

UNIVERSITI TEKNOLOGI MARA

**FTIR ANALYSIS ON MODIFIED KAPOK FIBER VIA
ESTERIFICATION FOR PALM OIL MILL EFFLUENT
(POME) TREATMENT**

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ABSTRACT

Palm oil mill effluent is a waste product from the palm oil industry and it was considered as a drawback to the environment. This effluent was highly polluted and many studies have been conducted in order to determine the most economical and environmental friendly scheme for palm oil mill (POME) treatment. The objectives for this research were to modify the kapok fiber using esterification technique and to analyze the unmodified and modified kapok fiber using Fourier Transform Infrared (FTIR) spectroscopy. The kapok fiber was modified by using esterification reaction with the different percentages of catalyst (5% w/w, 10% w/w and 15% w/w). The modified kapok fiber was analyzed by using Fourier Transform Infrared (FTIR) spectroscopy to observe the functional groups presented after modification and the results were compared with the unmodified kapok fiber. Based on the FTIR spectra, the ester group was formed at the range of 1733-1737 cm^{-1} for the esterified kapok fiber for all of the percentages of catalyst. Meanwhile, the alcohol O-H stretching was presented at the region of 3329-3346 cm^{-1} both for unmodified and modified kapok fiber. However, the alcohol O-H stretch in esterified kapok fiber has reduced due to the reaction between the alcohols with stearic acid to form an ester. The best modification was by using the 5% of calcium oxide as the result showed the highest formation of ester which was 90.5%T. In conclusion, it shows that the esterification reaction has successfully modified the characteristic of the unmodified kapok fiber.

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CHAPTER 1

INTRODUCTION

1.1 Background study

Palm oil industry is being a major industry as it produces raw material for other industrial sector and it is becoming one of the income that contributes to the Malaysian economy. This industry is still in progress as it is undergoing a lot of research and development mainly in Malaysian Palm Oil Board (MPOB) as to make a new product that will be marketing worldwide (Nazatul and Khairul, 2014).

Before getting the crude palm oil product, the fruit needs to undergo a lot of processes or stages such as extraction, sterilization, stripping, digestion, pressing, clarification, purification and vacuum drying. The process of extraction required a huge amount of water. For 1.5 m³ of water, it is equivalent to 1 t of fresh fruit bunch. Meanwhile, half of the water ends up as palm oil mill effluent (Soh, *et. al.*, 2013).

Palm oil mill effluent (POME) is a viscous brown liquid accumulated with fine suspended solids. It is acidic as the pH number is in between 4 and 5. This effluent is highly polluted wastewater that contaminates the environment directly and indirectly through many ways. Due to the variety of mill operations and seasonal cropping throughout the year, the chemical properties of POME are different (Anwar, *et. al.*, 2014). If the untreated POME is discharged into watercourses, there will be a major problem towards the environment and thus there were many studies to determine the most economical and environmental friendly schemes for POME treatment.

According to Jeremiah, *et. al.*, (2014), there were various effluent treatments which are presently applied by the palm oil industry in Malaysia such as anaerobic or facultative ponds, tank digestion with mechanical aeration, facultative ponds with tank digestion, facultative ponds with decanter and physic-chemical with biological treatment. The ponding system is the most adapted one in Malaysia's palm oil mill. However, it is not an effective effluent treatment as the concentration oil residue in palm oil mill is high than in toxic wastewater. As for anaerobic ponds, the uses of microbial populations are still in progress studies by the researchers.