reverse biomass to obtain adequate oxygen circulation.

The technology of waste composting has been widely published; nevertheless, it generally requires the process of minimizing the size of waste by enumeration or milling of garbage and biomass stirring process. This study aims to formulate a simple and easy to do mass composting technology by eliminating the process of enumeration or milling of garbage and does not need biomass stirring.

## II. Materials and Methods

The research was conducted at Rumah Kompos or Jambangan Recycling Center, it is a Work Unit under Hygiene and Green Open Space Office of Surabaya City, and in green house or Laboratory of Faculty of Agriculture at Universitas Wijaya Kusuma Surabaya. The study took 8 months and implemented in 2017.

The materials used in the research are: biomass of urban organic waste (market waste and leaf waste), plastic bags, iron cube-shaped, and starter of composting process EM$_4$ and urea. Meanwhile, the tools used include the scales, bucket for watering, stirring tools, pH measuring devices, temperature gauges, and stationeries.

The study employs factorial research with two factors set out in complete random design.

Factor I: Type of Promoters of Composting Process (Starter)
$G_1$: given $EM_4$ 3 liters of solution with concentration of 0.2/unit experiment plus urea 1 kg/unit experiment;
$G_2$: given $EM_4$ 3 liters of solution with a concentration of 0.1 plus urea as much as 2 kg/unit of experiment.
$G_3$: watered in sea water;
Factor II: The comparison between market waste and dry leaf litter
$K_1$: 0 percent of market waste, 100 percent of dry leaf litter
$K_2$: 20 percent of market waste, 80 percent of dry leaf litter
$K_3$: 40 percent of market waste, 60 percent of dry leaf litter
$K_4$ : 60 percent of market waste, 40 percent of dry leaf litter

The variables measured once a week are temperature, pH and volume depreciation. Meanwhile, the variables observed in the fifth week were C/N ratio and physical appearance (color, odor and structure). In addition, the variables observed at week 9 were C/N ratio, N-Total, P2O5, K2O and physical appearance. The data obtained were processed statistically according to the variety analysis procedure to know the effect of treatment. Here, the Smallest Differential Test was used to compare the median between treatments with $\alpha = 5\%$.

## III. Results

### The Volume Changes of Mixed Dried Leaf Waste and Market Waste Biomass

The results of the study showed that there was volume depreciation in each treatment during the composting process. The volume was depreciated dramatically in the first week, a week after the incubation with 10-40 percent shrinkage, and biomass volume started stabilizing at 5-6 weeks, i.e. four to five weeks after incubation with 30-65 percent shrinkage. The smallest volume decrease happened in the treatment of $K_1$ (dry leaf litter without wet waste mixing) and the greater the mixture of market waste, the greater the volume reduction. The treatment of starter had little effect. Here, the largest biomass volume lessening occurred in at treatment of $K_2$ of $EM_4$ 0.1 concentration plus 2 kg of urea. Volume diminution data for single factor treatment is presented in Table 1.

**Table 1.** The average of biomass volume reduction (%) on mass composting with mixed treatment of wet garbage and dry leaf garbage (K) with various starter type (G) on Week 1 - Week 8

| Single Factor Treatment | Week Observation | | | | | | |
|---|---|---|---|---|---|---|---|
| | Week 1 | Week 2 | Week 3 | Week 4 | Week 5 | Week 6 | Week 8 |
| $K_1$ | 10.20 d | 11.40 d | 18.07 d | 24.00 d | 29.73 d | 33.40 d | 39.53 d |
| $K_2$ | 26.20 c | 29.13 c | 34.53 c | 40.00 c | 46.80 c | 48.93 c | 52.13 c |
| $K_3$ | 29.67 b | 32.40 b | 36.27 b | 44.93 b | 51.00 b | 54.00 b | 57.13 b |
| $K_4$ | 37.87 a | 42.80 a | 45.40 a | 53.20 a | 57.80 a | 60.80 a | 63.40 a |
| BNT | 2.25 | 1.50 | 1.80 | 1.56 | 1.42 | 1.50 | 1.42 |
| $G_1$ | 22.70 c | 26.05 c | 31.50 b | 37.10 c | 42.9 c | 45.90 c | 49.95 c |
| $G_2$ | 29.80 a | 31.85 a | 37.30 a | 44.95 a | 51.00 a | 53.35 a | 56.90 a |
| $G_3$ | 25.45 b | 28.90 b | 31.90 b | 39.55 b | 45.10 b | 48.60 b | 52.30 b |
| BNT | 1.95 | 1.3[illegible] | 1.56 | 1.35 | 1.23 | 1.30 | 1.24 |

Note: The average value in a column followed by the same letter is not significantly different based on BNT test 5%

### The Temperature Changes of Mixed Dried Leaf Waste and Market Waste Biomass

Temperature was one indicator that indicated the changes in microorganism activity in decomposing organic matter. Temperature parameters also showed a balance between the heat energy generated during the composting process and the aeration factor. The average data of the temperature of mixed dried leaf waste and market waste biomass is presented in Table 2.

**Table 2.** The average of biomass temperature ($^0$C) on mass composting with mixed treatment of dried leaf (K) and wet garbage with different type of starter (G) from the beginning of the experiment to week 8

| Single Factor Treatment | Week Observation | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Week 0 | Week 1 | Week 2 | Week 3 | Week 4 | Week 5 | Week 6 | Week 8 |
| $K_1$ | 49.3 a | 48.1 a | 43.3 ab | 42.3 a | 40.6 b | 39.2 b | 38.3 b | 35.1 b |
| $K_2$ | 48.4 ab | 47.8 a | 44.6 a | 41.0 ab | 42.3 a | 40.3 a | 39.3 a | 35.3 b |
| $K_3$ | 47.3 ab | 46.9 ab | 42.5 b | 40.5 b | 39.5 b | 40.2 a | 39.2 a | 37.1 a |
| $K_4$ | 46.6 b | 45.0 b | 39.7 c | 39.9 b | 39.9 b | 39.1 b | 38.3 b | 36.8 a |
| BNT | 2.06 | 2.68 | 1.74 | 1.45 | 1.16 | 0.82 | 0.69 | 0.71 |
| $G_1$ | 43.3 c | 45.8 | 41.8 | 40.2 | 39.5 b | 38.8 b | 37.8 c | 38.3 a |
| $G_2$ | 47.1 b | 47.7 | 43.2 | 41.4 | 41.4 a | 41.0 a | 40.0 a | 34.4 c |
| $G_3$ | 53.4 a | 47.4 | 42.8 | 41.2 | 40.9 a | 39.4ab | 38.6 b | 35.5 b |
| BNT | 1.79 | TN | TN | TN | 1.00 | 0.71 | 0.60 | 0.61 |

Note: The average value in a column followed by the same letter is not significantly different based on BNT test 5%

**The pH Changes of Mixed Dried Leaf Waste and Market Waste Biomass**

PH is an important environmental factor for microorganisms for the decomposition of organic matter. During the mass composting period of biomass mixture of leaf waste with market waste in this study, pH was measured 8 times. The complete pH observation data are presented in Table 3.

**Table 3.** The average of biomass pH on mass composting with mixed treatment of wet and dry leaf garbage (K) with different type of starter (G) from the beginning of the experiment to week 8

| Single Factor | Week Observation | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Treatment | Week 0 | Week 1 | Week 2 | Week 3 | Week 4 | Week 5 | Week 6 | Week 8 |
| $K_1$ | 7.60 | 7.82 | 7.90 | 7.87 | 7.80 | 7.80 | | 7.30 |
| $K_2$ | 7.57 | 8.00 | 7.83 | 7.83 | 7.83 | 7.83 | | 6.80 |
| $K_3$ | 7.53 | 7.73 | 7.73 | 7.83 | 7.83 | 7.83 | | 6.97 |
| $K_4$ | 7.70 | 7.71 | 7.63 | 7.73 | 7.67 | 7.70 | | 7.40 |
| BNT | TN | TN | TN | TN | TN | TN | | TN |
| $G_1$ | 7.88 a | 7.80 | 7.83 | 7.85 | 7.83 | 7.83 | | 7.38 |
| $G_2$ | 7.38 b | 7.83 | 7.78 | 7.85 | 52.33 | 7.85 | | 6.95 |
| $G_3$ | 7.40 b | 7.83 | 7.73 | 7.75 | 10.23 | 7.70 | | 7.03 |
| BNT | 0.24 | TN | TN | TN | TN | TN | | TN |

Note: The average value in a column followed by the same letter is not significantly different based on BNT test 5%

**Discoloration**

In the study, the initial color of biomass was fresh green (market waste) turned into yellow and finally changed to blackish brown. Meanwhile, the dry leaf litter changed from brown to dark brown and became blackish brown at the end. Here, the green color is due to the chlorophyll content and the chlorophyll damage and the decomposition of carbon compound then the color turns to yellow and brown. The data of mixed dried leaf and market waste biomass color changes is presented in Table 4.

**Table 4.** The biomass color changes on mass composting with mixed treatment of wet and dry leaf garbage (K) with different type of starter (G)

| Combination | Week observation of the biomass color | | |
|---|---|---|---|
| Treatment | Week 0, 7 May | Week 5, 11 June | Minggu 9, 2 July |
| $K_1G_1$ | brown dried leaves | brown | dark brown |
| $K_2G_1$ | brown dried leaves/ green fresh vegetables | dark brown-brown black | brown black |
| $K_3G_1$ | brown dried leaves/ green fresh vegetables | dark brown-brown black | brown black |
| $K_4G_1$ | brown dried leaves/ green fresh vegetables | brown black | brownish black |
| $K_1G_2$ | brown dried leaves | dark brown | dark brown |
| $K_2G_2$ | brown dried leaves/ green fresh vegetables | dark brown-brown black | black |
| $K_3G_2$ | brown dried leaves/ green fresh vegetables | brown black | brown black |
| $K_4G_2$ | brown dried leaves/ green fresh vegetables | dark brown-brown black | brownish black |
| $K_1G_3$ | brown dried leaves | dark brown | dark brown |
| $K_2G_3$ | brown dried leaves/ green fresh vegetables | dark brown-brown black | brownish black |
| $K_3G_3$ | brown dried leaves/ green fresh vegetables | dark brown | brown black |
| $K_4G_3$ | brown dried leaves/ green fresh vegetables | brown black | brown black |

**The Changes of Biomass Structure**

The biomass structure changes from fresh to soft and fragile conditions are in line with the microbial decomposition process. The most recently revamped tissue is the fibrous tissue of the petiole. The higher the decomposition activity, the faster the biomass becomes fragile and breaks down into fine particles. The data on changes in the biomass structure of leaf waste mixtures with market waste are presented in Table 5. On week 5 observation (four weeks after incubation, the mixed leaf and market waste biomass for all treatments had become fragile even though its forms and tissues were still visible. For the treatment of $K_1$, the structure change was relatively slight; it still looked clear in the form of leaves although the color had changed.

**Table 5.** The biomass structure changes on mass composting with mixed treatment of wet waste and dry leaf garbage (K) with different type of starter (G)

| Combination Treatment | Week observation of biomass texture | | |
|---|---|---|---|
| | Week 0, 7 May | Week 5, 11 June | Minggu 9, 2 July |
| $K_1G_1$ | original dry leaves/wet garbage | strong, intact although it was pressed | strong, intact although it was pressed |
| $K_2G_1$ | original dry leaves/wet garbage | crumbs, broken if it was pressed | crumbs, broken if it was pressed |
| $K_3G_1$ | original dry leaves/wet garbage | crumbs, broken if it was pressed | crumbs, broken if it was pressed |
| $K_4G_1$ | original dry leaves/wet garbage | crumbs, broken if it was pressed | crumbs, broken if it was pressed |
| $K_1G_2$ | original dry leaves/wet garbage | strong, intact although it was pressed | strong, intact although it was pressed |
| $K_2G_2$ | original dry leaves/wet garbage | crumbs, broken if it was pressed | crumbs, broken if it was pressed |
| $K_3G_2$ | original dry leaves/wet garbage | strong, intact although it was pressed | crumbs, broken if it was pressed |
| $K_4G_2$ | original dry leaves/wet garbage | strong, intact although it was pressed | crumbs, broken if it was pressed |
| $K_1G_3$ | original dry leaves/wet garbage | crumbs, broken if it was pressed | crumbs, broken if it was pressed |
| $K_2G_3$ | original dry leaves/wet garbage | crumbs, broken if it was pressed | crumbs, broken if it was pressed |
| $K_3G_3$ | original dry leaves/wet garbage | crumbs, broken if it was pressed | strong, intact although it was pressed |
| $K_4G_3$ | original dry leaves/wet garbage | crumbs, broken if it was pressed | crumbs, broken if it was pressed |

**The Compund Element of the Result of Mass Composting of Mixed Dried Leaf Waste and Wet Garbage Biomass**

The change of C/N ratio becomes the indicator of the decomposition process in composting, i.e. the decomposition of C/N substrates by microorganisms or other decomposer agents. The change of C/N ratio occurs during the composting period due to the use of carbon as an energy source and is lost in $CO_2$ form. Meanwhile, nitrogen is used by microbes for synthesizing the protein and forming body cells, so that the carbon content decreases and the nitrogen content increases. In the study, the data C/N ratios are presented in Table 6.

**Table 6.** The biomass C/N-ratio development data on mass composting with mixed treatment of wet waste and dry leaf garbage (K) with different type of starter (G)

| Single Factor Treatment | Week Observation of C/N-Ratio | | |
|---|---|---|---|
| | Week 0*) | Week 5 | Week 9 |
| $K_1$ | High > 30 | 24.62 | 19.77 |
| $K_2$ | High > 30 | 22.01 | 20.07 |
| $K_3$ | High > 30 | 24.38 | 19.37 |
| $K_4$ | High > 30 | 24.23 | 19.65 |
| | | | |
| $G_1$ | High > 30 | 25.05 | 20.36 |
| $G_2$ | High > 30 | 22.91 | 19.44 |
| $G_3$ | High > 30 | 23.56 | 19.40 |

Source: primary data

**Table 7.** The data of the content of biomass element N, P, and K at the end of mass composting with mixed treatment of wet litter and dry leaf garbage (K) with different type of starter (G)

| Single Factor Treatment | Element Content | | | |
|---|---|---|---|---|
| | C | N-Tot | P ($P_2O_5$) | K($K_2O$) |
| $K_1$ | 19.32 | 0.87 | 0.25 | 0.29 |
| $K_2$ | 19.62 | 0.79 | 0.20 | 0.22 |
| $K_3$ | 18.73 | 0.81 | 0.23 | 0.31 |
| $K_4$ | 18.27 | 0.93 | 0.26 | 0.38 |
| | | | | |
| $G_1$ | 18.65 | 0.89 | 0.25 | 0.32 |
| $G_2$ | 19.86 | 0.78 | 0.22 | 0.27 |
| $G_3$ | 18.46 | 0.89 | 0.24 | 0.32 |

Source: primary data

## IV. Discussion

Based on Table 1 the volume of biomass was stabilized at week 5 with 30-65 percent depreciation rate. Furthermore, for the next 4 weeks, i.e. week 5 to week 9 the additional depreciation was only about 6-10 percent (with depreciation at 40-70 percent in week 9). The volume of wet trash had decreased greater than dry leaf litter, so that the more the portion of wet waste, the larger the volume reduction. However, the starter treatment almost had the same number of about 50 percent. The volume decline was due to the decomposition of microorganisms: the breakdown of cellulose, hemicellulose, fat, and other materials into carbon dioxide ($CO_2$), the aerobic composting reduced the composite material by 50% of its initial weight, and water. With these changes, the weight and contents of the compost base material reduce between 40-60%, depending on the compost base material and composting process (Yuwono, 2005). The decomposition of biomass process of leaf litter and market waste done by microorganisms contained in EM4 which are generally aerobic microorganisms. At this point, the more EM4 ($G_1$) given, the more the volume depreciation and the more oxygen avaibility, the more volume reduction will be.

During the decomposition process, the rate of decomposition of each treatment decreases to the end of composting. This is due to the less available organic material as a result of microbial activity that breaks down organic waste. For this reason, the process of decomposition of the material naturally stops when the limiting factors are not available or have been spent in the process of decomposition itself. During the decomposition process, the compost experiences volume shrinkage of up to 30-40% of the initial volume of compost (Maradhy, 2009). The mixed treatment of wet and dry leaf waste (K) with various starter type (G) was less influenced to biomass temperature. However, generally the initial biomass temperature was high (43.3-53.4$^0$C) and at the sixth week it started to stabilize at the room temperature of around 35-38$^0$C. Here, the higher the temperature, the more oxygen consumption and the faster the decomposition process. According to Ruskandi (2006), in aerobic composting process there are two phases: mesophilic phase which ranged between 23$^0$C-45$^0$C and thermophilic phase ranged between 45$^0$C- 65$^0$C. In this study, it was suspected that active microbes were mesophilic microbes, i.e. microbes that live at the temperatures of 25$^0$C-45$^0$C, minimum 15$^0$ C and maximum 55$^0$ C. The activation of mesophilic microbes in the decomposition process will generate heat by removing $CO_2$ and taking $O_2$ in the compost piles to reach the maximum temperature (Isroi and Yuliarti, 2009). Compost piles that pass through the peak temperature will experience a decrease in temperature or maturation phase, where the concentration of organic material in the composting process is slight in number. In line with this, Hajama (2014) states that the decline in the number and activity of microbes causes no proliferation of the temperature.

At initial observation on the treatment of $S_3B_1$, the pH value was very low that was 2.9, and had gone up to neutral at the following week that was 5.3. Overall, the biomass pH of mixed leaf litter with market waste at the beginning of the study varied greatly with values ranging from 2.9-6.9. However, after three weeks since the starter given, the pH was relatively stable and relatively similar for all treatments with a range of values of 6.7 - 7.4, a range of pH values indicating that the composting process had been completed (the crunching activity had begun to slow down). The optimum pH for the composting process ranges from 6.5 to 7.5. The composting process itself will cause changes to the organic material and the pH of the material itself. The mature of compost pH is usually close to neutral (Widarti, 2015).

The results of biomass color observation for all treatments at the beginning of decomposition average showed that the color change from brown to brownish black. At the first of decomposition process at all treatments had the same color as the raw material that was yellowish or brownish. On week 5 observation (four weeks after incubation) all the treatment had color alteration into dark brown or brownish black, except on K1, the outer leaves were still seen brown dried leaves color. In accordance with SNI standards when the color has become blackened, it is feasible to be used as biomass. The changes in the physical properties of biomass, the color, from brown to brown black are due to the decomposition process done by microbes. Based on the color change indicator, the treatment of $K_4G_1$, $K_4G_2$, $K_2G_2$, and $K_2G_3$ was qualified as biomass and the most feasible was $K_2G_2$ treatment because the color was blackish.

Based on the indicators in the structure of biomass changes, the treatments of $K_4G_1$, $K_3G_2$, $K_4G_2$, and $K_4G_3$ had qualifications as finished compost because the structure was crumb and had been destroyed. Based on Table 6 for all treatment showed a decrease of C/N ratio. In line with this, Isroi (2009) states that during the composting process the value of C/N ratio will continue to decline; mature compost is marked with a C/N ratio of less than 20%. The composting principle is to decrease the C/N ratio of organic matter to the equal ratio of the C/N of soil that is 10-20%. Based on the compost specification of domestic organic waste SNI: 19-7030-2004 that the mature compost also has a C/N ratio of 10-20%.

In the 5th week observation (four weeks after incubation) the highest C/N ratio (still above 20) was in treatment of $B_1$ (biomass was left open) and the $S_1$ treatment was only given an $EM_4$ starter without urea, while for the other treatment the C/N ratio had been below 20 indicating that biomass had turned into a viable compost. Based on the data presented in Table 7 the content of C-total, N-total, P2O5 and K2O between treatments were not significantly different.

## V. Conclusion

Based on the results of data analysis of research variables, the conclusion can be formulated as follows:

1. The reduction of biomass volume on mass composting of the mixture of dry leaf litter with wet garbage significantly occurred in the first two weeks with depreciation ranging from 10-40%, and the volume has been relatively stable during the composting period of five weeks with depreciation ranging from 30-70%. The largest shrinkage occurred in K4G2 treatment shrink by 70%.
2. The biomass temperature on mass composting of the mixture of dry leaf litter with wet garbage rises above 45$^{o}$C in the first two weeks of composting period, and after that it decreases and has the same temperature with atmospheric air below 400C, and there is no difference between treatments.
3. The pH of biomass on mass composting of the mixture of dry leaf litter with wet garbage is very varied in the first two weeks that is around 7.5-8, and become relatively the same starting from week 4 (3 weeks after incubation) with value around 7.0- 7.5.
4. The biomass color change on mass composting of the mixture of dry leaf litter with wet garbage is almost the same for all treatments that is changed from fresh green, yellowing brown, dark brown and become blackish brown at week five (four weeks after incubation). Based on the color change indicator, the treatments of K4G1, K4G2, K2G2, and K2G3 are eligible as compost and the most feasible is K2G2 treatment because the color is blackish.
5. The odor changes on mass composting of the mixture of dry leaf litter with wet garbage is almost the same for all treatments that is changed from the smell of the mixture of dry leaf waste biomass with wet fresh litter, smelly garbage, and it gradually decreases, and finally relatively odorless at the fifth week (four weeks after incubation).
6. The changes in the structure of mass composting of the mixture of dry leaf litter with wet garbage is almost the same for all treatments that is altered gradually from fresh biomass to breakable even for leaf litter is still a fibrous period that has been fragile at week eight. Based on the indicators of changes in the structure of biomass, the treatments of K4G1, K3G2, K4G2, and K4G3 have qualification as finished compost because the structure is crumb and has been destroyed.
7. The changes in C/N ratio of biomass on mass composting of the mixture of dry leaf litter with wet garbage from 33-37 (High), and at week five (four weeks after incubation) the results vary widely have decreased to 20- 27, and decreased again in the eighth week to 18-21.
8. The mass composting of biomass mixture of leaf waste with market litter takes 50 days since incubation period.
9. From a variety of indicators, the recommended treatments become the reference for the preparation of appropriate technology for mass composting of urban organic waste is the treatments of K2G1, K2G2, K2G3, K3G1, K3G2, K3G3, K4G1, K4G2, and K4G3, while the most recommended are K2G2, K3G2, K4G2, and K4G1.

## References

[1] Dahlan EN. 2002. Hutan Kota untuk Pengelolaan dan Peningkatan Kualitas Lingkungan Hidup. Jakarta: Asosiasi Pengusaha Hutan Indonesia.
[2] Darmawan. 2011. Perlunya Cadangan Hutan Kota di Bangka Barat. Bangkapos: http://bangka.tribunnews.com/2011/07/28/perlunya-cadangan-hutan-kota-di-bangka-barat
[3] Foth, H.D. 1991. Dasar-Dasar Ilmu Tanah. Terjemahan oleh Endang D.P.L., Dwi Retno, dan R. Trimulatsih. Gadjahmada University Press. Yogyakarta.
[4] Hakim, N., Y.M. Nyakpa, M.A. Lubis, G.S. Nogroho, Saul R.M., Diha A.M., Hong B.G., dan Bailey N.H. 1986. Dasar-Dasar Ilmu Tanah. Universitas Lampung. Lampung
[5] Hardjowigeno, S. 1995. Ilmu Tanah. PT Media Tama Sarana Perkasa. Jakarta.
[6] Isroi dan N. Yuliarti, 2009. Kompos. Penerbit ANDI. Yogyakarta
[7] Maradhy, E., 2009. Aplikasi Campuran Kotoran Ternak dan Sedimen Mangrove Sebagai Aktivator pada Proses Dekomposisi Limbah Domestik. Tesis. Universitas Hasanuddin. Makassar
[8] Nguyen, V.V. 1973. Report on the Aquatic Weed Problem of the Brantas River Multipurpose Project. Kumpulan Laporan III. Masalah Biologi Perairan. Aquatic Weed. Bogor.
[9] Samsoedin, I & Subiandono E. 2007. Pembangunan dan Pengelolaan Hutan Kota. Prosiding Ekspose Hasil-Hasil Penelitian
[10] Sarief. 1989. Kesuburan dan Pemupukan Tanah Pertanian. Pustaka Buana. Bandung.
[11] SNI.2004. Standar Kualitas Kompos. http://www.pu.go.id/balitbang/sni/buat%20web/RSNI%20CD/ABSTRAKS/Cipta%20Karya/PERSAMPAHAN/SPESIFIKASI/SNI%2019-7030-2004.pdf.
[12] Solihah. 1995. Pengaruh EM 4 terhadap Pertumbuhan. http://dwiantoerwin.blogspot.com/2012/09/ pengaruh-em-4-terhadap-pertumbuhan-dan.html)
[13] Sudarto.1979. Pengaruh Pemeliharaan Ikan Koan (Ctenopharyngodon idella) dan Ikan Nila (Tilapia nilotica) terhadap Pertumbuhan Net Plankton pada Perairan yang Ditanami Gulma Air dan Diberi Pakan Hydrilla. Tesis. Fakultas Pertanian Institut Pertanian Bogor.
[14] Sutanto, R. 2002. Penerapan Pertanian Organik. Pemasyarakatan & Pengembangannya Penerbit Kanisius. Yogyakarta.
[15] Talatala, R.L. 1976.Biologi of Eichornia crassipes(Mart.) Solms. IV. BIOTROP Weed Sci. Train. Cour. April 19May 28, 1976.Los Banos. Philipines.
[16] Widarti, BN; Wardhini, WK; Sarwono, E. 2015. Pengaruh Rasio C/N Bahan Baku Pada Pembuatan Kompos Dari Kubis Dan Kulit Pisang. JURNAL INTEGRASI PROSES. Website: http://jurnal.untirta.ac.id/index.php/jip.
[17] Yuwono Dipo. 2005. Kompos. Seri Agritekno. Jakarta. Jurnal Sains dan Teknologi 7 (2), September 2008: 58-61.

Dwi Haryanta The Development of Mass Production Technique of Urban Dry Leaf Litter and Wet Garbage Biomass." IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS), vol. 10, no. 10, 2017, pp. 01-06.

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