UNIVERSITI TEKNOLOGI MARA

EFFECT OF FIBRE TREATMENT ON THE PROPERTIES OF MEDIUM DENSITY FIBREBOARD MADE FROM EMPTY FRUIT BUNCHES

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ABSTRACT

Natural fibres are widely used in the composite industry because of their availability and desirable properties. Malaysia being one of the largest producers of palm oil in the world generates empty fruit bunch (EFB) that has potential of being used as fibrous raw material in the fibreboard industry. Pre-treatment on the EFB fibres is needed in order to produce acceptable fibre properties for medium density fibreboard (MDF). The objectives of this study are to evaluate the fibre properties with different chemicals and concentration levels and to determine of the effects of different chemicals, their concentration and fibre properties on the physical and mechanical properties of MDF, and finally to determine the optimum condition for the EFB fibres. Two types of chemicals that were used : sodium hydroxide (NaOH) and acid acetic. The EFB fibres were treated at 0.2, 0.4, 0.6 and 0.8% with NaOH and acetic acid, and the fibres were used in the MDF production. The results showed that fibre treated with NaOH tends to remove more residual oils, produced longer fibre with high aspect ratio and low cellulose content. However it produced higher hemicellulose content with lower tensile strength resulted in poor fibre surface, higher pH value and less sensitive towards acid compared to those fibres treated with acetic acid. The results also showed that both treatments resulted in different MDF performance, where acid acetic fibre produced good fibre characteristic and better panel's properties. The optimum condition was 0.4% for NaOH and 0.6% for acetic acid in order to produced panels with good strength and better dimensional stability and meets the standard requirements of EN 622-5 2006 (Requirements for Ultra-light MDF board for use in dry conditions (Type UL2 MDF))

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CHAPTER ONE
INTRODUCTION

1.1 BACKGROUND

Agricultural wastes are produced in huge quantities and become an alternative raw material for fibre production. These raw materials play an important role in fibre production due to the shortage of wood as a main raw material. The shortages are due to several reasons including deforestation and forest degradation, and also increasing demand in wood-based products (Colak et al., 2007). The advantages using these materials include low cost, light in weight (Hill and Abdul Khalil, 2000), low density, recyclability and very high strength-to-weight ratio (Varma et al., 1998).

Oil palm (*Elaeis guineensis*) is one of the important agricultural crops in Malaysia. The oil palm plantation covered about 5.39 million hectares (MPOB, 2015) and it was the largest crop plantation area. This has made Malaysia as second world's largest producer with an estimated 40% of the world's oil production (Otieno et al., 2016)

The oil produced only about 10% of the total biomass produced from oil palm tree, with 90% produced as wastes (Abdullah et al., 2012). Abdul Khalil et al. (2011) reported that, oil palm plantation generates more than 90 million tons of wastes annually from the empty fruit bunch (EFB), oil palm trunk (OPT) and oil palm frond (OPF) during replanting stage.

The medium density fibreboard (MDF) industry in Malaysia, mostly used rubberwood (*Hevea brasilinsis*) as main raw material due to its availability, attractive price, good characteristics and also acceptance by international buyers (Anon, 2009). However, the number of rubber plantation is reducing year by year due to land acquisition for country development and conversion of rubber plantation to other crop plantation including oil palm. Thus, oil palm wastes were recognized as one of the potential raw materials to substitute rubberwood in MDF industry.

One of the primary wastes material generated from oil palm industry is EFB. EFB has good potential as raw material for MDF production due to the availability. The fresh oil palm contains about 21% palm oil, 6-7% palm kernel, 14-15% fibre, 6-7% shell and 23% empty fruit bunch (Umikalsom et al., 1997). However the main disadvantage of EFB is that