ISSN: 2224-0616
Int. J. Agril. Res. Innov. Tech. 11(1): 109-116, June 2021
DOI: https://doi.org/10.3329/ijarit.v11i1.54473

OPEN ACCESS
Available online at https://ijarit.webs.com
https://www.banglajol.info/index.php/IJARIT

Effectiveness of local microorganisms (LMO) coconut pulp on composting time

Darwel*, R. Selvia, F. Fadillah, Mahaza and E. Zicof

Received 30 April 2021, Revised 18 May 2021, Accepted 23 June 2021, Published online 30 June 2021

A B S T R A C T

Compost can be used to reduce waste, it formed naturally, but it will take a long time, around 6-12 months. Bioactivators accelerate composting process; one of them is a solution of LMO (Local Microorganism) coconut pulp. The purpose of this study to determine the effectiveness of LMO coconut pulp for the composting time. The method in this research is quasi-experimental. This study consists of 3 treatments with 5 replications. Treatment 1 composting with the addition of LMO coconut pulp 50,000 ppm; treatment 2 composting with the addition of LMO coconut pulp 100,000 ppm; treatment 3 composting with the addition of LMO coconut pulp 200,000 ppm. The materials used in this study are vegetables and sawdust and the composting process carried out aerobically. From the observations, the average time to compile with LMO coconut pulp 50,000 ppm is 21.00 (21 days), 100,000 ppm 18.60 (19 days) and 200,000 ppm 18.20 (18 days). Based on the ANOVA test, the p value is 0.0001 ($p < 0.05$) which means that Ho rejected, that there is a significant difference in composting time using LMO coconut pulp 50,000 ppm, 100,000 ppm, and 200,000 ppm. The most significant difference is between compost with LMO coconut pulp 50,000 ppm and compost with LMO coconut pulp 200,000 ppm. It is recommended for the further researchers using other types of waste, and test the quality of compost produced especially C/N compost. The community can use coconut pulp as a bioactivator in accelerating the composting process.

Keywords: Waste, Composting, LMO Coconut Pulp, Composting Time.

Environmental Health Department, Health Polytechnic Ministry of Health Padang, Sumatera Barat, Indonesia.

*Corresponding author's email: welpiero1@gmail.com (Darwel)

Cite this article as: Darwel, Selvia, R., Fadillah, F, Mahaza and Zicof, E. 2021. Effectiveness of local microorganisms (LMO) coconut pulp on composting time. *Int. J. Agril. Res. Innov. Tech.* 11(1): 109-116. https://doi.org/10.3329/ijarit.v11i1.54473

Introduction

Based on data from the Ministry of Environment and Forestry, Indonesia produced up to 65 million tons of waste in 2016, and increased by 1 million tons from the previous year. The type of waste dominantly organic waste, which reaches around 60 percent and plastic waste that reaches 15 percent of total waste, especially in urban areas (Kurnia, 2019).

Garbage is still a problem that worries the community and is one of the causes of environmental damage (Hamidah, 2018). Garbage piles can produce a dangerous liquid called leachate (Badan Pusat Statistik, 2018). Garbage is still a classic problem for every country, including Indonesia. Along with population growth and technological development, the type and volume of waste has also increases. Waste that is not managed properly often pollutes the environment. However, the resulting waste can still be processed into something useful as long as there is a will and a little creativity; one example is by processing waste into compost. Compost produced from organic waste can be used to fertilize plants because compost has been proven to help improve soil fertility and increase crop production. Not only that, in addition to its own use, the compost produced can be sold because the demand on the market is quite high (Suwahyono, 2015).

Composting is the process of weathering organic materials biologically by microbes (Purwendro and Nurhidayat, 2011). The success of making compost can be judged by the length of time of composting, the faster the compost is producing the higher the success rate. In fact, compost can form naturally, but it will take quite a long time, which is 2-3 months. In fact, some reach 6-12 months, depending on the organic material used. Therefore, various treatments need to be applied to speed up the composting time (Suwahyono, 2015).

There are several things that must be consider to accelerate the composting process, including the selection of bioactivators, the use of composters, and the regulation of composting conditions. By paying attention to these things, composting process accelerated from the usual 2-3 months to 2-3 weeks, depending on the basic ingredients. In addition to shorten composting time, good quality compost also needs to be considered. Therefore, choosing the type of raw material must carefully because it will greatly affect the quality of compost (Suwahyono, 2015).

One of the bioactivators in composting is a solution of LMO (Local Microorganisms). LMO solution is a liquid made from natural organic ingredients. LMO solution contains a collection of microorganisms that help speed up the process of decomposition of organic matter to shorten the composting time. Basically, MOL solution can be made by you from a variety of organic materials, provided that the material is preferred and can be used as a growing medium for microorganisms (Suwahyono, 2015).

Many studies regarding the use of MOL as a bioactivator in composting. Among them is a study conducted by Royaeni *et al.* (2014) who obtained the average length of time of composting organic waste using stale rice MOL was 13 days and using cassava tapai MOL was 10 days (Royaeni *et al.*, 2014). Whereas, Lubis (2017) found 18 days for MOL tapai cassava and 20 days for rice.

Coconut is a fruit that has many benefits, so many people use coconut as a raw material for making various products, such as coconut milk sellers who only use coconut to take coconut milk, restaurants that only take coconut milk as one of the ingredients in food processing, and also households that do not have livestock tend to only discard coconut pulp so that it becomes waste in the environment (Gultom, 2017). After a survey was conducted at the Nanggalo Market in Padang, still found coconut pulp that is not utilized by coconut milk seller, from 1 coconut milk production site, the resulting pulp is average one sack of rice or about 30 kg day^{-1}.

Dries coconut pulp (fat free) contains 93% carbohydrates consisting of: 61% galactomannan, 26% manosa and 13% cellulose. Research conducted by Pamungkas *et al.* (2018) who found the presence of cellulotic bacteria in coconut dregs that can produce cellulase enzymes, which are one of the hydrolytic enzymes that are important in the degradation of organic wastes (Pamungkas *et al.*, 2018).

From the description above, the authors are interested in making MOL from coconut pulp, which is use as a bioactivator in the composting process. The purpose of this study is to figure out the length of composting time with local microorganisms (MOL) of coconut dregs. And to know the difference of MOL of Coconut Dregs concentration of 50,000 ppm, 100,000 ppm, and 200,000 ppm to the length of composting.

Research Methodology

The method used in this research is quasi-experimental. This research consisted of 3 treatments. Each treatment consisted of 5 composters. First treatment composting with the addition of MOL coconut pulp 50,000 ppm, second treatment composting with the addition of MOL coconut pulp 100,000 ppm, third treatment composting with the addition of MOL coconut pulp 200,000 ppm. The materials used in this study are vegetables and sawdust and the composting process is carried out aerobically. The type of research data is primary data. Data obtained from observations during composting. Data were processed by computerization. The analysis was carried out bivariately with ANOVA test to get a picture of the difference in time of compost maturity and from composting with MOL of coconut pulp with different concentrations. The instrument used in this study was in the form of an observation table (Table 1).

Table 1. Operational definitions of this study.

No	Variable	Operational Definition	measuring instrument	How to measure	measuring results	measuring scale
1.	Local Microorganism (LMO) coconut Pulp	Products produced from the fermentation process of coconut pulp are propagated with natural ingredients that contain carbohydrates (sugars), protein, minerals, and vitamins	1. Scale 2. Measuring cup	Weigh the coconut pulp and put it in 1 liter of solution.	1. 50.000 ppm 2. 100.000 ppm 3. 200.000 ppm	Interval
2.	Length of composting time	The length of the process of overhauling the organic material by microbes to mature compost.	Calender	Observation	Number of days	Interval

Results

Observation results of physical properties during composting

Temperature

This is a graph of change in average temperature during composting.

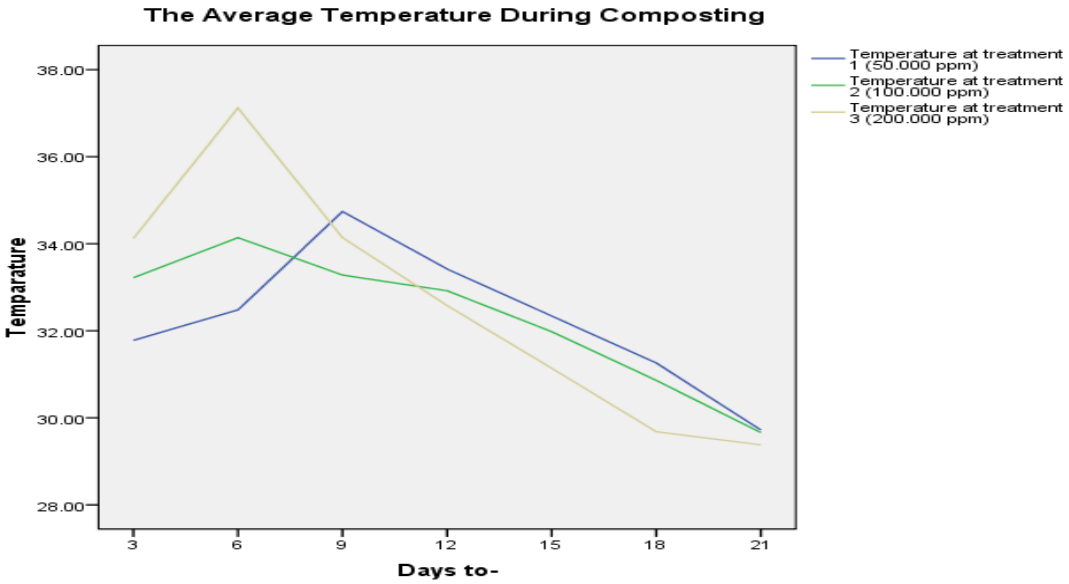

Fig. 1. Average temperature of composting.

Based on the graph, composting with MOL of Coconut Pulp 50,000 ppm has the highest temperature on the 9th day with an average of 34.74°C. Composting with MOL Pulp 100,000 ppm has the highest temperature on the 6th day with an average of 34.14°C. Meanwhile, composting with MOL of Coconut Pulp 200,000 ppm has the highest temperature on the 6th day, 37.12°C.

pH

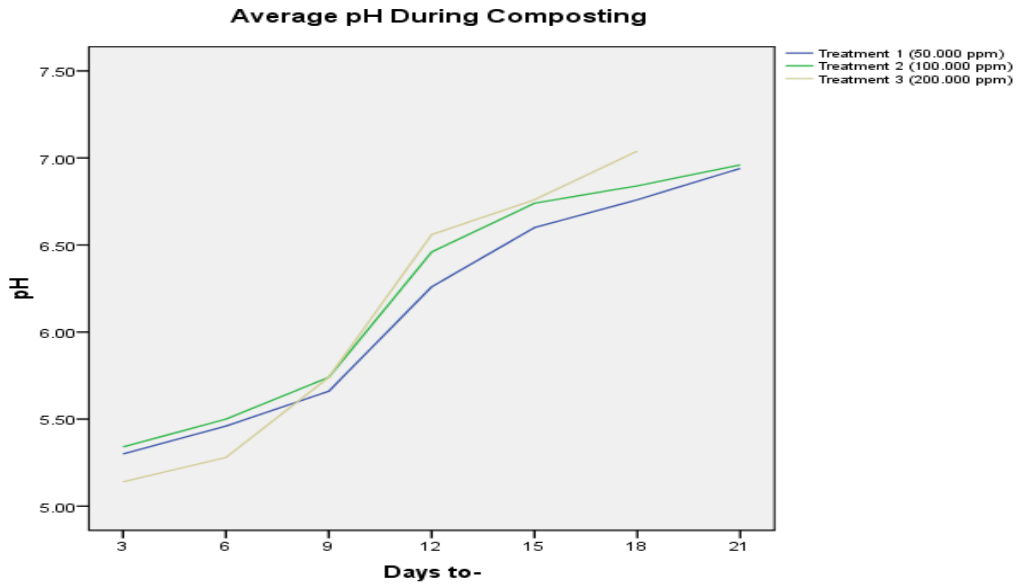

Fig.2. Graph of average pH during composting.

From the graph, it can be seen that during the composting process the pH has increased, which is from acidic to neutral and alkaline conditions.

Moisture

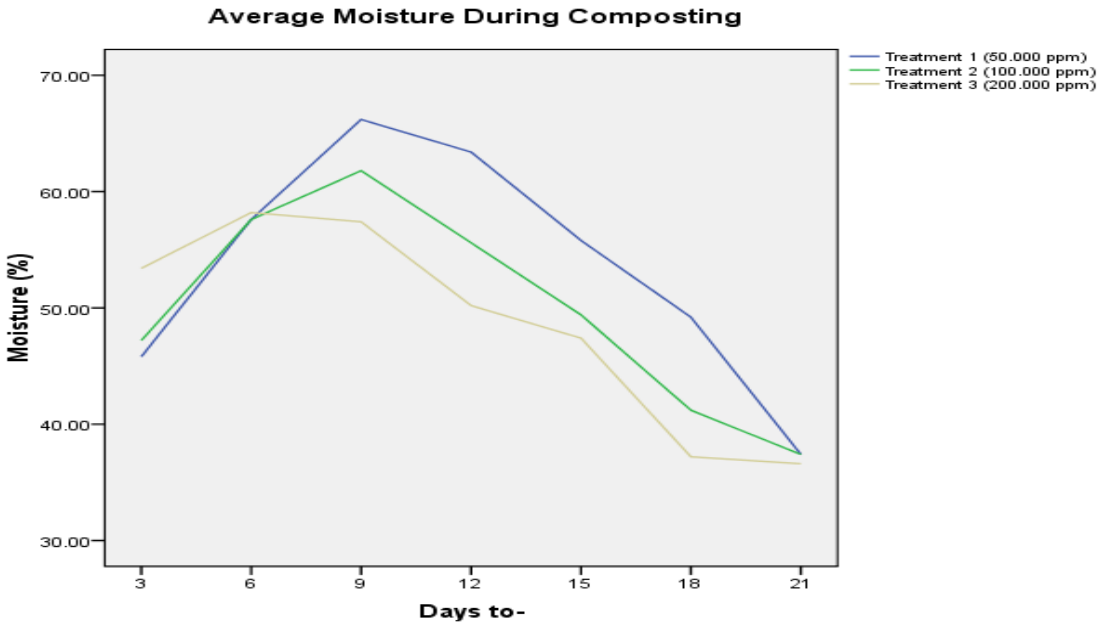

Fig.3. Graph of average moisture during composting.

Smell, Color and Texture

The following are the results of physical observations during composting.

Table 2. Physical observation results (odor, color, and texture) during composting.

Days to-	Treatment		
	Treatment 1	Treatment 2	Treatment 3
3	Typical vegetable, green, rough	Typical vegetable, green, rough	Typical vegetable, green, rough
6	A little smell, brownish green, a little subtle	Typical Vegetable, brownish green, slightly smooth	Typical vegetable, brownish green, slightly smooth
9	A little smell, greenish brown, a little subtle	Typical Vegetable, greenish brown, slightly smooth	Typical Vegetable, greenish brown, slightly smooth
12	A little smelly, blackish brown, smooth but still a little rough	Little Smell, blackish brown, smooth but still a little rough	Little Smell, blackish brown, smooth but still a little rough
15	A little smelly, blackish brown, smooth but still a little rough	Land odor, blackish brown, smooth but still a little rough	Land odor, blackish brown, smooth but still a little rough
18	Land odor, blackish brown, smooth but still a little rough	Land odor, blackish, smooth but still a little rough	Land odor, blackish, like the ground but still a little rough
21	Land odor, blackish brown, smooth but still a little rough	Land odor, blackish, like the ground but still a little rough	Land odor, blackish, like the ground but still a little rough
24	Smell the Land, Blackish, Like the Land but still a little rough	Land odor, blackish, like the ground but still a little rough	Land odor, blackish, like the ground but still a little rough

Characteristics of compost produced

After composting is complete, compost is produced with the following characteristics.

Table 3. Characteristics of compost produced.

Treatment	Temperature	Humidity	pH	Smell, Color and Texture
T1CA	29.5	39%	6.9	Soil odor, blackish, like the ground but still a little rough
T1CB	29.3	38%	6.9	Soil odor, blackish, like the ground but still a little rough
T1CC	29.8	35%	7.2	Soil odor, blackish, like the ground but still a little rough
T1CD	30.0	37%	6.8	Soil odor, blackish, like the ground but still a little rough
T1CE	30.0	38%	6.9	Soil odor, blackish brown, like earth but still a little rough
T2CA	29.6	36%	6.9	Soil odor, blackish, like the ground but still a little rough
T2CB	29.9	39%	7.2	Soil odor, blackish brown, like earth but still a little rough
T2CC	29.3	35%	7.1	Soil odor, blackish, like the ground but still a little rough
T2CD	29.5	43%	6.8	Soil odor, blackish, like the ground but still a little rough
T2CE	30.0	34%	6.8	Soil odor, blackish, like the ground but still a little rough
T3CA	29.1	35%	7.1	Soil odor, blackish, like the ground but still a little rough
T3CB	29.7	38%	6.9	Soil odor, blackish, like the ground but still a little rough
T3CC	29.8	37%	6.9	Soil odor, blackish, like the ground but still a little rough
T3CD	29.1	36%	7.2	Soil odor, blackish brown, like earth but still a little rough
T3CE	29.2	37%	7.1	Soil odor, blackish, like the ground but still a little rough

Composting time

The observation of composting time using MOL of coconut pulp 50,000 ppm, 100,000 ppm and 200,000 ppm presented in Table 4.

Table 4. Composting time with MOL Coconut pulp concentration of 50,000 ppm, 100,000 ppm, 200,000 ppm.

Composter	Treatment		
	Treatment 1 (50.000 ppm)	Treatment 2 (100.000 ppm)	Treatment 3 (200.000 ppm)
Composter A	21 days	18 days	18 days
Composter B	21 days	19 days	18 days
Composter C	21 days	19 days	19 days
Composter D	21 days	18 days	18 days
Composter E	21 days	19 days	18 days
Average	21	18.6	18.2

Based on table 4, the fastest time of composting with MOL of Coconut Pulp is found in treatment 3 (200,000 ppm), with an average of 18.2 (18 days), and the longest time is in treatment 1 (50,000 ppm), with an average of 21 days.

Table 5. ANOVA test results of composting time using LMO of coconut pulp concentration of 50,000 ppm, 100,000 ppm, 200,000 ppm.

Variable	N	Mean	SD	Std Error	Minimum	Maximum	p Value
LMO Coconut Pulp 50.000 ppm	5	21.00	0.0001	0.0001	21	21	0.0001
LMO Coconut Pulp 100.000 ppm	5	18.60	0.548	0.245	18	19	
LMO Coconut Pulp 200.000 ppm	5	18.20	0.447	0.200	18	19	
Total	15	19.27	1.335	0.345	18	24	

Table 5 shows that the ANOVA test p value is 0.0001 ($p < 0.05$) therefore Ho is rejected, there is a significant difference in composting time using MOL coconut pulp concentration of 50,000 ppm, 100,000 ppm, and 200,000 ppm.

Table 6. LSD test results of composting time using LMO coconut pulp concentration of 50,000 ppm, 100,000 ppm, and 200,000 ppm.

Duration of Combined Composting Time LSD				
(I) Compost	(J) Compost	Mean Difference (I-J)	Std. Error	Sig.
Compost with 50,000 ppm Coconut Pulp LMO	Compost with 100,000 ppm Coconut pulp LMO	2.400*	0.258	0.0001
	Compost with 200,000 ppm Coconut Pulp LMO	2.800*	0.258	0.0001
Compost with 100,000 ppm Coconut pulp LMO	Compost with 50,000 ppm Coconut Pulp LMO	-2.400*	0.258	0.0001
	Compost with 200,000 ppm Coconut Pulp LMO	0.400	0.258	0.1470
Compost with 200,000 ppm Coconut Pulp LMO	Compost with 50,000 ppm Coconut Pulp LMO	-2.800*	0.258	0.0001
	Compost with 100,000 ppm Coconut pulp LMO	-0.400	0.258	0.1470

**The mean difference is significant at the 0.05 level.*

The most significant difference is between compost with MOL Coconut pulp 50,000 ppm and compost with MOL Coconut pulp 200,000 ppm.

Discussion

Temperature

From the research conducted, the temperature during composting is less than 40°C, this shows that the bacteria that work during composting are mesophilic bacteria. The temperature increased faster in treatment 3 (200,000 ppm) which on the 3rd day the temperature obtained was 34.12 ° C which was higher than treatment 1 (50,000 ppm) and treatment 2 (100,000 ppm) which only has an average temperature of 31.78°C and 33.22°C. According to Yulianto *et al.* (2009), the higher the temperature, the more oxygen consumption will be and the faster the decomposition process will be.

pH

Based on Figure 2. The pH during composting has increased from acidic to neutral or basic conditions. This is because the production of ammonia from nitrogen-containing compounds derived from vegetables (Yulianto *et al.*, 2009).

Humidity

The highest humidity occurs in composting with MOL of Coconut Pulp 50,000 ppm which reaches 66.20%. Humidity greater than 60% will decrease oxygen supply and nutrients are leached, consequently microbial activity will also decrease. Decreased microbial activity will cause the composting process to run slower. However, this can be overcome by reversing the compost pile, so that air can supply oxygen for the composting process and reduce the moisture of the material (Yulianto *et al.*, 2009). In the following days, from 66.20% to 63.40% on the 12th day, and from 63.40% to 55.80% on the 15th day, and likewise in the following days the humidity drops until the compost has matured.

Composting time

The duration of composting in this study was influenced by the addition of MOL of Coconut Pulp, in which each treatment was given different

concentrations of 50,000 ppm for treatment 1, and 100,000 ppm for treatment 2, and 200,000 ppm for treatment 3. Each treatment consisted of 5 composters. The amount of MOL used is 200 ml in 5 kg of waste, which is given at the beginning of composting. After the composting process was observed every 3 days to measure the temperature, humidity, pH and physical form of the compost, it was found that the fastest compost was 200,000 ppm MOL compost, which was 18 days, while the longest was 50,000 ppm that was 21 days.

The criteria for future compost in this study are based on SNI 19-7030-2004 where the mature compost does not exceed 30°C, the humidity does not exceed 50%, the minimum pH is 6.80 and the maximum is 7.49, the color is blackish brown or blackish, and texture and smell like soil (Standar Nasional Indonesia, 2004).

Composting with MOL Coconut pulp is effective in accelerating the composting process, which in this study; the higher the concentration given, the faster the composting process occurs. This is because the content of cellulotic bacteria found in coconut dregs can produce cellulase enzymes, which are one of the hydrolytic enzymes that are important in the degradation of organic waste (Pamungkas *et al.*, 2018).

In fact, compost form naturally, but it will take quite a long time, which is 2-3 months. In fact, some have reached 6-12 months (Suwahyono, 2015) .However, using this Coconut Pulp MOL, composting can be shortened, which in this study the fastest time obtained was 18 days on composting with a concentration of 200,000 ppm of Coconut Pulp. However, composting with coconut pulp MOL runs longer when compared with research conducted by Royaeni *et al.* (2014), that composting with MOL of Stale Rice and Tapai Cassava runs faster, namely 13 days and 10 days. However, even so the quality of compost produced from composting with MOL Coconut Pulp is very good and in accordance with SNI 19-7030-2004, in terms of temperature, humidity, pH, odor, color, odor and texture (Standar Nasional Indonesia, 2004).

Judging from the results of the study, the researchers suggest MOL of coconut pulp used for composting is a concentration of 200,000 ppm, so that the composting process can run faster, which make 200 grams of coconut pulp as a source of microorganisms dissolved in 1 liter of coconut water added with sugar as energy for bacterial growth and propagation, then fermented for 7 days.

Of the various waste problems that occur, both in the household, public places such as markets that produce a lot of vegetable waste, and the furniture industry that produces sawdust, and other places, it is hoped that MOL Coconut Pulp can be an alternative for solving problems garbage with the composting method. In addition, the community can do composting using this MOL by utilizing organic materials in the surrounding environment to reduce waste.

Conclusions and Suggestions

The average time to compile with MOL Coconut pulp concentration of 50,000 ppm is 21 days with a standard deviation of 0,0001. The average length of composting time with MOL of Coconut Pulp concentration of 100,000 ppm is 18.60 (19 days) with a standard deviation of 0.548. Meanwhile, the average length of composting time with MOL Coconut Pulp concentration of 200,000 ppm was 18.20 (18 days) with a standard deviation of 0.447. Based on the ANOVA test, the p value was 0.0001 ($p < 0.05$) which means that Ho was rejected, there was a significant difference in composting time using MOL coconut pulp concentration of 50,000 ppm, 100,000 ppm, and 200,000 ppm. The most significant difference is between compost with MOL Coconut pulp 50,000 ppm and compost with MOL Coconut pulp 200,000 ppm.

Other researchers should try other organic materials with MOL of Coconut Pulp in the composting process. To avoid high humidity when composting, it is recommended that before composting the organic material is dry. Take measurements of the quality of compost produced, especially C/N compost. For people who want to process organic waste into compost in a fast time, they can use bioactivators whose ingredients are easily obtained, one of which is this Coconut Pulp MOL.

Acknowledgements

This study was conducted without any funding, and the authors have no competing interests.

References

Badan Pusat Statistik. 2018. Statistik Lingkungan Hidup Indonesia 2018 (Pengelolaan Sampah di Indonesia). In: Subdirektorat Statistik Lingkungan Hidup, ed. Badan Pusat Statistik; 2018: 7. https://www.bps.go.id/publication/2018/12/07/d8cbb5465bd1d3138c21fc80/statistik-lingkungan-hidup-indonesia-2018.html.

Gultom, R.D. 2017. Pemanfaatan Limbah Air Kelapa Menjadi Pupuk Organik Cair Menggunakan Mikroorganisme *Aspergillus niger*, *Pseudomonas putida* dan Bioaktivator EM4. Chemical Engineering Department Faculty of Industrial Technology Sepuluh Nopember Institut of Technology Surabaya. 114p. http://repository.its.ac.id/44185/1/2313100011_2313100025-Undergraduate_Theses.pdf

Hamidah, L. 2018. Teknologi Pengolahan Sampah Skala Besar. (Tim Penerbit, ed.). Depok: Hijaz Pustaka Mandiri. Kurnia, N. 2019. Sampah Menjadi Masalah Lingkungan di Indonesia. Kompasiana.com. https://www.kompasiana.com/niningkurnia/5cbef26595760e2b081e54a4/sampah-menjadi-masalah-lingkungan-di indonesia?page=all.

Lubis, A.T. 2017. Efektifitas Penambahan Mikroorganisme Lokal (MOL) Nasi,Tapai Singkong, dan Buah Pepaya dalam Pengomposan Limbah Sayuran Tahun 2017. 2017: 51. http://repositori.usu.ac.id/handle/123456789/1596.

Pamungkas, N.D., Firmansyah, A. and Ethica, S.N. 2018. Isolasi dan Uji Patogenitas Bakteri Indigen Penghasil Enzim Selulase dari Limbah Ampas Kelapa di Pasar Tradisional Ngawen untuk Bioremediasi. *Pros Semin Nas Mhs Unimus*. 1: 261-267. https://www.researchgate.net/publication/329130783_Isolasi_dan_Uji_Patogenitas_Bakteri_Indigen_Penghasil_Enzim_Selulase_dari_Limbah_Ampas_Kelapa_di_Pasar_Tradisional_Ngawen_untuk_Bioremediasi_Isolation_and_Pathogenicity_Test_of_Indigenous_Bacteria_Pro.

Purwendro, S. and Nurhidayat. 2011 Mengolah Sampah. Penebar Swadaya. 52p. https://books.google.co.id/books?id=AqKp7QXl7YQC&pg=PA6&dq=jenis-jenis+sampah+organik&hl=id&sa=X&ved=0ahUKEwjz-8Gp5-TmAhWQb30KHdKkC-0Q6AEIODAC#v=onepage&q=jenis-jenis sampah organik&f=false.

Royaeni, Pujiono and Pudjowati, D.T. 2014. Pengaruh Penggunaan Bioaktivator Mol Nasi dan Mol Tapai Terhadap Lama Waktu Pengomposan Sampah Organik Pada Tingkat Rumah Tangga. *J. Kesehat*. 13(1): 1-9. http://publikasi.dinus.ac.id/index.php/visikes/article/view/1112.

Standar Nasional Indonesia. 2004. Spesifikasi Kompos dari Sampah Organik Domestik SNI : 19-7030-2004.

Suwahyono, U. 2015. Cara Cepat Buat Kompos Dari Limbah. (Nugroho S, ed.). Jakarta: Penebar Swadaya.

Yulianto, A.B., Ariesta, A., Anggoro, D.P., Heryadi, H., Bahrudin, M. and Santoso, G. 2009. Buku Pedoman Pengolahan Sampah Terpadu : Konversi Sampah Pasar Menjadi Kompos Berkualitas Tinggi. (Bhinekawati R, Joko F, Rima L, Wiranto B, eds.). Jakarta: Yayasan Danamon Peduli.