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POLLUTION IN PALM OIL MILL WASTE: CASE STUDY ON WASTE MANAGEMENT OF SUNGAI JERNIH PALM OIL MILL

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Abstract

This research is to investigate the pollution in Palm Oil Mill (POM) waste and how the POM manages the waste. The Palm Oil industry creates vast amounts of waste which a tough process for elimination. From the vast amount of waste produces, POMs is the sector that contributes to the highest number of solid and water waste with major environmental consequences. In this research, it will highlight on the rules and regulation that the Sungai Jernih Palm Oil Mill must comply to handle the waste produce. This research also will discover all the processes involved to dispose of the waste. Other than that, the purpose of the research is also to define the Sungai Jernih Palm Oil Mill strategies to minimize the pollution occur caused by the waste. This research used a qualitative approach by conducting two respective respondents from the mill to collect the essential data. The result shows that the mill waste management of the mill is based on the rules and regulations from the Department of Environment (DOE) and the Malaysia Palm Oil Board (MPOB). Most of the Biomass waste will be reused at the mill and plantation, while the hazardous waste must be handle by the DOE hired contractor. To reduce waste pollution, the mill has been practicing preventive maintenance and also recycling which help to reduce the aunt of waste that needs to be sent to the landfill.

Key words: Palm oil Mill, Waste management, Pollution

1.0 INTRODUCTION

This research is conduct to study the pollutant in palm oil mill waste, a case study on waste management by Sungai Jernih Palm Oil Mills. This research will be held in Pekan, Pahang. The nature of business for this company is palm oil mill but they also own oil plantation at the same place. The Sungai Jernih Palm Oil Mill (POM) first started operating in 1992, with a production capability of 30 metric tons of fresh fruit bunches per hour. The POMS has been receiving supply of the Fresh Fruit Bunches (FFB) to be process into Crude Palm Oil (CPO) from three estates which is from the Sungai Jernih plantation, Bebar plantation and Tabung Tentera plantation.

Malaysia is listed as one of the world's biggest producers of palm oil which is the second-highest in exporting palm oil after Indonesia. The country is witnessing the vigorous growth of oil palm plantations and mills over time. This commodity is essential to Malaysia's economic development. Due to the rapid development of the industry, a large fraction of oil palm waste is produced and the industry had to faces environmental issues arise

Research Problem

Lack of technique to handle the waste produced will cause pollutions to occurs. Palm Oil Mill Effluent (POME) has been treated using the anaerobic digestion method used by most of POMs. However, this method is releasing biogas and become a major concern for the environment [1]. Besides, the recent trend of dumping has produced extra nutrients in the soil in the most unscientific way. This situation is detrimental to both flora and fauna wanting to live. Malaysia industry has been facing global critics on the palm oil industry's impact on the environment.

Research Objective

the specific policy that must be adopted by the business in the handling of the waste. Since many activities would be involved in waste management until the waste is eventually disposed of, thus this study will also explore all processes involved in waste disposal. The palm oil mill often has negative environmental impacts, which is why this research would explore the strategies and methods used to mitigate the issues.

Impact to Environment

POME that is not achieve the standard condition is released into the oceans, rivers, and streams will be effected. This has been seen by the pollution of some river in Malaysia that occur due to the POMs negligence in handling POME, which is at Ambual, Punti and Ongom river. The pollution was reported by the locals since it effected the water source for the resident. The content of the POME which is soluble organic will threaten the aquatic living things and the organism because the substance is a reducing the level of oxygen in the water. POME emit CH4 (Methane) into the atmosphere would lead in a 23 times greater contribution to global warming than that of CO2 (Carbon Dioxide) POME contributes up to 90% of GHG. The large amount of GHG that release from the POME is because of the POMs failure to provide the biogas capture strategies to reduce the amount GHG release [1].

Choice preferred by the farmers and mills is to burn the by-product without any profit also has caused air pollution to the surroundings [2]. The EFB was also use as boiler fuel by the palm oil mill. Burnt biomass content emits a wide variety of gases such as Particulate Matter (PM) elements, CH4, CO2, CO, volatile and semi-volatile organic compounds, aldehyde, organic acid and inorganic and [3].

Waste Management Practice in Palm Oil Mill

Empty Fruit Bunch (EFB) appears in a bulky shape that brings up the issue of disposal of this by-product. The common method practiced of POMs in handling the EFB is by burning, transferred to landfills, or use it as organic fertilizer [4]. In addition, the use of EFB as a boiler fuel would require a drying process since the EFB content is 67% moisture, which indicates th at EFB is less suitable for combustion use [5]. the Palm Oil Industry are making a lot of attempts to utilize the EFB as the main potential feedstock to produce bioethanol [6], biochar [7], bio-oil [8] and many others. EFB also high potential to be processed as a paper replacing the current fiber resources [9].

Palm kernel shell (PKS) contains around 11% to 13% moisture [10]. Low in the moisture has resulted, most of the mill use shells as a burner for the steam boil in the factory and the steam release will contribute to the electricity by the running turbine. The ashes from the burning will be utilize as the fertilizer for the palm oil plantation [11]. PKS is much easier and the characteristic of PKS is also considered great for the feedstock to produce bio-oil, biochar, and biogas [12].

Mesocarp Fiber (MF) is a by-product that contains the fruit fiber and some particle of shells and kernels. The conventional method that has been practice by POMs is by using it as the main fuel for the steam boiler at the factory [13]. MF has attracted some researchers by being lignocellulosic that make it highly potential for bio composite production [14].

Open ponding system where POME is release into watercourse is one of the methods that involves low capital and simplicity that ease the handling which becomes the main option of more than 85% of the POMs in Malaysia [15]. The open ponding system commonly will be divided into cooling and mixing, anaerobic, facultative, and aerobic ponds. This is the example of biological treatment that is ecofriendly by using the microorganism that consume the high organic content of the POME [16].

Government Policies of Waste Management

The measures discussed in this analysis include separate official legislation and report issued by the main authorities such as Department of Environment Malaysia (DOE) and Malaysia Palm Oil Board (MPOB). In Malaysia to reach the sustainability of industry, the Malaysia Sustainable Palm Oil (MSPO) and Roundtable Sustainable Palm Oil (RSPO) also provide a standard to be followed by the industry [17].

2.0 METHODOLOGY

This research is using the qualitative method. The data is collected through the interview and the data collected is based on the experience and knowledge of the respondent. By performing this method, the researcher will be getting more accurate data upon the study since the respondent is working in the industry. Therefore, the knowledge of the respondent is more practical and precise. This method will be able to give solution on the research question and the method was focused on the literature review and the compilation of interview details.

Description of the Study Area

The study will be conducted at Sungai Jernih Palm Oil Mill located at Pekan, Pahang. The nature of the business for this company is expertise in plantation. However, the company

also operate their own palm oil mill that located near to plantation. The POMS has been receiving supply of the Fresh Fruit Bunches (FFB) to be process into Crude Palm Oil (CPO) from three estates which is from the Sungai Jernih plantation, Bebar plantation and Tabung Tentera plantation.

Research Instrument

The research instrument are distinguished into two types, which is primary and secondary data. Primary data of this research is based on the interview at the selected place and the secondary data will focus on collecting data through previous study.

There are a variety of ways to collect primary data. In this research, the researcher uses the qualitative method by performing an interview with the selective people for the data collection. By using this method, it will involve several processes before the data is 2

Secondary data is contrast with the primary data that collected from the personal research and direct sources. While secondary data is the data that has been collected from the previous researchers or study. As for this research the data is collected from the Journal, article, government report and internet. The secondary data is necessary for the research to provide a better understanding of the field study.

Data Sampling

Throughout research, sampling is performed to be able to obtain accurate results. A sample is a subset of the population that is being researched and chosen for the particular analysis. The purpose of research sampling is to look for appropriate samples to prevent bias. These sampling choices allow researcher to deepen her understanding of whichever phenomenon of the study. There are one types of sampling that been chosen for this research which is purposive sampling.

Purposive sampling Also known as selective sampling, purposeful sampling is a sampling technique used by qualitative researcher to recruit participants who can provide detailed and in-depth information on the phenomenon being investigated. This is highly subjective and decided by the researcher who determines the qualifying criteria that each individual will satisfy in order to be eligible for the study. Purposive sampling is often used when one's objective is to include participants representing a wide range of perspectives, purposeful sampling may also be used when a researcher wishes to include only person who meet very narrow or specific criteria

Data Analysis

Data analysis can be done in various way, as for this research the researcher is using the thematic analysis to process the information. This is the common method that use to analyze the qualitative data that will be in form of text such as the interview transcript. There several step that will be complete by the researcher in using this method of analysis.

Coding Technique

Coding the information allows the researcher to arrange the information. Data coding refers to the method of translating data or findings gathered into a series of meaningful categories. In order to provide a complete account of the reported or observed phenomenon, it is a method of summarizing and re-presenting results. Interviews do not often perform as expected. Conversations may take an abrupt turn and open up a new area to be examined by the researcher. This shows that various facets of the issue can be answered in the same interview questions. Therefore, Coding is necessary for the researcher to organize the collected information.

In this research the data collected is using inductive coding technique or also known as transparent coding. This approach is generally associated with qualitative research. Depending on the contextual proof itself, to generate codes. There is no fixed codebook for this form of encryption, all codes are explicitly the result of responses from the respondent. Inductive coding is an iterative process, which take longer and more detailed than other coding. But it also provides a more comprehensive, unbiased look at the themes in the results.

Formula

This formula will be used by the researcher to identify the text from the transcript that contain specific information. This formula help the examiner examine the facts an evidence that exist in transcript that related to the themes. Below is the formula structure:

Fig. 1. Formula

T = Transcription Module, P = Pages, L =Line

Conceptual Framework

A conceptual framework represents the researcher's synthesis of literature on how to explain a phenomenon. In other words, the conceptual framework is the researcher understanding of how the particular variables in his study connect with each other. Thus, it identifies the variables required in the research investigation. It is the researcher's "map" in pursuing the investigation. Before researchers begin gathering information, the conceptual structure should be constructed and it is always depicted in a visual format. In addition, the variable are basically the characteristics specified in the cause and effect relationship. The two variable are consisting of dependent and independent variable. The dependent and independent variable of this research found by researcher as below.

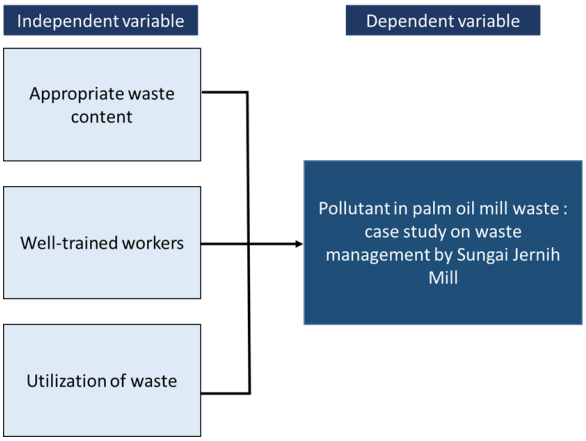

Fig. 2. Independent and Dependent analysis

3.0 RESULTS AND DISCUSSION

Table.1 Summary of Finding

Themes	Details
Rules and regulation	• Pahang state government, Alam Flora • Department of Environmental
	• Environmental Quality Prescribe Premise Crude Palm Oil Regulation 1977must be complies to handle POME • Prohibition of POME discharge in lake • Land applications
	• Installs Electro Static Precipitator (ESP)
	• Equip censor at chimney • System Continuous Emission Monitoring System (CEMS)
	• Have both MSPO and RSPO
Waste management	• Non-hazardous is the by-product (POME, PKS, MF, EFB) • Hazardous is scheduled waste
	• EFB use as fertilizer, called as mulching • PKS and MF use as fuel for boiler • System conveyer • Automatic fuel feeder • Store in roofed placed
	• EFB only used as mulching
	• Also known as black soil • Given free to anyone
	• Dispose within 180 days and not more than 20 metric/tons • Hire contractor from environmental department • This mill hazardous waste 3-5 metric tons • Collection of hazardous waste twice a year
	• Land application • Sprinkle system • license from the Pahang environmental that has lenient parameter • BOD average 100 mg/l • pH level 8 • Suspended solid lower than 400 mg/l • Oil and grease average 4-7 • Nitrogen 70-80
	• 9 ponds for Pome treatment 2 two dumping ponds • Clean sludge from the treatment ponds also called as slugging • Three stages of ponding system • Time consume for completion is

	78.3 days or around 70-80 days • BOD measure at the lab of the mill
	• Experience • Background of study • Certificate in scheduling waste
	• Provide budget for management training • Guideline provide from the environmental officer
Strategy	• Recycle • Preventive maintenance

Rules and Regulations

There are a lot of rules and regulations that must be comply by the POM in their operations. The laws that must be followed by the POM is the Environmental Quality Prescribe Premise Crude Palm Oil Regulation 1977. This is the act from the DOE that provide the method of the POME discharge and all the parameter limit of the content. Next, Environment Quality (Scheduled Waste) Regulations 2005. This is the regulation that must be followed by the POM to handle the scheduled waste. it is compulsory for the POM to make sure that the Particulate Matter and opacity of the smoke release is comply to the Environmental Quality (Clean Air) Regulation 2014. . It is compulsory for the POM to registered the Malaysia Sustainable Palm Oil (MSPO). to be more advance, the mill also registered the Roundtable on Sustainable Palm Oil (RSPO)

Waste Management

As for this mill the EFB will be use as the fertilizer at the plantation which become the source of nutrient for the palm oil tree This process is also called as mulch, where the EFB without any process will directly bring to the plantation and placed under the palm oil tree. The EFB will mulching even without any supplement of inorganic fertilizer. This mill does not use burn as the method to disposed the EFB because the EFB contain moisture that will result in black smoke if its burn and the mill does not own incinerator that can control the black smoke release from the EFB burning.

Next, for the PKS and MF, both respondent highlight that these waste is use as fuel for boiler. The content of this waste that is less moisture make it suitable to be use as fuel for boiler at the mill. After get burn in boiler, the PKS and MF will leave the ashes that is also called as black soil. The black soil is good for farming, which is also can be use at the plantation. However, in this POM the ashes will be stockpile and given free to anyone interested.

POME is a wastewater produce along the milling operation, due to its highly polluting properties, it needs adequate treatment before being discharged. Sungai Jernih Mill has been practicing the land application method. To treat the POME, the mill also use the most common method used in Malaysia which is open ponding system that is low cost and effective in treating the POME. This POM is also need to handle the hazardous waste, the hazardous waste is disposed by the contractor of DOE.

This company, hired an environmental officer based on the educational background, which is it must relate to the environment scope. mill will make sure that the environmental officer has the certificate of scheduling waste. In order to getting update of the new trend and rules, RM 4000 budget is provided for the waste management training that is compulsory to attend by the first respondent.

Strategy

In order to reduce the waste produce, the mill is practicing the recycling of the recyclable material. It will help the mill to reduces the amount of waste sent to landfills and incinerator. The waste management of the mill will make sure the workers always do the preventive maintenance of ponding system. The workers will always monitor each of the pond to make sure it has the suitable depth to reduce the polluted level.

4.0 CONCLUSION

The objectives of the research are achieved successfully. The researcher manages to identify the compliances of the mill to the rules and regulation by the DOE and MPOB. After doing this research, the researcher also able to define the flow of all the waste for the disposal and further treatment. Based on this research, the strategies of the mill to reduce the pollution occur is also succeeded identify by the researcher.

To complete this research, the are several limitations that the researcher need to overcome. The first one is the access to the location of research, the researcher is not able to conduct the interview face to face and to visit the location of the research which located in Pekan, Pahang due to the Conditional Movement Control Order. Next, the limitation is Sample size/sample bias, the size of the mill is small, the number of person in-charge to control waste management if the mill is a person only, which is the environmental officer. The last limitation is time, the preparation to conduct the interview was pending due to the

researcher had to seek for new company in last minute.

The researcher has the recommendation to boost their waste management efficiency. The mill should supply the waste to related industry. By supplying the waste produce by mill, it will enable the mill to increase the profit of the mill. Besides, this method will help the mill to minimize the waste and reduce the pollution occurs. Other than that, the mill should use the technology advancement to handle the POME to reduce the pollution release by the POME.

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