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Nature of Chemical and Biological Sludge Biogas Liquid Waste Oil Palm

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Abstract:- Sludge Biogas liquid waste oil palm is an output product of anaerobic fermentation that can be utilized as organic fertilizer and biological fertilizer. The results of chemical properties analysis showed that there are macro and micro nutrients needed plant N total 346.32 mg/l, P total 79.96 mg/L, available P 125.06 mg/l, K 0.9%, Ca 0.02%, Mg 0.03%, Na 2364.33 mg/L and Cu 0.44 mg/L. Analysis of biological properties can be explained that the biogas sludge contains functional microbes i.e. nitrogen and phosphate solvent bacteria and has a population of 480 x 104 CFU/ML and 42 x 104. Nitrogen and bacterial phosphate solvent bacteria can be utilized as biological fertilizer, which helps to availability of nitrogen and phosphate nutrients in the soil.

Keywords:- *Sludge Biogas, Palm Oil Liquid Waste, Macro Nutrients, Micro Nutrients, Nitrogen-Blocking Bacteria And Phosphate Solvent Bacteria.*

I. INTRODUCTION

Palm oil Mills (PMKS) in the process of every ton of fresh fruit bunches (TBS) will produce an average of 120-200 kg crude palm oil (CPO), 230-250 kg of empty oil palm (TKKS), 130-150 kg fiber/fiber, 60-65 kg shell, 55-60 kg kernel, and 0.7 m3 of waste water. If Indonesia successfully becomes a major producer of the world's CPO, by producing 18 million tonnes of CPO per year as targeted, it will result in the liquid waste of palm oil Mills (LCPMKS) by more than 50 million tonnes per year (Ditjenbibprodbun, 2004). The MCC's liquid waste (LCPKS) on average contains the BOD (Biologycal Oxygen Demand) ranging between 30,000 – 50,000 mg/l will be pollutants when disposed directly to the free waters, but when viewed from the content of organic matter contained in MCC liquid waste, then the waste is the best alternative to replace the function of organic fertilizer (Ginting, 2007).

The liquid waste of palm oil Mills is a source of potential pollutants that can make a serious impact on the environment, so that the plant is required to handle this waste through improved end of pipe. In Indonesia, almost all palm oil mills use an open pool system to process liquid waste, in consideration of Keenomisan and ease of operation. In the process of management of the outdoor pool system, liquid waste is streamed through a series of ponds with several processing steps. The naming and function of ponds may vary between factories and others, but in general the system consists of four types of ponds namely fat pit, cooling pool (cooling pond), anaerobic pool (anaerobic pond), and aerobics pool (aerobic pond). Although the pool system has an economical value, it requires a wider area of land, time-consuming and removing the methane directly into the atmosphere from the parsing of organic substances occurring in the anaerobic pond. The release of methane from the liquid waste processing system accounts for up to 70 percent of total greenhouse gas emissions in the overall CPO production process (Rahayu et al. 2015).

One of the other ways that can be done to reduce the release of methane into the air is through biogas technology. Biogas is a flammable gas and is produced through anaerobic processes or fermentation of organic materials such as human and animal manure, domestic waste (households), garbage or organic waste that is biodegerable in anaerobic conditions. Biogas is a combination of several kinds of flammable gases and produced due to the process of digesti microorganisms carried out among other bacteria methanogenesis of organic matter (Demirel and Scherer, 2008).

II. METHODOLOGY

This research uses descriptive methods and experiments.

A. Place and time of research

Sampling of sludge biogas is carried out in the laboratory of ecology, Faculty of Chemical Engineering of North Sumatera University, chemical analysis conducted in research and Technology Laboratory of PT. Socfindo, build city and biology analysis conducted in laboratory Soil biology, Faculty of Agriculture, University of North Sumatra. The study was conducted in January 2020 to February 2020.

B. Materials and tools

The materials used are sample biogas sludge, some kinds of chemicals for characteristics of chemical properties, media pikovskaya, media James Nitrogen Free Malat Bromthymol Blue (JFNB), sterile water, cling pack, label, aluminum foil, sterile cotton, alcohol, spritus. The tools used are petri dish, measuring cup, beaker glass, ose Bent, ose straight, Bunsen, reaction tube, analytical scales, colony counter, Burette, sprayer, pipette drops, micro pipette, incubator, pH meter, LAFC (Laminar Air Flow Cabinet), stationery, camera .

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C. Research implementation

➢ Sampling sludge Biogas palm oil liquid waste

Sample biogas sludge taken from ecological laboratory, Faculty of Chemical Engineering University of North Sumatra. Samples were taken into containers for homogenization. After homogenized the sample is inserted into the sterile thermos and taken to the laboratory to be observed.

➢ Analysis of the chemical properties biogas sludge:

This analysis is done to test the nutrient content of the nutrients contained inside the biogas sludge

- pH: pH meter
- C-Organic: Walkey and Black
- N Total: Kjeldahl
- P Total: spectrophotometer
- P Available: spectrophotometer
- K: Flamefotometer
- Ca, Mg, Na: AAS

(Mukhlis, 2014)

➢ Analysis of biological sludge properties of biogas:

- Population calculation of nitrogen-blocking bacteria is conducted by TPC (Radji, 2011) with James Nitrogen Free Malat Bromthymol Blue (JFNB).
- Population calculation of phosphate solvent bacteria is carried out by TPC (Radji, 2011) method with Pikovskaya media.

Engineering calculation of TPC (Total Plate Count) of sludge biogas palm oil waste. Taken as much as 10 ml sludge biogas was dissolved in 90 ml of the solution of NaCl 0.85%. From the solution then performed dilution 10-2 to Dengan10-4 then as many as 0.1 ml from the second to 10th dilution stage in plating on the Media James Nitrogen Free Malat Bromthymol Blue (JFNB) and the media Pikovskaya. Microbes are incubated for 2 – 3 days, and the colony is observed that grows on the plate medium.

Colony growth is recorded in each cup overgrown by a bacterial colony. Calculated Total Plate Count (TPC) Colony of bacteria contained at each level of dilution using the colony counter (Radji, 2011). Positive tests of nitrogen-blocking microbes characterized by the presence of growing colonies in JNFB media and microbial growth of phosphate solvent characterized by the presence of a clear zone around the microbial colony on the Pikovskaya media.

III. RESULT AND DISCUSSION

A. Chemical Properties of Biogas Sludge Liquid Waste palm oil

Parameter	Unit	Value
pH		6.5
C-Organik	%	0.14
COD	mg/l	21.996,5
BOD	mg/l	5637.5
N-total	mg/l	346.32
P-total	mg/l	79.96
P_2O_5 Bray II	mg/l	125.06
K	%	0.19
Ca	%	0.02
Mg	%	0.03
Na	mg/l	2364.33
Cu	mg/l	0.44
Rasio C/N		4.05

Table 1:- The composition of Biogas Sludge palm liquid Waste
Source: Data processed

In table 1 can be explained that the pH sludge biogas is alkaline, it occurs because the fermentation process of anaerobic requires optimal pH for the growth and activity of bacteria at the same time in producing methane gas ranging from 7.0-7.2, although gas production is still being fulfilled in hoses 6.6 – 7.6. At the beginning of decomposition, the production of organic acids during the fermentation and acidogenesis can decrease pH to 5.0, and gradually increase during the process of Methanogenesis (Wandansari, 2009).

The biogas sludge contains macro and micro nutrients that are needed by plants, but from the C/N analysis deviating from the criteria of organic fertilizer in general is 10-20. This is due to low C-organic levels and high nitrogen contained fertilizers caused by high degradation of nitrogen by bacteria in the biogas digester (Lubis, et al. 2014).

B. Nature of Biological Sludge Biogas Liquid Waste Oil Palm

Samples of biogas sludge that is used as a source of isolating bacteria of nitrogen and phosphate solvent obtained from the Ecological laboratory, Faculty of Chemical engineering Univeristy North Sumatra. The bacteria in the biogas sludge samples were inoculated into the media James Nitrogen Free Malat Bromthymol Blue (JNFB) and solid Pikovskaya media. Not all bacteria can grow on these mediums. The growing nitrogen bacteria in the JNFB media calculated bacterial colonies with the TPC

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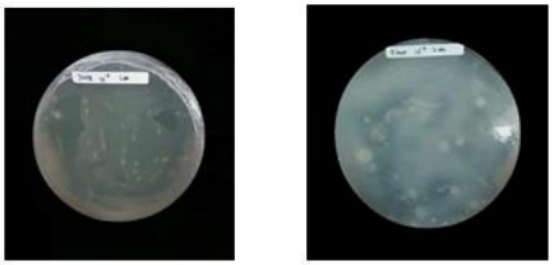
method. Phosphate solvent bacteria that grow on solid pikovskaya media will dissolve phosphate characterized by the presence of a clear light-colored zone or clear zone surrounding the bacterial colony. This is due to the dissolving of phosphate from CA3 (PO4) 2 contained in the media. The calculation of the population of nitrogen inhibitors is 480 x 104 CFU/ml and phosphate solvent bacteria as much as 42 x 104 CFU/ml.

Bacteria phosphate solvent (BPF) is a group of soil bacteria that has the ability to dissolve P that is fixated in soil and turn it into an available form so that it can be absorbed by plants. Some bacteria that can dissolve phosphate include Pseudomonas sp, Bacillus sp., Escherichia sp., and Actinomycetes sp. Genus Pseudomonas sp, and Bacillus sp. It has the greatest ability to dissolve soluble phosphate into a form of soluble soil. This dissolving is caused by the secretion of organic acid such bacteria such as formiic acid, acetate, propionate, lactate, glycolic, Glioksilat, Fumarate, Tartaric, Ketobutyric, succinate, and citrate (Subba-Rao, 1982).

Nitrogen-blocking bacteria has the ability to increase the efficiency of N-available use in soil. The bacteria use free nitrogen to synthesize protein cells where the proteins will undergo a process of mineralization in the soil after the bacteria experience death, thereby bacteria contributing to the availability of nitrogen to the plant (Rahman et al.,2015).

Plants and most microbes have no way to bind nitrogen into compounds in its cells. Plants and microbes generally get nitrogen from compounds such as ammonium and nitrate in soil. To utilize nitrogen in the form of gases, biotechnology experts focus their attention on the relationship between plants and certain types of microbes that can slow down nitrogen from the air and construct nitrogen atoms into the ammonium nitrate molecules, or other compounds that can be used by plants.

In Figure 1 can be seen that after growing bacteria on selective media that is JNFB and Pikovskaya, there are bacteria that grow on both media.



(A) (B)

Fig 1:- (A) Nitrogen-blocking bacteria with a 10-4 reduction. (B) phosphate solvent bacteria with dilution 10-4

IV. CONCLUSION

Sludge Biogas liquid waste palm oil has a chemical properties that can be used as organic fertilizer and has a content of nitrogen and phosphate solvent inhibitors that can be utilized as biofertilizer (biological fertilizer).

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