Production of wood vinegar from empty fruit bunch biology essay

Pyroligneous acid, or pyrolysis oil also called wood vinegar, is a dark liquid produced throughout the natural act of carbonization which occurs when wood is heated in an airless container during charcoal production. When the gas is cooled, it condenses into liquid. Raw wood vinegar has more than 200 chemicals, such as acetic acid, formaldehyde, ethylvalerate, methanol, tar, and others. For agricultural use, tar residue in the raw wood vinegar is usually extracted by coagulation, since the tar residue can stick as a coat on plant leaves. Wood vinegar believes can improves soil quality, eliminates pests and controls plant growth, but is slightly toxic to fish and very toxic to plants if too much is applied. It accelerates the growth of roots, stems, tubers, leaves, flowers, and fruit. In certain cases, it may hold back plant growth if the wood vinegar is applied at different volumes. A study shows that after applying wood vinegar in an orchard, fruit trees produce increased amounts of fruit. Wood vinegar is safe to living matters in the food chain, especially, insects that help pollinate plants.

Industry of palm oil, besides contribute main foreign exchange for Malaysia, it is also recognized as the sole largest source of water pollution. Palm oil industry produces large volume of highly polluting effluents, for example, 2. 5 tonnes of Palm Oil Mill Effluent (POME) is generated for every tonne of crude palm oil produced (DOE, 1999). In Malaysia, POME contributes major oily wastewater that pollute environment badly. Like other processing, palm oil industries also produce large quantities of effluent, when discharged untreated into waterstream, adversely affects aquatic life and domestic water supply. This is due to high organic compound content in the effluent. Most of the methods that have been used to treat POME such as aerobic

digester, trickling filter, aerobic and aerobic pond, lagoon and others were reported in several research papers.

1. 2 Problem Statement

In the development of jungle to oil palm, in addition to socio economic considerations, the palm oil industry has and will continue to place strong emphasis on balancing environment protection and human welfare (M. A Fuad et al., 1999). POME treatment needs an efficient system in facing the current challenges. There are many treatment plants failed to achieve the standard discharge limits even though they have applied biological treatment system.

For that reason, an alternative POME treatment system is required to meet standard discharge limits. A technological shift from biological and chemical treatment to coagulation-flocculation process with environmental friendly coagulants could result to the improved the POME treatment system.

Palm oil processing mills generally discharge large volumes of wastewater. About 0. 67 tonne of POME is generated for every tonne of fresh fruit bunch (FFB) processed. One of the main ingredients in palm oil mill effluents that cause severe problems is its residue oil. POME contains about 4000-6000 mg/l of oil and grease, approximately 2000 mg/l of residue oil is present in an emulsified form in the supernatant of POME. In terms of biochemical oxygen demand (BOD) which amounts to 25000mg/l, it is highly polluting. The suspended solids is about 4-5% in the POME are mainly cellulosic material from the fruits. Emulsified oil droplets are experienced spontaneous coalescence into larger flocs, thus making oil separation by gravity is difficult

and time consuming process. This residual oil has to be removed to prevent interfaces with water treatment units, to avoid problems in the biological treatment stages.

Objective of the Research

To produce wood vinegar from Empty Fruit Bunch

To study the best characteristics of wood vinegar as coagulant agent

To investigate the effect of wood vinegar as coagulant agent to treat POME

CHAPTER II

LITERATURE REVIEW

2. 1 Palm Oil Mill Effluent (POME)

Every country in the world depends on its major industry to develop its economy to achieved well develop country status. Oil palm is the major agricultural product in Malaysia and it was the largest products export in Malaysia. Since its first introduce in Malaysia early in 20 century and commercially produce in 1917, this plantation grows rapidly throughout the country and now its cover about 40% of the cultivated land. The common process to obtain palm oil from palm fruit is called extraction and the most common method applied in Malaysia. However, this process also generates brownish slurry that contains high organic matter and can harm aquatic life if it dumped directly into water stream. For every tonne of palm oil produce, it is estimated that 2. 5 tonne wastewater also being generated as byproduct. Thus, the production of nearly 8 million tonnes of palm oil per annum, the

amount of POME generated is equivalent to the wastewater generated by 22 million of population people in the country.

Palm oil mill effluents generated have very unpleasant odor and highly acidic even it categorized as non toxic. They are highly polluting and contain high organic matter. The Biological Oxygen Demand and Chemical Oxygen Demand (BOD5 and COD) of this slurry was high as well as Total Suspended Solid, Total Nitrogen, Ammonical Nitrogen, as well as oil and grease. As for physical nature, this POME is thick brownish liquid in color, hot about 80-90 oC , and have unpleasant odor.

2. 2 POME Treatment Technologies

At present, there are so many technologies available to treat POME. The common method employed to treat POME is biological treatment. Usually, combination of aerobic, anaerobic and facultative pond been employed where at the end of treatment the residue of the effluent is discarded at the river or sea.

Other than that, the common method to treat POME using open digestion tank systems have particular disadvantages such as a long hydraulic retention time of 45-60 days, bad odor, difficulty in maintaining the liquor distribution to ensure smooth performance over huge areas and difficulty in collecting biogas, a mixture of about 65% methane, 35% carbon dioxide and true amount of hydrogen sulfide which can have detrimental effects on the environment.

In the other hand, extended aerobic process was employed widely. In this system, to further reduce the BOD content, the liquid slurry is aerated by

using floating aerators by means of providing oxygen. This floating aerators help to ensure complete mixing by make the pond content always in suspension form. Through this process, levels of useful microorganisms are raising thus speed up the conversion of pollutants to energy, carbon dioxide and water. However, the main advantages of these systems are its high BOD removal efficiency and low solid yield.

In chemical precipitation process, the commonly used coagulants in wastewater treatments such as aluminium sulphate (Alum) and poly-aluminum chloride (PAC) produce sludge that is difficult to dispose and in terms of health concern can cause Alzheimer’s disease in long term effects.

2. 3 Wood Vinegar as a Coagulant Agent

So far, there is no officially trial to make wood vinegar as a coagulant agent to treat waste water. However the characteristics of wood vinegar as a coagulant, anti microbial, anti fungal, and others have been studied. Baimark and Niamsa found that, wood vinegar can completely inhibit the fungi growth on the surface of natural rubber. This is because the phenolic compound contained in the wood vinegar might exhibit some antifungal property (Nakayama et. al, and Kartal et. al). Other than that, Baimark and Niamsa also stated that plasticity retention index, Mooney viscosity and mechanical properties of natural rubber coagulated by wood vinegars were similar to those using acetic acid and better than using formic acid. This statement strengthens the ability of wood vinegar to act as a coagulant agent.

CHAPTER III

RESEARCH METHODOLOGY

3. 1 Research Methodology

This trial consists of 2 steps of research study:

The production of wood vinegar through fast pyrolysis method.

Wood vinegar produced during thermal cracking was collected at different temperature. The characteristics of wood vinegar are investigated using High Performance liquid Chromatography (HPLC), the compositions of pyroligneous acids were analyzed by Gas Chromatography-Mass Spectrophotometer (GC-MS), and Karl Fischer titration (KFT) determine water in pyrolysis liquids.

Determination of POME composition and wood vinegar testing as coagulant agent.

Usually POME contains high organic matter. Sampling process of POME is doing before the composition of POME is determined by using Gas HPLC and Gas Chromatography-flame ionization detection (GC-FID). After that effects of wood vinegar to POME are investigated by determine the BOD5, COD, suspended solid (SS) , total Kjedahl Nitrogen (TKN), Ammoniacal Nitrogen, turbidity, color and pH. The characteristic of treated POME is then determined and compare to other commercial coagulant agent such as Alum, and PAC in order to analyze the performance of wood vinegar in POME treatment method.

CHAPTER IV

EXPECTED RESULT

4. 1 Expected Result

There have been growing interests in the analysis of chemical constituents of pyroligneous acid, yet there is no preliminary study has been done on the performance of POME treatment by using this application. However, according to 10 years of research in Manchester as well as working experience with a variety of companies to treat a range of waters, including industrial effluents, colored waste, raw water and groundwater, a few forecasting result can be made. The research is expected to give effective result in removing organic matter, oils and solvents, hard chemical oxygen demand (COD) and many more from POME. In addition, the research will lead into reducing the cost of POME treatment and produce more effective environment friendly waste water treatment method.