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EMPTY RECEMUS OF OIL PALM AS SOURCE OF ORGANIC FERTILIZER WITH BIO-ACTIVATOR ON SOYBEAN PLANTS

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ABSTRACT: *Objective of the research was to create bio-activator as decomposer in empty recemus of oil palm. The research was conducted for two years, however, in the first year, two types of bio-activators were made of different materials using fruit's wastes and banana's capitulum. Then, the organic fertilizers were made of empty recemus of oil palm by the assistance of bio-activator. In the second year, the organic fertilizers were applied on the cropland of soybean plots. Such bio-activator was taken the banana plant, in which the fruits had been taken (harvested), while the fruit's wastes were obtained from the fruit's sellers. The bio-activator was made at the Laboratory of Agronomy, State Polytechnics of Agriculture, Samarinda. Such bio-activator was made through fermentation. A ton of empty recemus was taken from waste of the oil palm's mill. Such empty recemus were chopped and given the bio-activator evenly, and then fermented until they are ready to be used. Results of the research on tankos compost from MOL of fruits showed low nutrients level, such as : N 0.25 %, P2O5 0.19 % , K2O 0.82 %, MgO 0.22 %, Pb 188.74 %, Ca 6. 29 %, Cu 33.56 %, Zn 57.40 %, Fe 1744.60 % , Mn 72.42 % and result of tankos compost from MOL of banana's capitulum have still showed relatively low nutrients level, such as : N 1.25 %, P2O5 0.27 %, K20 0.94 % , MgO 0.23 %, Pb 425,66 %, Ca 6.95%, Cu 27.52 % , Zn 59.49 % , Fe 3593.20 % , Mn 77.95%. Results of the bacterial identification on MOL of fruits and MOL of banana's capitulum showed one type of bacteria for fruit MOL, such as Bacillus sp., and the banana's capitulum MOL, such as Enterobacter sp.*

KEYWORDS: *Empty Recemus of Oil Palm, Bacillus* sp., *Enterobacter* sp.

INTRODUCTION

One of the main problems in agricultural development is the continuation of degradation process of the farming land. Such degradation of farming land resources include the decreasing physical, chemical, and biological fertility of the soil due to over intensive use of the soil, decreasing organic fertilizer use, and lack of implementation on conservation farming operation. Development of the oil palm production in Indonesia keeps increasing, and automatically, the solid waste of empty recemus of oil palm would increase as well, due to the production of empty recemus is almost comparable with the amount of raw palm oil production, 23% of the fresh fruit recemus. The oil palm mill by the capacity of 30 tons fresh fruit per hour could produce 100 tons of empty recemus. Developing a million hectare of oil palm estate at the East Borneo is one of the agricultural development programs, which has been proclaimed since 2003. In 2011, the planted area has covered 827,347 hectares with fruit production of 4,471,546 tons. Along with the development rate and production of oil palm, solid waste management for empty recemus of oil palm is highly required.

High production of empty recemus of oil palm would be valuable if it is utilized as organic fertilizer (compost). One of alternatives utilizing the empty recemus of oil palm is to be used as organic fertilizer through decomposing **(Fauzi *et al*., 2002)**.

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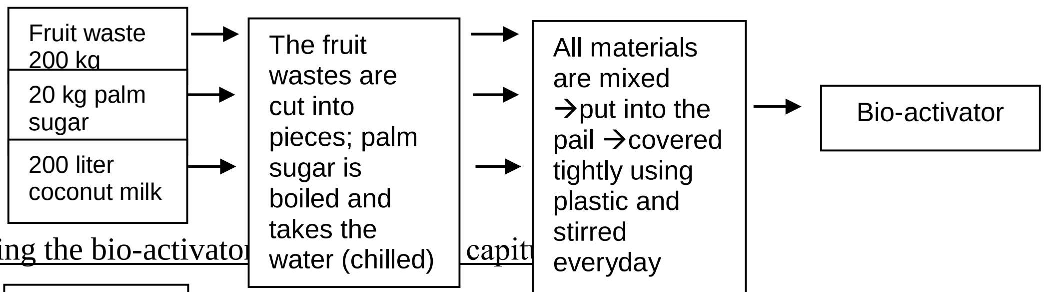
Longer duration (6 months) during decomposition of empty recemus would create some problems because they keep piled up and if they are applied directly, it takes longer for the plant to absorb them, and they would also become the breeding place of pest. Efforts to accelerate the decomposition process could be done using the appropriate reorganized bio-activator of organic material. In order to fulfill the domestic demand, Indonesia has still imported 40% on the average of the national demand for soybean, which keeps increasing year-by-year, whereas, the domestic production has still relative low and tends to decreasing. It causes some dependence upon the imported soybean, which keeps increasing. As a whole, during the last 3 years, the national imported soybean has tended to increase 8.59%.

MATERIALS AND METHODS

The research was conducted at four locations, which included the Laboratory of Agronomy, State Polytechnics of Agriculture, Samarinda (making of the bio-activator, Laboratory of Production, State Polytechnics of Agriculture, Samarinda (making of organic fertilizer). Equipments used in this research included: plastic drum by capacity of 200 l of water, scales, chopping machine, and fermented container made of wood, as well as stirring tool. Meanwhile, materials of the research used waste water of rice, coconut milk, banana's capitulum, fruit wastes, palm sugar, empty recemus of oil palm, and plastics.

Implementation of the Research

Making the bio-activator of fruit waste



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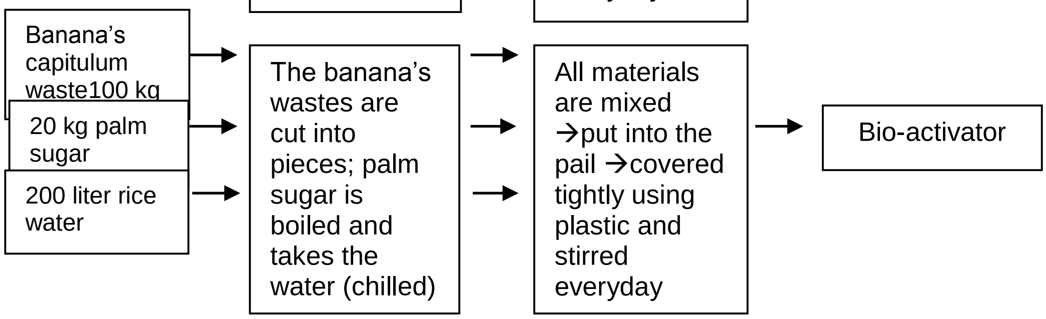

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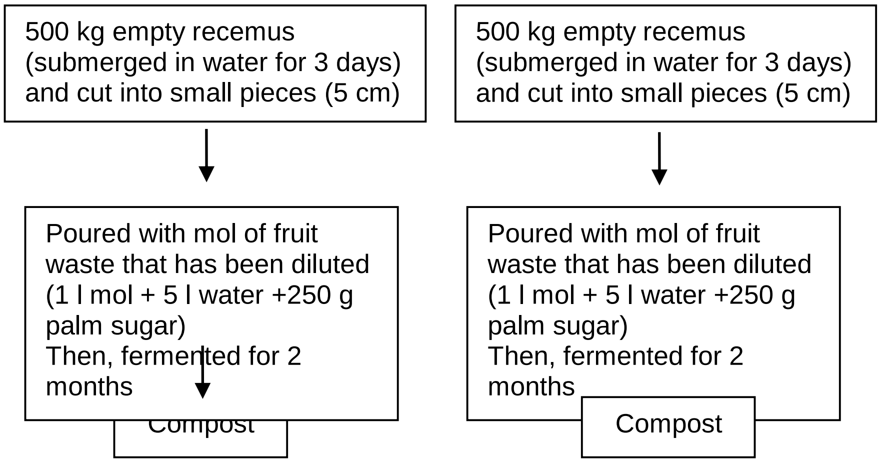
Making the empty recemus compost



Observation

Observation in the first year was to analyze the content of nutrients and C/N in both composts of oil palm's recemus with bio-activator of fruit waste and banana's capitulum, while in the second year was to analyze the nutrients in compost of the empty recemus of the oil palm.

Data Analysis

Data analysis of the research was used descriptively by comparing the analysis results of compost from both bio-activators in accordance with regulations of the Agricultural Ministry number 70/Permentan/SR.140/10/2011, whether it has met the given standard or not.

RESULT AND DISCUSSION

Result

A. Result of the Research

Making the mol

Based on the implementation in making the mol, it is made of banana's capitulum, which is mixed with waste water of rice and mol that is made of fruit waste and coconut milk. Results of the physical observation on making the mol are presented in Table 1 and Table 2 as follow :

Table 1. Data of observation in Making Mol of Banana's Capitulum and Waste Water of Rice.

No	Observation	Before fermentation	After fermentation
1	Smell	No smell	Smell likes fermented rice
2	Color	Yellow	Brownish yellow and mycelium threads

Table 2. Data of observation in Making Mol of fruits and coconut milk.

No	Observation	Before fermentation	After fermentation
1	Smell	No smell	Smell likes fermented rice
2	Color	Yellow	Brownish yellow and white threads

Based on Table 1 and 2 above, the making of both mol were good enough because at the fourth day, white threads emerged on mol's surface. These were due to each of the applied materials of

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the mol has played its own function and benefit, in which their energy sources such palm sugar is adequate, as well as the carbohydrate sources to fulfill the microorganism life that are expected to be derived from fruit and banana's capitulum wastes.

Nutrient analysis on mol of fruits and banana's capitulum

Based on result of the analysis for nutrients on both mol is presented in Table 3 below :

Table 3. Result of the nutrient analysis on mol of banana's capitulum and fruits wastes

No	**Parameter**	**Method**	**Unit**	**Result for mol of banana's capitulum**	**Result for mol of fruits**
1	Total N	Kjeldaji	%	0.03	0.07
2	P2O5	Spectronic	ppm	7.28	0.29
3	K2O	AAS	ppm	971.17	945.05
4	CaO	AAS	ppm	219.38	366.64
5	MgO	AAS	ppm	82.66	120.30

Source : Laboratory of Soil Science. 2014. Result of the Bio-activator Analysis on banana's capitulum and Banana's Capitulum Waste. University of Mulawarman. Samarinda.

Based on result of nutrient analysis for mols of fruit wastes and banana's capitulum, content of the nutrients are very small, and it is presumed that microorganisms in both mols have taken such nutrients as their foods to survive. Mol of the banana's capitulum contains bacteria of *Lactobacillus* sp., *Pseudomonas* sp., *Azospirillium, Azotobacter, Bacillus, Aeromonas, Aspergillus,* microbial phosphate solvent and cellulosic microbial. However, one of such mol's functions from fruit wastes becomes as decomposer of the organic materials or in making compost.

Identification of microorganism on mols of the fruit and banana's capitulum wastes

Based on result of identification, there was a bacteria for each mol, which is presented in Table 4 below :

Table 4. Results of the bacterial identification on MOL of the fruits and MOL of the banana's capitulum

MOL of Fruits	MOL of Banana's Capitulum
Bacteria : *Bacillus* sp	Bacteria : *Enterobacter* sp

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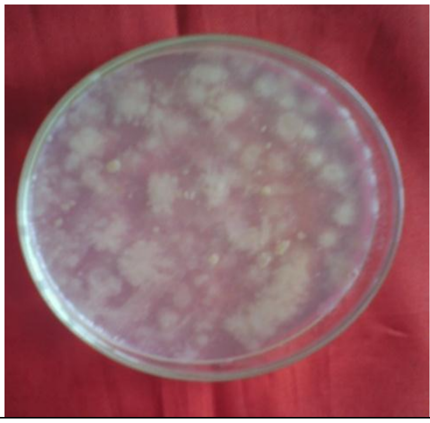
Pure culture of fruits

Pure culture of banana'a capitulum



Bacteria are organism, which have the widest spread in the nature. Mol of the banana's capitulum contains bacteria of *Lactobacillus sp*, *Pseudomonas sp*, *Azospirillium*, *Azotobacter*, *Bacillus*, *Aeromonas*, *Aspergillus*, microbial phosphate solvent and cellulosic microbial. However, one of such mol's functions from fruit wastes becomes as decomposer of the organic materials or in making compost.

Nutrient Analysis on compost fertilizer of empty recemus of the oil palm

After the compost fertilizer is ready to be used, a chemical analysis could be done on some macro-and-micronutrients. Results of the analysis on those nutrients are presented in Table 5 below.

Table 5. Results of the nutrient analysis on compost of the empty recemus of the oil palm with bio-activator mol of the banana's and fruits wastes

No	Parameter	Method	Unit	Analysis Result of Sample	
				Decomposer of mol in banana's capitulum	**Decomposer of mol in fruits**
1	pH H_2O	Electrode	-	7.75	7.62
2.	Total N	Kjaldahi	%	1.25	0.25
3.	C Organic	Walkey & Black	%	18.21	20.36
4.	Ratio C/N	Count	-	16.26	81.43
5.	P2O5	Spactonic	%	0.27	0.19
6.	K2O	AAS	%	0.94	0.82
7.	CaO	AAS	%	0.66	0.08
8.	MgO	AAS	%	0.23	0.22
Micronutrient					
9.	Pb (Lead)	AAS	%	425.66	188.74
10.	Ca (Potassium)	AAS	%	6.95	6.29
11.	Cu (Copper)	AAS	%	27.52	33.56
12.	Zn (Zinc)	AAS	%	59.49	57.40
13.	Fe (Iron)	AAS	%	3593.20	1744.60
14.	Mn (Manganese)	AAS	%	77.95	72.42

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Source : Laboratory of Soil Science. 2014. Results of the analysis on compost of the empty recemus of the oil palm with the decomposer of mol of the banana's and fruits wastes. University of Mulawarman. Samarinda.

DISCUSSION

Micro Fermentation Process of Local Organism

Duration the fermentation process of mol, which derived from fruits wastes and banana's capitulum, took two weeks. Color of both mols has changed from yellow to brownish yellow and smelled like fermented rice and white threads emerged on the surface of each mol. MOL solution is a result of fermentation, which is made of diverse resources at local area. MOL solution contains both micro-and-macronutrients, as well as bacteria that are potential to be the organic decomposer, stimulant of growth, and controller agents of pest and disease on plants, so that MOL is better to be applied as decomposer, bio-fertilizer, and organic pesticide, particularly as fungicide **(Purwasasmita, 2009)**.

Anonim (2007) added, Mol is liquid that is made of natural materials as media of micro organisms to live and grow, in which they are useful to spur the decomposing process organic materials or decomposer and bio-activator in order to increase nutrient availability for the plants, which are intentionally developed from local microorganisms, which are available at the local environment. According to **Hadinata (2008)**, MOL solution, which has the fermentation process, could be used as decomposer and liquid fertilizer to improve soil fertility and nutrient sources for the plant's growth.

a. Smell

Well-rotted mol smelled like fermented rice due to, during the fermentation process, smell of the mol solution has changed as a result of fermentation process that occurred anaerobically as the fermentation place was closed tightly, airtight and no light could come in, and it resulted bad smell. It was presumed that such bad smell was due to the inhibition of aeration during the decomposing process, therefore the anaerobe process resulted stinking compounds, such as organic acids, ammonia, and H_2S **(Isroi and Yulianti, 2008)**.

b. Color

Based on result of observation on physical feature of mol solution after being fermented, the color has changed from yellow, before fermented, and turned into brownish yellow, after fermented. Such change in color could only be observed visually. The decomposing organic materials, which are caused by activities of diverse microorganisms, have changed the colors **(Susanto, 2002)**
MOL solution was made in a very simple form by utilizing household wastes or plants wastes around the environment, such as the plant's remains, such as banana's capitulum, trunk of banana's plant, pineapple, rice straw, remains of vegetables, spoiled rice, and etc. The main materials in MOL solution include 3 components, such as : Carbohydrate : waste water of rice, spoiled rice, cassava, potato, and wheat, however, carbohydrate is required as food stuff for microorganism in mol solution. Glucose : liquid of palm sugar, liquid of refined sugar, coconut milk (sap obtained by tapping inflorescences of palm), in which the glucose could be used as energy for the micro organisms, and; Bacterial sources : gold snail, fruits, such as tomato, papaya, and animal's droppings **(Purwasasmita, 2009)**.

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Nutrient analysis on mol of fruits wastes and mol of banana's capitulum

After well fermented, a nutrient analysis was implemented on both mols. Results of the nutrient analysis on mol of the banana's capitulum showed that N 0.03, P2O5 7.28, K2O 971.17, CaO 219.38, Mg 82.66, while results of the nutrient analysis on mol of the fruits wastes showed that N 0.007, P2O5 0.29, K2O 945.05, CaO 366.64, and Mg 120.30. The nutrient contents of both mols have still shown small numbers.

The main superiority of using MOL is economical and even no cost at all, as well as some advantages, such as : support the environmentally safe agriculture, overcome the problems that concerning with pollution of the agricultural and household wastes, the making and its application are easily implemented, contain complex elements and beneficial microbes in producing fertilizers and organic decomposer, enrich the varieties of soil biota, improve quality of the soil and plants. **Kurnia *et.al* (2003)** has performed sample analysis on MOL solutionof *Berenuk* and MOL solution of coconut milk, as well as household wastes. The wastes brought about fewer nutrients for mol of the banana's capitulum with the nutrient content, such as N, which was found that MOL solution of *berenuk* contained *bacillus* sp, *sacharomyces* sp, *azospirillium* sp, and *azotobacter*. MOL of the household wastes contained *pseudomonas*, *aspegillus* sp, and *lactobacillus* sp.

According to some literatures, MOL of banana's capitulum contains growth regulators, Gibberellins and Cytocinine. Besides that, it also contains 97 beneficial micro organisms, such as: *Lactobacillus* sp*, Pseudomonas* sp*, Azospirillium, Azotobacter*, *Bacillus*, *Aeromonas, Aspergillus,* microbial phosphate solvent and cellulosic microbial. Those bacteria could decompose the organic materials including nitrogen, phosphate, and potassium within the organic materials in the soil and becoming nutrients, which are readily absorbed by the plants. Moreover, MOL of the banana's capitulum does not only produce cytocinine hormone, but also could be used as bio-fertilizer, decomposer, or accelerate the decomposing process. The organic wastes should be decomposed first by microbe of the soil to become nutrient that could be absorbed by the plants. Natural decomposing process takes longer time, so that appropriate microbial decomposer, which is able to accelerate the decomposing process of organic materials, is required. Local Micro organisms (MOL) are to mostly found at the field and it has been proven to be useful as decomposer, bio-fertilizer, and bio-pesticide **(Institute of the Agricultural Technology Review, 2011)**, adds that today, most of the commercial microbial decomposer have still faced some challenges in their development at the farmer level concerning with effectiveness and efficient use of the decomposer relating to the resulted quality, cost, and easiness in application. The application of Local Micro Organism has some benefits, such as relative economical and easier application is the option taken by farmers at some regions. Not only as decomposer, MOL is also used as bio-fertilizer and bio-pesticide, which can be applied directly to the plants. MOL can be used to make compost fertilizer, in which MOL is well-known as starter/decomposer. MOL can be used as liquid fertilizer. MOL can be applied as ZPT (Growth Stimulant Substance). Besides that, MOL is applied as decomposer, therefore the nutrients can be absorbed by roots of the plant. In order to comprehend the way how to make the MOL, however, there are some points that should be understood first. At least, 3 points must be existed in making each MOL, such as : 1. Availability of the used materials, such as the dominant ones that contain N, for instance, bamboo shoot, *gamal* (kind of trees that exterminates elephant grass) leaf, tips of leaves, and etc. MOL is very good for initial vegetative growth of the plant. Dominant N and P is rather comparable : banana's capitulum, gold snail, fruits, households wastes, etc. MOL is very good for intermediate vegetative growth of the plant.

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Dominant P : trunk of banana's plant, cocoa seeds, and etc. MOL is very good for primordial application of the plant. Dominant K : coconut fiber, tea dregs, etc. This MOL is very good for spike filling application. 2. Availability of materials as carbohydrate sources, such as : waste water of rice, bran, rice, pounded-unhulled rice, fine-grained corn, etc. 3. Availability of materials as energy sources, generally in sweet forms. For instances: molasses, palm sugar, refined sugar, coconut milk, seed of ripe *maja* fruit, stem of sugar cane, and etc. For instances, making the MOL of gold snail, which has 3 main materials, such as: gold snail, waste water of rice, and *maja* fruit. However, other materials can be used, such as: gold snail, waste water of rice, coconut milk, and palm sugar.

Identification of micro organism on mol of banana's capitulum and mol of fruit wastes
After both mols were well-done, not only nutrient analysis can be implemented, but also identification of the microorganisms. Result of the identification showed 2 types of bacteria. *Bacillus* was found in mol of fruits and *Enterobacter* was found in mol of banana's capitulum, but a fungus was never found.

However, characteristics of both bacteria are described below :

a. Bakteri *Bacillus* spp

Bacillus belongs to the Kingdom: Procaryotae, Division: bacteria, class: schizomycetes, Order: Eubacteriales, Family: Bacillaceae, Genus: Bacilllus and Species: *Bacillus* spp. *Bacillus* spp is categorized into heterotropical class, a protista that has micellular feature, and including in micro organism of *redusan* or well-known as decomposer. Bacillus genus has rod forms and easily found in soil and water, including sea water. Bacillus forms endospore as positive gram that moves with peritricus flagella that could has aerobic feature or facultative anaerobic that has positive catalase feature. Bacillus genus is one of six bacterium as producer of endospores. There are various shapes of those endospores, such as round, oval, ellipse, or cylindrical, which are formed inside the vegetative cell. Those endospores differentiate the Bacillus from bacterial species, which form the exospores. The main features that differentiate between bacillus and other bacterium, which form endospore, are the bacillus's abilities to live as an aerobe (even some of them are facultative anaerobe) and majority of the species produce catalase (positive catalase).

Species of *Bacillus* spp. shows different shapes of colony on agar medium of agar nutrient dish, in general, color of the colony is yellowish white or faded white, diverse and uneven edges of the colonies, rough surfaces and no mucus, and some of them tend to dry and no powdery, big colony and not shining. Big shapes and varying sizes of the colonies depend on the species. The bacillus genus, which is able to grow under temperature of 10 – 50^{o}C, is a safe and moderate saprophyte, easily grown in high density and able to form endospores that resistant to heat. The *Bacillus* has increasing physiological feature due to each species has different ability, such as to able to degrade the organic compounds, for instance, protein, starch (amilum), cellulose, hydrocarbon, and agar, have been able to produce antibiotics, which play in nitrification and dentrification, binding nitrogen, oxidizing selenium, oxidizing and reducing manganese, and have some features, such as chemolitotrof, aerobe or facultative anaerobe, alkaliphylic, psychopriphylic or thermophylic **(Hatmanti. A, 2000).**

b. Enterobacter

Members of the Enterobacteriaceae family are bacteria that have short rod shape/cocobasil and it is negative gram of facultative anaerobe. Fermenting sugar to bring about lactate acids and other

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products. Reducing nitrate into nitrite. Enterobacteriaceae generally release cytochrome carbon oxides except Plesiomonas shigelloides that mostly have flagella as motile organs and few of them has non motile organs because they do not form any spore. The reactions of catalase are different between Enterobacteriaceae. Most members of this family have natural habitat in human's or animal's intestines, and sometimes they are found in water, soil, as well as parasites on animals and plants. One of the most important ones is used as organic model for the study of genetics and biochemistry. Most members of Enterobacteriaceae have Timbriae and Pertichous type 1, which play in binding process between bacterial cells and the host.

The decomposing process of empty recemus of oil palm by bio-activator of mol of banana's capitulum and fruit wastes

The decomposing process is a natural, biological process in decomposing organic materials, which contain carbon, minerals that include nitrogen and other nutrients, as well as water that is controlled by microorganism, which is supported by oxygen availability. The process has increased the temperature and resulted CO_2, evaporation, and heat energy. At the last process, it produced organic materials that contain carbon, chemical energy, nitrogen, protein, humus, mineral, water, and microorganisms.

Disentangling a compound is determined by composition of the materials, in general, the organic compounds are quickly disentangled, while inorganic compounds are difficult to be disentangled. The biological process is a natural process that runs dynamically and continually as long as factors, which relate to the need of microorganism to live in it, have been met. The organic decomposer will run through familiar process lines as whole, which is so-called fermentation. During the initial stage, those organic materials will be changed into simpler compounds, such as sugar, glycerol, fatty acid and amino acid. And then it will be continued with other processes, both aerobically and anaerobically **(Suriawiria, 2003).**

According to Starbuck, 2004, the decomposing comprises of several phases. During the initial decomposing, the bacteria increased rapidly. And then, the filamented bacteria (*actinomycetes*), fungi, and protozoas started to work. After a great amount of carbon (C) in compost has been utilized and temperature has decreased, *centipedes*, *milipedes*, aphids, worm, and other organisms continued to the decomposing process. In the next phase, fungi will reabsorb the organic substances for the worm and *actinomycetes* in order to start to work. The worm will mix the organic substances, which have been reabsorbed by fungi, with a small amount of clay and calcium within the worm's body. During the process, the polymerized carbon chains will be reconstructed in forming humus by absorbing cation, such as sodium, ammonium, calcium, and magnesium. In this stage, the compost is readily applied as fertilizer on corn, squash, sweet potato, honeydew, and cabbage. At the last phase, organisms oxidize the nitrogen substance into nitrates, which are required by roots and sprouting plants, such as bamboo shoot and bean sprouts. Ripeness phase, the compost will turn to dark, smell nice, crumbs, and easily crushed. Therefore, the compost is readily applied. During the decomposing process, some controls should be taken on humidity, aeration, temperature, and acidity level (pH). Humidity between 50-60% is quite optimal to make compost. An aerobe decomposing needs air, therefore, turning of the compost should be done for air circulation. During the initial phase of decomposing, temperature will increase, but it will gradually decrease and reach room temperature at the final phase. Compost acidity will increase due to the reorganized materials produce simple organic acids and this acidity will be back to normal when the compost has reached ripeness.

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Murbandono (1995) stated factors, which determine quality of decomposing yield, depend on : 1. Structure of Raw Material, organic decomposition rate also depends on features of the decomposed materials. They include kinds of vegetables, age, and chemical composition of the plants. The younger the plants, the faster decomposition process will run. It is due to high water content, high nitrogen level, narrow counterpart of C/N, and low lignin content. The greater amount of N compound, the faster raw materials will be decomposed. It is due to microorganism as decomposer of these materials require N compound for their development. 2. Size of Raw Material, the decomposing process could be fastened by reducing size of the materials, and the smaller size of the materials (5-10 cm), the faster decomposing process will run. 3. Temperature, increasing temperature is an indicator of the decomposing process as a result of relationship between water content and roles of the microorganism. When the organic materials were reorganized by microorganism, amounts of energy were released in the form of heat. During the initial decomposing, microorganisms were quickly proliferated and increased the temperature. When the temperature was stable, ripeness process of the compost was occurred. Temperature and high pile affect metabolism of the microorganisms in the pile and produce energy in the form of heat. 4. Water content, microorganisms need water to live and grow. The decomposing process run well under initial water content of 60 – 65%, and due to the temperature increases, water content will increase as well. It is due to the microorganisms' activities. When water content increases to become 80% (20 – 25 days) the process became anaerobic, and then water content will reduce, so that thermal capacity would reduce as well. 5. Value of material C/N, ratio C/N is really important to supply nutrients, which are required by microorganism during the decomposing process. Carbon is required by microorganisms as energy and nitrogen sources to form protein. Materials, which contain carbon, 30 times higher than nitrogen, has ratio 30 : 1 for C/N. Ratio for base material of compost is 20 : 1 for C/N and 35 : 1, which benefit the decomposing process. Other organisms formed material of new cells using the kept nitrogen. During the process, more carbons were burnt. Therefore, numbers of carbons were reduced, and nitrogen was recycled. Decomposing took longer, however, when ratio **C : N** was higher than 30. Speed of the organic decomposition is directed by the counterpart change of C/N. During mineralization process, the counterpart of C/N for materials, which contain great amount of N, will reduce along the time. Speed of losing C was higher than N, so that the counterpart of C/N was lower (10-20). If the counterpart of C/N has reached the numbers, it means that the decomposition process has reached the final level or the compost is ready to be applied (ripe). 6. Acidity (pH), basically, the organic materials by pH values between 3 and 11 could be decomposed, optimum pH ranges between 5.5 and 8. Bacteria prefers to neutral pH. Fungi grow well under rather acid pH. Highly acid during the initial decomposition process showed that the decomposition process ran without any increasing temperature occurred. In general, pH may decreases during the initial decomposition process due to the bacterial activities that produce acid. The emergence of other microorganism from the decomposed materials would increase pH after few days and pH in neutral condition **(Sutanto, 2002)**. 7. Type of the involved microorganisms, based on the appropriate temperature for metabolism and growth, microorganism are classified into three categories, such as *Psychrophiles* (microbe of low temperature) under temperature less than 20^0C, *Mesophiles* (microbe of temperate temperature) under temperature between 25-40^0C, and *Thermophiles* (microbe of high temperature) under temperature above 65^0C. Moreover, other organisms that include *Actinomycetes*, centipede, millipede, fungi, cockroach, spider, and worm will assist in final process, the phase of compost ripeness, temperature would decrease and the mofiled microorganisms would progressively disappear and the return of mesophyll microorganisms. This phase keeps going till the storage phase and it is the ripeness phase of compost (maturation), so

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that the compost will turn as humus. 8. Aeration, good aeration is highly required to accelerate the decomposing process of organic materials. Good aeration to all parts of the compost pile is highly required to provide oxygen for microorganisms and release the resulted CO_2. The resulted CO_2 must be released in order to avoid any toxic substance that may inhibit activities of the microorganisms. In practices, aeration setting can be done by turning pile of the compost materials regularly. Besides that, it can be done by having natural air circulation into compost piles through aeration channels. 9. Stirring (Homogenization), stirring raw materials of compost include mixture of various organic materials that having different decomposed features (easily decomposed and difficult decomposed). If such material mixtures are not stirred, the decomposition process will not run evenly. As a result, the composts are not good enough. Therefore, before and during the decomposing process, mixture of the raw materials must be stirred, so that the microbial decomposer would spread out evenly. So that performance of the microbial decomposer will be more effective. Such stirring (homogenization) should be done once a week. Quality standard of the compost is usually identical with the nutrient content in it and its level highly depends on raw materials or the decomposing process. 10. Using the composter, accumulation of the decomposed organic materials should consider adequate air circulation to supply sufficient oxygen needed by microorganisms, ideal size of pile (accumulation) is $1m^3$. This volume has effectively kept heat resulted by the bacteria. Volume of the single pile (accumulation) should not more than $2m^3$ to keep the air circulation of the pile. 11. Turning the decomposition aerobically requires great amount of oxygen, particularly during the initial process. If the supply of oxygen is limited, the decomposing process becomes anaerobic, so that the process becomes slower and stinky. The oxygen content in the pile would be changed by turning it manually. Such turning is required whenever different temperatures occur in the pile. Oxygen availability and microbial activities would affect on temperature of the compost pile. During the decomposing process, oxygen would run out quickly by microbe when the organic metabolism process occurs. Oxygen makes the decomposing process becomes slower and reduces the temperature. Aeration over the compost fertilizer through turning is done to make sure sufficient oxygen availability for the microbes. Oxygen Availability and Turning. Ideal oxygen level is 10%-18% (the acceptable levels range 5%-20%). If the piles (accumulation) are too moist, the decomposing process would be inhibited due to water covers the air perforation inside the piles, therefore it would restrict the oxygen level inside the piles. Lack of oxygen would cause the aerobic microorganisms start to die and they will be replaced by mean aerobic microorganisms. However, such turning will return the piles' condition back to normal. Aeration is highly required to reduce high water content in the organic materials, which are going to be decomposed, and to keep the decomposing process having fresh air.

In order to find out ripeness level of the compost in the field, some steps can be done as follow : 1. Smell, the ripe compost has nice smell like earth (soil), even it derived from urban refuse. If it still has bad smell as raw materials, it means that the compost has not ripe yet. 2. Color of the compost, color of the ripe compost is blackish brown. If the color is still green or just like raw materials, it means that the compost has not ripe yet. 3. Decreasing, the decreasing depends on characteristics of the raw materials and ripeness level of the compost. Such decreasing ranges 20 – 40%. If the decreasing is tolerable, it is possibly that the decomposing process has not finished and the compost has not been ripe yet (**Murni, MC, 2000**).

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Nutrient Analysis on Compost of Empty Recemus of Oil Palm
Based on result of the chemical test on nutrients in compost by bio-activator of banana's capitulum, it showed N 1.25 %, P2O5 0.27 %, K20 0.94 % , MgO 0.23 %, Pb 425,66 %, Ca 6.95%, Cu 27.52 % , Zn 59.49 % , Fe 3593.20 % , Mn 77.95 %, while the nutrient contents for compost by bio-activator of fruit wastes include : N 0.25 %, P2O5 0,19 %, K2O 0.82 %, MgO 0.22 %, Pb 188.74 %, Ca 6.29 %, Cu 33.56 %, Zn 57.40 %, Fe 1744.60 %, Mn 72.42 %.

Compost derived from empty recemus of oil palm can be utilized to fertilize all kinds of plants. Such compost has some beneficial features, such as : improving the clayey soil to be light, assisting nutrients solubility as required by the plant's growth, homogenous, and reducing the risk as pest's carrier, uneasily washed by water that permeate into the soil, and applicable in any season. The recemus of oil palm, which has been changed into compost, not only contain nutrients, but also other organic materials that are useful for improvement of the organic structure in the soil layers, particularly in tropical condition. Compost is sources of Phosphorus (P), Calcium (Ca), Magnesium (Mg), and Carbon (C). Empty recemus of oil palm as solid waste can be burnt and resulted recemus ashes. In fact, such ashes contain 30 - 40% K2O, 7% P2O5, 9% CaO and 3% MgO. Also, they contain micronutrients, such as 1,200 ppm Fe; 1,000 ppm Mn; 400 ppm Zn; and 100 ppm Cu **(Anonim, 2012)**.

Astuty, LY and Veny (2010) stated results of the research that the nutrient contents in empty recemus of oil palm include N 0.24%, P 0.61%, and K 0,38%, however, results of the nutrient analysis on empty recemus of oil palm as the remains of fungi along with the additional activator EM4 showed increasing N 48.84 %, P 44.16% and K 64.15%. This was due to during the cultivation of edible mushrooms (*Volvariella volvacea*), these edible mushrooms degraded lignin and cellulose that existed in empty recemus of oil palm. Results of degradation in lignin and cellulose will be disentangled by microorganism, so that N, P, and K will increase. Besides that, the addition of EM4 could accelerate the increasing nutrients level because EM4 could accelerate mineralization of nutrients due to EM4 consists of bacteria of lactate acid and phosphate decomposer.

The use of cocomas active clay activator could assist the reorganizing process in forming compost that is made of empty recemus of oil palm. Such compost has color and smell just like soil by percentage of micronutrients Fe 0.21%, Zn 0.01% and N-organic 2.25% **(Rahmiana, dkk, 2013)**. **Dwi et al. (2013)** added results of their research on compost of empty recemus of oil palm, in which the nutrients percentage of N 1.34%, P 0.08%, K 1.22%, Ca 0.24%, Mg 0.25% and compost with different level of ripeness have resulted different performance of the plant's growth and compost with better ripeness, which resulted high growth. The lower ratio of C/N, N would be easier to be provided for the plants.

CONCLUSION AND SUGGESTION

A. Conclusion
Based on result of the research and discussion, it can be concluded that *tankos* compost from MOL of fruits still has low nutrients : N 0.25 %, P2O5 0,19 %, K2O 0.82 %, MgO 0.22 %, Pb 188.74 %, Ca 6.29 %, Cu 33.56 %, Zn 57.40 %, Fe 1744.60 %, Mn 72.42 %.

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1. Yield of *tankos* compost from MOL of the Banana's Capitulum still has low nutrients : N 1.25 %, P2O5 0.27 %, K20 0.94 %, MgO 0.23 %, Pb 425,66 %, Ca 6.95%, Cu 27.52 %, Zn 59.49 %, Fe 3593.20 %, Mn 77.95%.
2. Results of identification on bacteria of MOL for fruits and MOL for banana's capitulum showed 1 species of bacteria for MOL of fruits, *Bacillus* sp, and MOL of banana's capitulum, *Enterobacter* sp.

Suggestion

Suggestion for the research is to increase the content of nutrients in compost *tankos* MOL of fruits and MOL of banana's capitulum by adding other organic materials, such as *brangkasan* of peanuts and stable manure.

REFERENCES

Anonim. 2007. Learning Material on Soil Ecology and System of Rice Intensificatium (SRI) Department of Agriculture. Jakarta.

Balai Pengkajian Teknologi Pertanian (Institute of the Agricultural Technology Review). 2011. Role and Utilization of Micro Organism (MOL) in Supporting the Organic Agriculture. Buletin No. 5. 2011. South Sulawesi.

Dwi, A, Mercy Bientri Yumindanova, Herdhata Agush. 2013. The Effect of Ripeness Level in Compost of Empty Recemus of Oil Palm and Mulch from Solid Wastes of Oil Palm on Plant Production in Ultisol Soil. Journal of Soil Science of Agroclimatology.

Fauzi, Y., Widiastuti, YE., Setyawibawa, I., and Hartono, R. 2002. Oil Palm, Breeding, Utilizing the Product and Waste, Analysis and Marketing. Penebar Swadaya. Jakarta.

Isroi and Nurheli Yuliarti. 2008. Compost. Effective, Economic, and Efficient Ways to Produce Compost. Published by Andi Puslisher.

Kurnia, K.P and I.NP. Aryantha. 2003. Study on Bacterial Pathogenic of Local Entamopathogenic on Larvae of Hyposidra Talaca Wlf and Medium Optimazion of Its Growth. Monthly Biotechnology Workshop. PPAU Biotechnology ITB. 15th September 2004. Bandung.

Laboratory of Soil Science. 2014. Result of the Bio-activator Analysis on Fruit Waste and Banana's Capitulum Waste. University of Mulawarman. Samarinda.

Murni, MC. 2000. Making of Compost. Published by PT. Balai Pustaka (Persero). Jakarta.

Purwasamita, M. 2009. Local Microorganism as the Trigger of Life Cycle in Bioreactor of Plant. Indonesian National Seminar on Chemical Technics. 19th – 20th October 2009.

Rahmiana, Z., Muhammad Refqi Zaki Yul Hag and Indrawati. 2013. Analysis of Color, Smell, pH, Fe, Ze, and N Organic in Compost made of Oil Palm's Recemus using Active Mud Activator. PT. Bumi Sarimas Indonesia (Cocomas). Journal of Chemical Unand (ISSN No.2303 – 3401) Volume .2. Number . 2

Susanto, R. 2002. Organic Agriculture. Go Into Alternative and Continual Agriculture. Published by Kanisius, Yogyakarta.

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