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USE OF SPORA STARTER AND ENZYME STARTER TRICHODERMA SPP. IN THE PREVENTION OF PALM OIL EMPTY WASTE

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ABSTRAK

Palm oil (*Elaeis guineensis* Jack.) Is the most popular oil-producing plant in Indonesia. The oil palm used by factories is only in the form of fruit flesh and fruit seeds. While oil palm empty fruit bunch waste is generally disposed of or burned by the company. This huge amount of oil palm empty fruit bunch waste will cause problems, so that good management is needed. Oil palm empty fruit bunches contain compounds such as cellulose, lignocellulose and hemicellulose which can prolong the decomposition process. One alternative to managing coconut empty bunches waste is by reducing the weight of waste. Based on this, it is necessary to add starter spores and starter enzymes using *Trichoderma* spp. mold which can accelerate the decomposition process of oil palm empty fruit bunches. After the weight of empty palm oil bunches waste has decreased, then the waste can be used as compost. Based on the results of the reduction in the weight of oil palm empty fruit bunches using products enzyme starter and spore starters, it is seen that enzyme starters are better at reducing the weight of oil palm empty fruit bunches waste. C/N ratio ratio contained in oil palm empty bunches by giving starter spores and starter enzymes after composting for 2 weeks by giving an enzyme starter as much as 11.08%. Whereas C/N ratio with spore starter is 15.95%.

KEYWORDS: *Trichoderma* spp., Starter Spores, Enzymes Starter, Weight Loss.

INTRODUCTION

Palm oil (*Elaeis guineensis* Jack.) Is the most popular oil-producing plant in Indonesia. Based on the area of oil palm plantations in Indonesia in 2017, it covers 4,756,272 hectares, while for West Sumatra the area of oil palm plantations reaches 202,831 hectares with production of 1,333,485 tons.[1] The oil palm used by the company is only in the form of fruit and fruit seeds. Whereas for oil palm waste is disposed of or burned by the company.

Soid waste produced from the processing of oil palm fresh fruit bunches consists of oil palm empty fruit bunches, shells or shells, fibers or fibers, sludge or palm oil sludge and cake.[2] For each ton of fresh fruit bunches that have been processed to produce empty oil palm bunches which are between 190-240 kg or about 19-24% of fresh fruit bunches. The empty oil palm bunches produced will be disposed of in the oil palm plantation area.[3] So that the amount of waste in the form of empty oil palm bunches does not cause problems, so it needs good management in its management. One alternative to managing coconut empty bunches waste is by reducing the weight of oil palm empty fruit bunches waste.

Oil palm empty bunches also contain cellulose 43-44%, hemicellulose 34% and lignin 17-20%.[4] Cellulose content is the cause of the length of oil palm empty bunches to be degraded in the process of decreasing the weight of the waste. The degradation process of oil palm empty bunches naturally requires a very long time which is around 3 months.[5] The length of time needed for the degradation process of oil palm empty fruit bunches will cause problems, because the longer the process of integrating waste takes place, the more area needed to accommodate oil palm empty fruit bunches waste, besides the costs incurred for the destruction of oil palm empty fruit bunches waste. will get bigger. To solve these problems, a proper waste degradation technique is needed so that the weight loss process can run optimally.

Based on this matter, it is necessary to add the prick using *Trichoderma* spp. mold which can accelerate the degradation process of oil palm empty bunches. The process of degradation of waste needs to be added by mold, including *Trichoderma* spp.[6] Molds are the most effective way of degrading waste compared to bacteria. The selection of molds in degrading cellulose waste is based on several provisions, including not having toxic, easy to apply, cheap products and less costs.[7] Some types of mold that can decompose cellulose include *Trichoderma* spp.[8]

Starters added to reduce the weight of empty oil palm bunches waste include starter spores and starter enzyme of *Trichoderma* spp. Products that are made ready to be used to reduce oil palm empty fruit bunch waste are one of the practical ways of applying them in the form of pellets and tablets in the processing of oil palm empty fruit bunches in oil palm plantation areas.

MATERIALS AND METHODS

Production of Stater Spores and Enzymes Stater

Trichoderma spp. starter spores are produced in the form of 4-5 mm pellets. The formed pellets are ready to be dried using dry air, for starter spore specifications with wind dry treatment, viability (17 x 107 propagul/gram), pH (4.8), and cellulase activity (2.53 umol/g). Then the *Trichoderma* spp. spore starter is ready to be tested. While for the starter enzyme production *Trichoderma* spp. is in the form of tablets measuring 2-3 cm. The formed tablets are ready to be dried using wind drier, for starter enzyme specifications with dry wind treatment, viability (12 x 107 propagul/gram), pH (4.7), and cellulase activity (3.55 umol/g) then the *Trichoderma* spp. enzyme is ready to be tested.

Decreasing Weight Weight of Oil Palm Empty Bunches

To measure the decrease in weight of oil palm empty fruit bunch waste by weighing the initial weight of oil palm empty fruit bunches waste and reducing the final weight of oil palm empty fruit bunches waste which has been given a spore starter and enzyme starter, then composted for 2 weeks.

RESULTS AND DISCUSSION

Reducing the weight of oil palm empty bunches waste was measured by weighing 100 grams of palm oil empty fruit bunch waste that had just been taken from the palm oil mill. The empty oil palm bunches taken are bunches that have just come out of the fresh fruit press machine and are still warm, so it takes one day to cool the empty palm oil bunches. After the empty bunches have cooled, the bunch is weighed as much as 100 grams and 10 grams of starter spore and starter enzymes are added with the dry treatment of the wind, then put into a clear glass and covered with newsprint tied with rubber bands. Next observe the activity of dry wind in degrading oil palm empty fruit bunch waste for 2 weeks. After two weeks it was seen that the weight loss of oil palm empty fruit bunches at the initial weight was reduced by the final weight and calculated C/N ratio for the highest reduction in waste in the treatment of spore starter and enzyme starter. The results of the reduction in the weight of oil palm empty fruit bunches by giving a spore starter and starter of dry wind treatment enzymes can be seen in the following table.

Table 1: Decrease in the weight of oil palm empty bunches waste by the Spora starter product and the Enzyme starter of *Trichoderma* spp. isolates T-DM (land around oil palm trees Dhamasraya) with 3 drying treatments after 2 weeks of composting.

Product	Treatment	Decreasing the Weight of Empty Bunches /100 grams
Spore Starter	Dry Wind	63,8%
Enzyme Starter	Dry Wind	65,3%

Based on the value of C/N ratio on oil palm empty fruit bunch waste by giving a spore starter and the starter enzyme *Trichoderma* spp. with dry wind treatment can be seen in the following table.

Table 2: Value of C/N ratio in oil palm empty fruit bunch waste by giving products of Starter Spores and Starter Enzymes to dry wind treatment.

Product	Parameter	Early TKKS (%)	Compost (%)	SNI	
				Minimum	Maximum
Spore Starter	C	30,15	21,37	9,80	32
	N	0,99	1,34	0,40	-
	C/N	30,45	15,95	10	20
Enzyme Starter	C	30,15	15,84	9,80	32
	N	0,99	1,43	0,40	-
	C/N	30,45	11,08	10	20

Based on the results of Table 1. the decrease in the weight of oil palm empty fruit bunches waste using starter spore products and enzyme starters with 3 drying treatments showed different results. In the starter product of the enzyme with dry treatment the wind gave a weight loss value of (65.3%). Whereas the decrease in oil palm empty fruit bunch waste by giving a starter spore with the treatment of dry wind as much as (63.8%). Decreasing the weight of empty bunches waste is closely related to the growth of *Trichoderma* spp. mycelium which grows on oil palm empty fruit bunch substrate.

Based on the results of the reduction in the weight of oil palm empty fruit bunches using enzyme starter products and spore starters, it is seen that enzyme starters are better at reducing the weight of empty palm oil bunches waste. This is because the enzyme product at the time of making the product already has enzymes contained in the product, so that when applied to empty oil palm bunches waste these enzymes directly work in breaking down cellulose with the help of cellulase enzymes. Whereas in the starter spore product, *Trichoderma* spp. mold must break down the spores into mycelium first in oil palm empty bunches waste. After the mycelium develops in oil palm empty bunches then the enzymes found in *Trichoderma* spp. work to solve oil palm empty fruit bunch waste.

When *Trichoderma* spp. mold mycelium attaches to oil palm empty bunches waste, mold will release enzymes. The work of enzymes requires a little oxygen to activate enzyme activity and to form spores by mold. During the process of degradation the enzyme will work like a lock and key mechanism. The decrease in the weight of oil palm empty fruit bunches waste is caused by the active enzyme that contains the product enzyme starter and starter spore given to the substrate. The enzyme activity basically produces CO_2, H_2O, energy. The resulting sugar from enzymatic lysis will be utilized by *Trichoderma* spp. for further growth. While the results of enzyme activity will free most of the water and substances contained in the substrate tissue, this will also trigger a decrease in the weight of oil palm empty fruit bunches waste.

Decreasing weight in oil palm empty fruit bunches begins with sticking the mold mycelium to the substrate and the fungus secretes enzymes that can degrade the waste. The process of enzyme activity in degrading waste begins with the activity of the enzyme endo-1,4-β-glucanase cutting off the amorphous part, ekso-1,4-β-glucanase cutting the end of the cellulose chain to become reducing sugar. The fungus is used for further growth.[9] Cellulase enzymes are produced from the fermentation process, the factors that influence the work of cellulase enzymes include pH, water content, and fermentation time.[10]

The pH value on the media before the mycelium grows is higher than when the mycelium has grown. It shows that the mycelium can reduce the pH value at the time of composting. The growth of mycelium will change the pH value of growing media, this is due to the process of reforming lignosellulose and other organic compounds that can produce organic acids.[11]

Cellulose waste has a compound with a long structure, so it takes microorganisms that can decide on these compounds by utilizing cellulase enzymes found in *Trichoderma* spp. mold known as the most potential mold compared to other molds in solving cellulose.[12] Factors that influence the duration of cellulose waste composting process are caused by the lignin component found in the substrate. Lignin physically wraps and binds cellulose, so that the cellulase enzyme works less optimally on the substrate and makes it long in reducing the weight of waste.[9]

Mycelium growth at the time of composting takes place in an anaerobic state so that oxygen is still needed, but in small amounts. So that within 3 days the compost needs to be reversed and the compost cover is opened, at that time removing CO2 and entering oxygen. Decreasing oxygen serves to increase the growth of mycelium, but if there is no oxygen, the mycelium cannot grow.[11]

In addition, the quality of the compost produced by empty bunches can be determined by calculating the C/N ratio. C/N ratio is one indicator of the quality and maturity of the composting process. The decomposition process that occurs in composting requires organic C for energy fulfillment and growth, while N is used to fulfill protein as a metabolic cell building agent. The most effective C/N ratio in the composting process ranges from 30-40. Microbes will break down compound C as an energy source and use N to carry out protein synthesis.[13] So to measure the C/N ratio first calculate the C/N ratio on the initial substrate before the application and end after harvest. The measurement of C/N ratio only counts on samples with the best results based on the results of the weight reduction of oil palm empty fruit bunches waste using starter spore granules and starter enzymes obtained the best results, namely by treating the wind dry.

Based on Table 2. It can be seen the C/N value of the ratio contained in oil palm empty bunches by giving starter spores and starter enzymes after composting for 2 weeks. The best C/N ratio is at the C/N ratio by giving an enzyme starter product as much as 11.08%. Whereas C/N ratio with spore starter is 15.95%. The most effective C/N ratio is in the range of 10% - 20%.[14]

A high C/N ratio in compost raw materials will cause the composting process to be slower. C/N ratio is composed of organic C and Nitrogen (N) values. Nitrogen functions in decomposing compost materials and the development of compost microorganisms (Purnomo et al., 2017). When the process of composting the C/N ratio will decrease, the decrease in C/N value is caused by several factors including the maturity of the fertilizer and compost material used. Decreasing the value of organic C is caused by mature compost and decomposition continuously, causing the nitrogen content to increase with the formation of ammonia released in the air. The cause of the decline in organic C compounds is caused by the activity of microorganisms that utilize carbon compounds as a source of energy for the composting process.[15] In addition, with the decrease in C-organic compounds, the N compound will increase when composting. After organic matter is completely degraded, these organic materials will produce a number of proteins and amino acids which break down into ammonium ($NH4^+$) or Nitrate (NO_3^-) which will produce large proteins.[16]

CONCLUSION

Use of the starter enzyme *Trichoderma* spp. dry wind treatment can reduce the weight of oil palm empty fruit bunches waste (65.3%), while by giving *Trichoderma* spp. dry wind treatment can reduce waste as much as (63.8%). The C/N ratio of starter spores with dry treatment of wind was 15.95% and for C/N ratios by giving a starter enzymes of treatment dry wind 11.08%.

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