

ISBN : 978-602-18940-0-2

# *The 2<sup>nd</sup> International Seminar on New Paradigm and Innovation on Natural Sciences and its Application*



## **“Science for Environmental Sustainability and Public Health”**

**DIPONEGORO UNIVERSITY  
OCTOBER 4, 2012  
SEMARANG, INDONESIA**

organized by :



**FAKULTAS  
SAINS DAN MATEMATIKA  
UNIVERSITAS DIPONEGORO**

supported by :



**Kementerian  
Perindustrian  
REPUBLIK INDONESIA**



**KEMENTERIAN LINGKUNGAN HIDUP  
REPUBLIK INDONESIA**

U  
N  
I  
V  
E  
R  
S  
I  
T  
A  
S  
D  
I  
P  
O  
N  
E  
G  
O  
R  
O



## The Potency of Palm Oil Mill Effluent As A Raw Material For Liquid Fertilizer

<sup>1</sup>Elfidiah, <sup>2</sup>Dedik B, <sup>2</sup>Faizal <sup>2</sup>Salni

<sup>1</sup>Graduate student of Environmental science study, Program, Graduate School of Sriwijaya University, Palembang, Indonesia.

<sup>2</sup>Lecturers Graduate School of Sriwijaya University, Palembang, Indonesia  
Email: gemaelfidiah@yahoo.com

### ABSTRACT

The purpose of this study is to examine the potential for the POME treatment plant Palm Oil Mill Effluent as the raw material of Liquid Fertilizer. Palm Oil Mill Effluent samples taken from the Oil Palm Plantation PT. Minanga Ogan, South Sumatra. The analysis method used for BOD Winkler method, the method Kjeldahl Nitrogen, Phosphorus Looks ray spectrophotometer method, K by Atomic Absorption Spectrophotometer methods and MLSS (Mixed Liquor Suspended Solid) using the gravimetric method. The results of this study demonstrate the pond Anaerobic 20 147 1 BOD, 25 Mg / L, N 1021.22 Mg / L, P 328.19 Mg / L, K 541.03 Mg / L, and MLSS 138 Mg / L. Anaerobic ponds 2 BOD 18 421, 16 Mg / L, N 876.35 Mg / L, P 279.24 Mg / L, K 473.59 Mg / L, and MLSS 154 Mg / L. Anaerobic ponds BOD 11428.27 3 Mg / L, N 662.61 Mg / L, P 238.32 Mg / L, K 348.26 Mg / L, and MLSS 163 Mg / L. Anaerobic ponds 4 BOD 4522.81 Mg / L, N 443.26 Mg / L, P 102.22 Mg / L, K 327.78 Mg / L, and MLSS 198 Mg / L. According to the Decree of the Minister of Environment of the Republic of Indonesia No. 29 Year 2003 on the Use of Palm Oil Technical Guidelines, BOD of 3000-5000 Mg / L does not pollute the environment but still have value enough nutrients for the plants. It can be concluded that the anaerobic pond 4 can be directly used for liquid fertilizer. While the anaerobic pond 2 and 3 should be treated as anaerobic raw material liquid fertilizer as BOD of both pools is quite high.

**Keyword :** Palm Oil Mill Effluent, Liquid Fertilizer.

### 1. INTRODUCTION

Conventional Fertilizer Needs lately increasing so is not covered by the farmers, except that there are negative effects of chemical fertilizers on the environment. One of the efforts is to use the example of the utilization of local resources Local Resources South Sumatra, namely Palm Oil Mill Effluent. Waste not be a matter that should be avoided or covered processing, waste also has economic value concept of 3R (Reduce, Recycle, Recovery) would encourage any producer of waste to make wastes have economic value. The processing of Fresh Fruit Bunches to Crude Palm Oil produce biomass byproducts enormous amount. In 2004 the volume of oil by-products amounted to 12,365 million tonnes of Oil Palm Empty Fruit Bunch, 10,215 million tons of shells and fiber, and 32257-37633 million tonnes of Palm Oil Mill Effluent. This number will continue to increase with the increase in production of Fresh Fruit Bunches Indonesia. Production of Fresh Fruit Bunches Indonesia in 2004 reached 53,762 million tons and by 2010 is estimated at 64,000 million tons. (Naibaho P, 2003). The results of Oil Palm Research Center indicates that millers Palm Oil Plantation is quite efficient yield from 0.6 to 0.8 m<sup>3</sup> Palm Oil Mill Effluent / tonne of Fresh Fruit Bunches are processed. For example, in reasonable condition, the total volume of Palm Oil Mill Effluent, with a capacity of 30 tonnes FFB / hour which operates 20 hours per day will process 600 tonnes of FFB / day. The liquid waste will be treated in a waste treatment facility next river discharge into water bodies (Naibaho P, 2003). Palm Oil Mill Effluent can be used for fertilizer on farm land through *land application* of POME are certain conditions to contain nutrients that can be used for crops. According to the Decree of the Minister of Environment Republic Indonesian No 29 Year 2003 on the Use of Palm Oil Technical Guidelines, BOD of 3000-5000 mg / L in order not to pollute the environment but still have value enough nutrients for the plants. Nutrient content in 1 m<sup>3</sup> of POME BOD<sub>5</sub> has approximately 5000 mg / L is equivalent to 1.5 kg urea, 0.3 kg SP-36, 3.0 kg and 1.2 kg MOP fertilizer kieserit. Palm Oil Mill Effluent with a capacity of 30 tons / hour will produce around 480 m<sup>3</sup> of liquid waste / day, so the area can be applied to the waste is 100-120 hectares ([www.primatama.litbang.deptan. Go.id](http://www.primatama.litbang.deptan.go.id)). Palm Oil Mill Effluent contains macro nutrients such as N, P, and K required by palm trees, so that with the application of POME to land (*land application*) fertilizer. substance can save the cost of using macro nutrients contained in POME comparable the quantity of organic matter contained in POME so the estimated quantities of N, P, and K is closely related to the content of BOD in the POME. According to the ministerial decree Environmental Republic Indonesian No 28 Year 2003 on Guidelines for Technical Assessment of Industrial POME Utilization of Palm



Oil Plantation in the palm oil industry POME can be applied to the land if BOD ranged between 3000-5000 mg / L. The percentage of the nutrient content is relatively high in inorganic fertilizers so that farmers tend to use fertilizer. But lately, the higher the prices of in organic fertilizers. This of course adds to the cost burden for farmers. Addition of inorganic fertilizers can lead to dependence and may bring adverse effects, such as land so damaged by overuse and continuously will cause the soil to be loud, polluted water, and the balance of the soil is disturbed (Indriani, 2004). To address these research needs that can turn waste into something useful. One of them in particular harnessing waste organic waste to liquid fertilizer raw materials so as to reduce the accumulation of waste and can assist farmers in providing fertilizer. During this compost produced from organic waste in solid form is plentiful. But rarely is a liquid, in more practical terms effluent used as fertilizer because the manufacturing process is relatively inexpensive, and manufacturing costs incurred is not too large (Hadiuwito, 2007). Raw materials are very good organic fertilizer from organic waste that is wet organic materials or organic materials that have a high water content such as waste oil. In addition to easily composed, this material is also rich in nutrients that plants need. The greater content of cellulose and organic matter (C / N ratio), the process of decomposition by bacteria takes longer (Purwendro and Nurhidayat, 2006). Based on this, researchers are interested to know the utilization of Palm Oil Plantation. Liquid fertilizer can be treated by several variables palm oil mill effluent with nutrient N, P, and K from a variety of BOD which is expected later to know one of the values of the above parameters, it can be predicted value of wastewater BOD or otherwise concerned with knowing BOD values can be predicted value of N, P, and K and Palm Oil Mill Effluent. Problem Formulation, Palm Oil Mill Effluent untreated BOD usually have about 25,000 mg / L. Palm Oil Mill Effluent containing suspended solids and oils with high levels. The solid, if generic entry stream will settle, slowly decompose, consuming Oxygen in the water, emit an unpleasant smell. Alternatively, the solids and the oil floats on the surface of the water so resist aeration (oxygen supply) and affect aquatic life (PPKS Field, 2003). Palm Oil Mill Effluent with BOD content of about 25,000 mg / L, COD of 50,000 mg / L indicate that the content of Palm Oil Mill Effluent is a biodegradable organic material. effluent pH around 4.0 to 4.9 (acidic) that need further processing of organic waste that can be processed in a maximum in the neutral pH (pH suitable for bacterial decomposers). (Afrizal, 2007). To utilize Palm Oil Mill Effluent efforts should be made to process and recycle waste water by means of analysis characteristics Palm Oil Mill Effluent thus increasing the nutrient content of N, P, K and the conversion process wastewater into liquid fertilizer, so that waste water can improve the quality of land and palm oil production, thus expected efficiency and understanding as waste material into material contamination can be use implement our natural resources and become competent. Research Objectives, Knowing quality Palm Oil Mill Effluent reservoir ponds, each pond Analyze the characteristics of the reservoir, looking Optimum conditions for BOD, N, P, K and MLSS to be used as fertilizer. The benefit of this study is to provide wastewater treatment solutions Palm Oil Mill Effluent a liquid organic fertilizer, tackle environmental pollution by way of reduce, recycle, recovery and resue (R4), can reduce the cost of waste processing of Oil Palm Plantations.

## 2. MATERIALS AND METHODS

### 2.1. Time and Location Research.

The research was conducted in the laboratory with Environmental and Soil Laboratory Program Sriwijaya University.

### 2.2. Research Methods

This study is an experimental laboratory. By using a method of analysis for BOD Winkler, Kjeldhal method for Nitrogen, Phosphorus Spectrophotometer Rays Looks Posphorus, and Atomic Absorption Spectrophotometer method for potassium, the gravimetric method for MLSS (Mixed Liquor Suspended Solid). Sampling of Palm Oil Mill Effluent PT. Minanga Ogan South Sumatra pond Anaerobic 1, pond Anaerobic 2, pond Anaerobic 3 and pond Anaerobic 4.

### 2.3. Materials – Materials.

Materials - Chemicals and samples of materials used and the specifications are as follows: starch, Ammonium Chloride, Ammonium Molybdate, Ascorbat Acid, Boric Acid, Nitric Acid Sulfuric Acid, Ferric Chloride heptahydrate, potassium Dhidrogen Phosphate, Potassium Dhidrogen Phosphate, Potassium Iodide, Manganese Sulfate Mercury iodide monohydrate, Sodium Hydroxide, sodium azide, Wastewater Samples Oil Palm Plantation.



## 2.4. Tools.

Pyrex Glass Equipment, Bottle Winkler Buret, Incubator, City Isotermis, Kjedahl Pumpkin, Pumpkin Relluks, Electric Heating, Cooling, PH meter, Bioreactor Tube, Mixer, Filter.

## 3. RESULTS AND DISCUSSION

### 3.1. Physical Characteristics of Palm Oil Mill Effluent.

Results Analysis of Palm Oil Mill Effluent in each pond for liquid fertilizer become changing physical properties. Analysis of Oil Palm Plantation on pond 1 and 2 color brown, very smelly and foaming is caused due to the influence of the microbes. Outdoor 3 fawn color, odorless and slightly frothy. And with 4 color dark brown, somewhat smelly and somewhat frothy is due to the influence of the microbes that changes color.

### 3.2. Characteristics of Palm Oil Mill Effluent.

#### 3.2.1. Relationship Value BOD In Pond Anaerobic.

Waste Oil Palm Plantations have the BOD content of about 25,000 mg / l. Based on the analysis of each reservoir pond, BOD contains diverse. We can see in Figure 1.

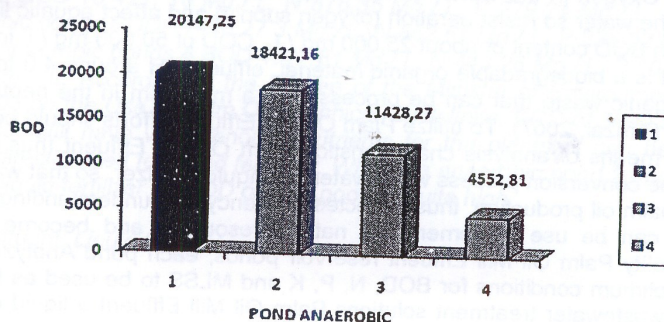


Figure 1 Relationship Between BOD value with Free Anaerobic.

Seen from Figure 1 that the value of BOD in the pond Anaerobic 1, 20147.25 Mg / L, pond Anaerobic 2, 18421.16 Mg / L, with Anaerobic 3, 11428.27 Mg / L and an Anaerobic 4, 4622.81 Mg / L has decreased. According Suriawiria (2003) BOD of each pool will decrease as a result of the decomposition process of biodegradation of organic material due to the activity of bacteria such as lactic acid, acetic acid, pirenat, organic acids are derived from the decomposition of carbohydrates proteins and fats.

#### 3.2.2. Relationship Value Nitrogen In Pond Anaerobic.

In POME Nitrogen Oil palm plantations will exist as organic nitrogen and ammonia nitrogen. Total Organic Nitrogen Ammonia Nitrogen plus the amount already present in the solution. Based on the analysis of each reservoir pool Nitrogen has a variety of content. We can see in Figure 2.

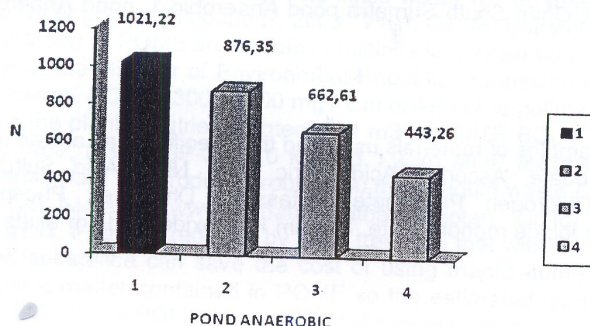




Figure 2 Relationship between N Value with Free Anaerobic

Seen from Figure 2 that the value of N in the Anaerobic pond 1, 1021.22 Mg / L, with Anaerobic 2, 876.35 Mg / L, with Anaerobic 3, 662.61 Mg / L and an Anaerobic 4, 443.26 Mg / L. That element of Nitrogen has decreased in each pond. According Notohadiprawiro (1999), the decline in the value of N is caused by the change Nitrogen by the activities of microorganisms for metabolic activity of life. Anaerobic pond 3 have the opportunity to be treated as a source of fertilizer to add nutrients to the plants, based on the researchers conducted a study on Anaerobic pond 3 at 662.61 Mg / L for liquid fertilizer raw materials.

### 3.2.3. Relationship Value Phosphorus In Pond Anaerobic.

Phosphorus contained in Palm Oil Mill Effluent contains compounds Ortoposfat, Poliposfat and Posfatorganis. Each phosphate compounds present in dissolved form, suspended or bound within cell organisms in the water. Based on the physical properties were dissolved Phosphorus, Phosphorus suspended (not dissolved) and Total Phosphorus (dissolved + Suspended). Phosphorus compounds to be analyzed depending on needs and circumstances of the examination body of water. Based on the analysis of each pond, Phosphorus contains diverse. We can see in Figure 3.

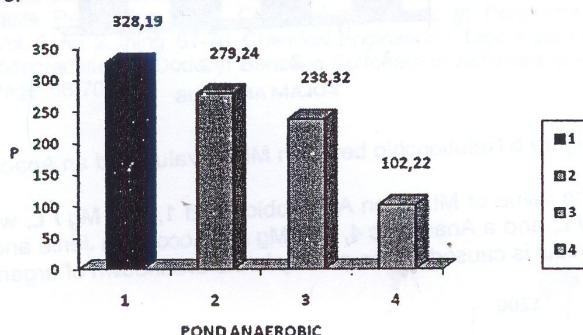


Figure 3 Relationship between Phosphorus Value with Free Anaerobic

Seen from Figure 3 that the value of the pond Anaerobic Phosphorus 1, 328.19 Mg / L, with anaerobic 2, 279.24 Mg / L, with anaerobic 3, 238.32 Mg / L, and a Anaerobic 4, 327.76 Mg / L. Viewed from each pool element Phosphorus has decreased. According Notohadiprawiro (1999), Phosphorus impairment is caused by the overhaul of Phosphorus by the microorganism activity for Metabolic activity of life.

### 3.2.4. Relationship Value Potassium in the Free Anaerobic.

Potassium is a vital ingredient for the formation of proteins, carbohydrates and also strengthen plant stems, flowers and fruits that do not fall Flaeder research and Megel (1976). If the deficiency element Potassium will cause the plant's leaves will dry and shrink or raised red spots brown, long dried up and died. Fruit shape be imperfect, small and not good quality. Based on the analysis of each reservoir pool Potassium has a variety of content. We can see in Figure 4.

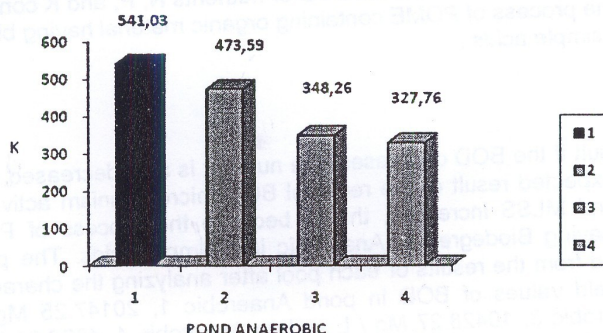


Figure 4 Relationship with Pond Anaerobic K Value

Seen from Figure 4 that the value of K at the pool Anaerobic 1, 541.03 Mg / L, with anaerobic 2, 473.59 Mg / L, with anaerobic 3, 348.26 Mg / L and an Anaerobic 4, 327.76 Mg / L. From Figure seen that a slight decrease in



the value of potassium equal to 5% of each pond 1 to pond 2, pond 2 to pond 3, and pond 3 to 4. According Notohadiprawiro (1999), Impairment of Potassium is caused by the decomposition of organic material at the expected result of the activity of microorganisms that remodel Potassium Metabolism life activities

### 3.2.5. Relations Mixed Liquor Suspended Solid Value In Pond anaerobes

Based on the analysis of each pond Anaerobic MLSS contains diverse. Increasing MLSS is because the process of Palm Oil Mill Effluent containing organic materials in a compound having Biodegradasi Anaerobes into simple acids. We can see in Figure 5.

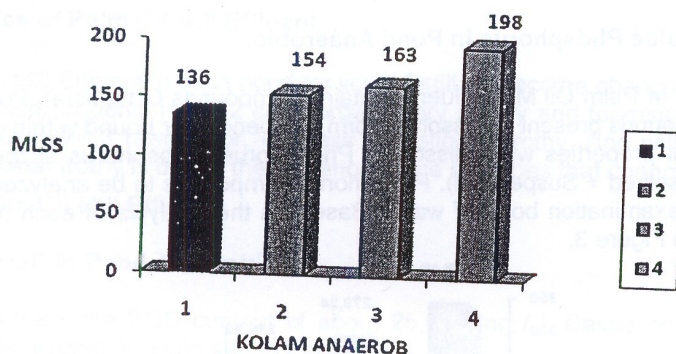


Figure 5 Relationship between MLSS value and an Anaerobic

Seen from Figure 5 that the value of MLSS on Anaerobic pond 1, 136 Mg / L, with anaerobes 2, 154 Mg / L, with Anaerobic 3, 163 Mg / L, and a Anaerobic 4, 198 Mg / L. According Jenie and Rahayu (1993) An increase in MLSS from pool 1 to 4 pools is caused by the activity in the breakdown of organic nitrogen into ammonia.

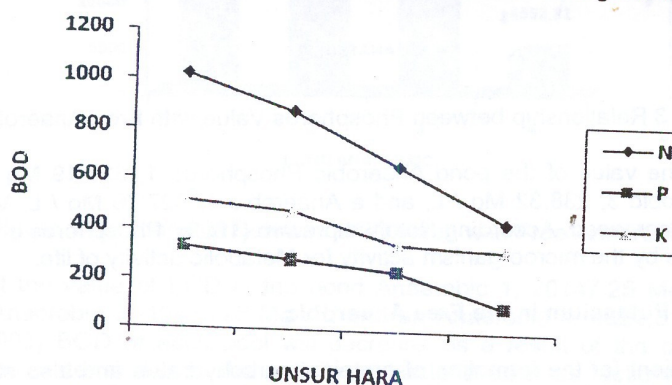


Figure 6 Relationship between BOD values with nutrients (NPK)

Seen from Figure 6 that if the graph is low then the BOD or nutrients N, P, and K contained in each pool will decrease, this is because the process of POME containing organic material having biodegrasi compound in anaerobic atmosphere into simple acids .

## 4. CONCLUSION

Of each pond that could result if the BOD decreased, the nutrient is also decreased due to the decomposition of organic material at the expected result of the remodel BOD microorganism activity and NPK nutrients for metabolic activity of life. and MLSS increases, this is because the process of POME containing organic materials in a compound having Biodegradasi Anaerobic into simple acids. The potential of Palm Oil Mill Effluent is chemically derived from the results of each pool after analyzing the characteristics of the POME in oil palm plantations can yield values of BOD in pond Anaerobic 1, 20147.25 Mg / L, with Anaerobic 2, 17421.16 Mg / L, with Anaerobic 3, 10428.27 Mg / L and an Anaerobic 4, 4622.81 Mg / L. value of N in the Anaerobic pond 1, 1021.22 Mg / L, with Anaerobic 2, 876.35 Mg / L, with Anaerobic 3, 662.61 Mg / L and an Anaerobic 4, 443.26 Mg / L. P values Anaerobic ponds 1, 328.19 Mg / L, with Anaerobic 2, 279.24 Mg / L, with anaerobic 3, 238.32 Mg / L and an Anaerobic 4, 327.76 Mg / L. the value of K at the pool Anaerobic 1, 541.03 Mg / L, with anaerobic 2, 473.59 Mg / L, with anaerobic 3, 348.26 Mg / L and an Anaerobic 4, 327.76 Mg / L.



Anaerobic pond MLSS values at 1, 136 Mg / L, with anaerobic 2, 154 Mg / L, with anaerobic 3, 163 Mg / L, and a Anaerobic 4, 198 Mg / L. With BOD, COD (3000-5000) does not necessarily produce raw material for making a good liquid fertilizer according SNI and vice versa. Results from Anaerobic pond 3 will be used as raw material fertilizer BOD value is 11428.27 Mg / L value of Nitrogen is 662.61 Mg / L, P value was 238.32 Mg / L, the value of Potassium is 348.26 Mg / L and MLSS is 163 Mg / L. And with four of the observations can be directly used as fertilizer.

## 5. REFERENCE

- [1] Ahmad, Adrianto, (2003), "Utilization of Process Parameters Kinetics Liquid Waste Anaerobic Biodegradation millers", Journal of Natur Indonesia 6 (I), ISN 1410-9379, Pekanbaru.
- [2] A. Alaerts And Sri Sumestry, (1987), "Water Research Methods", National Business Surabaya Indonesia.
- [3] Ali, Muzar, (2008), "Applications of Liquid Waste to Land millers and Influence padaTanaman Soybean", Thesis Department of Agriculture Faculty of Agriculture, University of Edinburgh, Edinburgh.
- [4] Arlen, (1997), Study of the Effect of Fertilization MCC Liquid Waste to Land area garden worms for Monitoring the Quality of Biological Earthworm. USU Department of Soil Science Thesis, Medan.
- [5] Basuki, BT, (2001), "Liquid Waste Processing 'Tank Cleaning' piled tank at Pertamina UPPDN IV Installation Semarang," Reactor Magazine, Vol. 5, no. 2. thing. 67-70, Chemical Engineering, Diponegoro University, Semarang.
- [6] Budiarsa, I. W et al, (2009), "Biodegradation of Dodecyl Benzene Sulfonate in Activated sludge systems", Journal of Sustainable Earth Vol. No. 9. 1 Page: 66-70.