RATE AND QUALITY OF DECOMPOSITION CAJEPUT WASTE WAS 2018

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RATE AND QUALITY OF DECOMPOSITION CAJEPUT WASTE WAS EFFECTED BY BIOACTIVATORS

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Abstract – Cajeput waste has the potential to source compost but has high C/N and essential oils so that decomposition naturally takes a long time. The objective of the study was to find an appropriate method in the decomposition of Cajeput waste through the addition of bioactivators. The bioactivators used are *Aspergilus*, *Trichoderma*, a combination of *Aspergilus + Trichoderma* and MA-11. *Aspergillus* and *Trichoderma* were obtained by isolation from Cajeput waste, while MA-11 was a bioactivator from outside the Cajeput waste. The study was conducted using a complete randomized design with five treatments and three replications. Observation parameters were C, N, C/N, P and K levels. The results showed that the addition of bioactivator can accelerate the process of decomposition of Cajeput waste. The decomposition of Cajeput waste with the addition of bioactivator takes 10 weeks, whereas without bioactivator takes more than 12 weeks. The best bioactivator is *Trichoderma*, capable of producing compost fertilizer with N content of 1.56 ± 0.10%, K of 1.02 ± 0.10% and C / N of 16.58 ± 2.37.

INTRODUCTION

Cajeput waste has the potential to be developed as a compost raw material with total of production 7.720 tons/year of wet season leaves. The process of producing Cajeput oil can produce solid waste in the form of residual twigs and leaves that have undergone a distillation process. The utilization of waste distillation has been used only for the fuel of factories whose needs are only slightly (20%), while the rest are still not utilized so that the number of days is getting more and more.

The waste of untreated Cajeput leaves will be constrained, that is, fisrtly, it takes a large space to accommodate. Second, waste materials are easily burned, so it can disrupt the activity in the environment. Thirdly, undecomposed waste will produce a lot of CO_2 resulting in environmental pollution (Uchida *et al.*, 2005). Cajeput waste has the potential to be used as raw material for making organic fertilizer, by way of microbial utilization capable of composting the material.

Cajeput waste containing high C/N rasio, but it can be degraded by the addition of fungi and bacteria. Fungi can degrade leave of bamboo with high C/N is *Trichoderma* (Wagh and Gangurde, 2014), and then Li *et al.* (2018) states that *Aspergillus* can decompose rice straw that has a high C/N ratio. In addition to fungi, the decomposition of organic materials that have a high C/N can also be done by bacteria, one of which is MA-11. Each decomposer agent has different capabilities in enhancing the decomposition process. Therefore, in this research will be examined the ability of some bioactivators to improve the decomposition process so that the decomposition time can be accelerated.

This research is useful to help solve the problems faced by Cajeput industry in waste management. Waste that has not been exploited because constrained by the difficulty of decomposed material will be solved by found decomposer agent that is able to accelerate the decomposition process.

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In this study obtained decomposer agent of *Trichoderma* which has the ability to accelerate decomposition and decomposer agent can be obtained from plant waste disposal land.

MATERIALS AND METHODS

The research was conducted with the waste material obtained from the Cajeput industry of KPH Sukun in Sidoharjo Village, Pulung District, Ponorogo Regency. The study sites are located at 111°30 '- 111°36' east longitude and 7°50 '- 7°54' south latitude. The altitude is 200 - 350 m above sea level. The decomposition process is done in Brotonegaran village, Ponorogo regency, 13 km from the location of the land agroforestry Cajeput.

The decomposition activator test was performed using a complete randomized design with 3 replications. Place decomposition using a box measuring 40 cm x 100 cm x 35 cm. Composting with activator *Aspergilus niger* (D1), Compost with activator *Trichoderma asperellum* (D2), compost with mixed activator *Aspergilus niger* and *Trichoderma asperellum* (D3), compost with activator MA-11 (D4), control (D0). Waste material was destroyed weighed 10 kg, then put into decomposer box and given activator of 1 liter with fungi content of 2×10^9 cfu. The humidity inside the box is kept 80%. C/N ratio of decomposition results was observed every 2 weeks to 12 weeks. At the end of the decomposition determined the content of N, P, K and C/N ratio.

The compost sample for C, N, P, K analysis is taken from the composition box. The compost sample was dried in an oven at 80 ° C, then crushed and stored before tissue analysis. The N analysis was performed using the Kjeldah method, P analysis using a spectrophotometer, and K using a flamephotometer.

Analysis data was done by using ANOVA with SPSS 16 program. If there is a significant difference then analysis continued with LSD test to find the difference between treatment

RESULTS

Decomposition process

The decomposition process can be determined from carbon content and C/N ratio. In this study showed that the carbon content in compost each bioactivator treatment decreased. The declinet carbon occurs at 2 weeks to 6 weeks is high, after which the decline is slow. *Aspergillus* bioactivators resulted in the lowest decrease in carbon content, the highest decrease in carbon content caused by the addition of MA-11 bioactivators at the beginning and end of the study (2 - 4 weeks and 10 weeks) (Figure 1). Levels of C/N ratio also decreased with increasing time of decomposition from week 2 to week 12. Treatment of *Aspergillus* biaoctivator resulted in the lowest decrease in C / N, whereas the highest decrease was due to *Trichoderma* bioactivator treatment from week 6 to week -12 (Figure 2). The addition of bioactivator from the market (MA-11) can be done to accelerate the decomposition process but its ability is lower than the bioactivator derived from the isolation of the fungi from the Cajeput waste, especially *Trichoderma*. Fungi capable of producing cellulase enzymes that can break the bond on the cellulose compound so it becomes a simpler compound so easily decomposed. Enzymes that can be produced by cellulotic fungi are enzymes endogluconase, exogluconase and fi-gluconase (Gottscalk *et al.*, 2010)

The pattern of N content in the process of decomposition of Cajeput waste showed an increase at up to 4 week, then there was a decrease

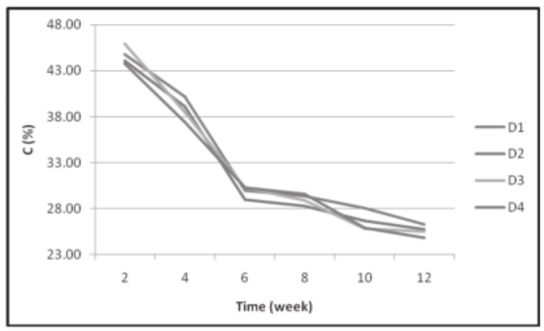

Fig. 1. Carbon level

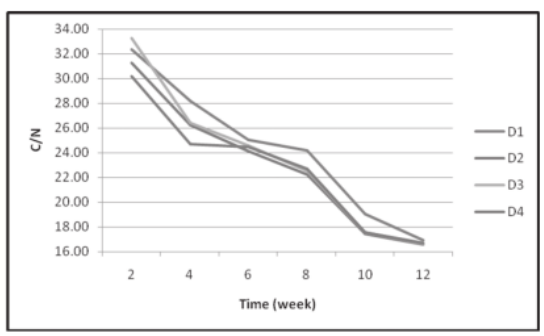

Fig. 2. C/N

at 6 week and after that increase to 12 week on all bioactivators. *Aspergillus* bioactivators cause the lowest N levels from start to 10 week, whereas at 12 weeks it is caused by bioactivator MA-11. The highest level of N at the beginning of observation (2 weeks to 8 weeks) was due to the addition of MA-11 bioactivator but at the end of observation (10 weeks to 12 weeks) caused by the addition of *Trichoderma* bioactivator (Figure 3)

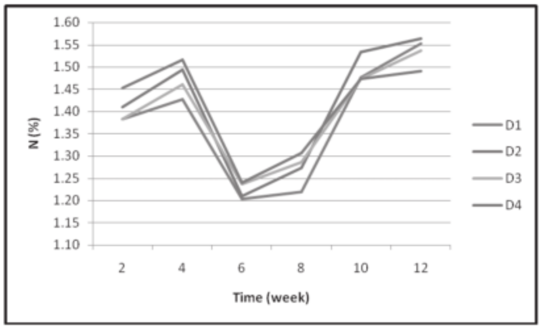

Fig. 3. N level

Quality of compost

The quality of the compost can be determined from the macro nutrient content (N, P, K) and C/N ratios. The addition of bioactivators can improve compost quality compared to without bioactivators. The control treatment has a C/N ratio of 21.2, the value is higher than the standard compost level for organic fertilizer that is C/N ratio of 20. The best compost quality is caused by the addition of *Trichoderma* bioactivator, because the treatment has the lowest C/N, K highest compared to other bioactivators.

DISCUSSION

Decomposition of organic matter is influenced by substrate characteristic, microbial activity, temperature and moisture content (Bania *et al.*, 2018). In this research, Cajeput waste before decomposition is done destruction and addition of urea. Destruction of 2 mm diameter dust material to reduce the size of the waste Cajeput, the smaller the particle size caused faster the decomposition process (Garcýa-Palacios *et al.*, 2016). While the addition of urea is done to accelerate the activity of cellulotic microorganisms in the decomposition process (Wild *et al.*, 2014; Kint *et al.*, 2016), but the addition of excessive nitrogen will reduce the activity and biomass fungi (Frey *et al.*, 2014). Waste Cajeput was maintained 80% also contributes to the increase of decomposition rate, since the decomposition of organic matter depends on moisture content (Sierra et al., 2015).

Bioactivators obtained from waste are more effective than market bioactivators. This is related to the composition of microbes present in the compost. This is supported by Cleveland *et al.*, (2014) which states that the microbial composition will affect the speed of decomposition. Microbes derived from fungi isolation from Cajeput waste are more adaptable than microbes outside Cajeput waste.

The most effective bioactivator in decomposing waste of Cajeput oil industry is *Trichoderma*. In this study *Trichoderma* bioactivator was able to decrease the C/N ratio of Cajeput waste from 39.78 to 16.94 on for 12 weeks of decomposition process. This result is similar to that of Siddiqueea *et al.* (2017) that *Trichoderma* was able to decompose the litter of the bamboo (C/N 45.77 to 16.79) and Galindez *et al.*, (2017) states that *Trichoderma* can be used as a bioactivator in composting from rice straw and manure. The ability of *Trichoderma* as decomposer oforganic materials depends on the species. *Trichoderma* SICC strains more effectively decompose than strain 11B in decomposing subtracts of the coconut oil industry, Kinabatangan, Lahad Datu, Sabah Malayisa (Siddiquee *et al.*, 2017).

The quality of compost from Cajeput waste with the addition of *Trichoderma* has a higher quality than that of the industrial waste of coconut oil with 0.90%

Table 1. Quality compos

	C (%)	N (%)	P (%)	K(%)	C/N
D0	29.78±0.52 b	1.41±0.02 a	1.15±0.09 a	0.56±0.03 a	21.12±0.46 a
D1	26.34±2.65 a	1.55±0.04 b	1.99±0.12 b	0.89±0.09 b	16.94±1.38 b
D2	25.77±2.17 a	1.56±0.10 b	2.11±0.03 b	1.02±0.10 b	16.58±2.37 b
D3	25.50±0.27 a	1.54±0.05 b	2.13±0.03 b	0.80±0.22 ab	16.61±0.66 b
D4	24.85±0.71 a	1.49±0.04 a	2.18±0.05 b	0.92±0.18 b	16.68±0.58 b

Data followed by the same letter in the same column show insignificant difference (P<0.05). D0: untreatment bioactivator, D1: *Aspergillus*, D2: *Trichoderma*, D3: *Aspegillus* + *Trichoderma*, D4: MA-11.

Nitrogen content (Siddiqueea *et al.*, 2017) but lower than compost from rice straw with 2.67% nitrogen (Galindez *et al.*, 2017)

CONCLUSION

The addition of bioactivators to the decomposition process of Cajeput waste can increase rate and quality of the compost. The best bioactivactors are *Trichoderma* which can accelerate the decomposition process by 8 weeks and the highest quality with N concentration of 1.56 ± 0.10%, K of 1.02 ± 0.10

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