UNIVERSITI TEKNOLOGI MARA

INFLUENCE OF PRESSING TIME, TEMPERATURE AND BOARD DENSITIES ON THE PROPERTIES OF PARTICLEBOARD FROM OIL PALM TRUNK

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ABSTRACT

This study was conducted on the oil palm (*Elaeis guineensiss*) trunk particles to determine the influence of pressing time, temperature and board densities on the particleboard properties and its suitability as a raw material for the manufacture of single layer particleboard. The properties of particleboard were determined based on British Standard (BS). Raw material was felled from the FELDA plantation in FELDA Jengka 25, FELDA Jengka 24 and FELDA Ulu Jempol, Pahang, Malaysia. The oil palm plants are harvested after 25 years old for replacement planting. The particleboard was made at 500 kgm^{-3}, 600 kgm^{-3}, and 700kgm^{-3} density. The resin content use in this study was 12 % of phenol formaldehyde. Hot pressing temperatures used in this study were 165 °C and 175 °C. The pressing times used were 6, 8 and 10 minutes. For particle geometry, only 2.0 mm particle size was used in this study and the board thickness was 12 mm. The properties of particleboard studied were modulus of rapture (MOR), modulus of elasticity (MOE), internal bonding (IB), water absorption (WA) and thickness swelling (TS).The result showed when the board densities increased from 500 kgm^{-3} to 700 kgm^{-3}, all mechanical properties increased and physical properties decreased. The pressing time increased from 8 to 10 min also increased all the mechanical properties and decrease the physical properties of the board. Meanwhile for the press temperature when increase from 165°C to 175°C, the results showed the decrease of the mechanical properties but increase in physical properties. The properties showed all boards produced with hot pressing time of 8 and 10 min and 165 °C press temperature, at targeted board density of 500, 600 and 700 kgm^{-3} were able to meet the minimum strength requirement of BS EN 310, 319 (1993). However, only 6 min and 10 min hot pressing time and 175 °C hot pressing temperature, with board density of 700 kgm^{-3} able to meet all the minimum strength requirement of BS EN 310, 319 (1993) and BS EN 317 (1993). Boards produced with press cycle 10 min and 165°C, at target board density of 700 kgm^{-3} were observed to possess the highest value of mechanical properties of MOR (34 MPa), MOE (4027 MPa), and IB (1.0 MPa). In general, the particleboard with hot pressing time 8 and 10 minutes for 500 kgm^{-3} and all the boards produced with 165°C press temperature surpassed the minimum strength of the BS EN standard for mechanical properties.

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Hopefully with the research carried out will be beneficial to all and can be used as reference material for teaching and learning purposes in the future.

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CHAPTER ONE
INTRODUCTION

1.1 BACKGROUND

The efforts to develop particleboards started in the United States in 1920s. At that time, failures in making particleboards were primarily due to the lack of suitable adhesives. Successful particleboard making started in the 1930's where the development of new thermosetting resin had been found. Then in 1941, the first industrial production of particleboards using synthetic resin started in Bremen, Germany. The importance of particleboard lies in the utilizing of residue and low-grade wood. Particleboards manufacturing is so flexible that it could be produced in large panel sizes with a full range of thickness (Moslemi, 1974). Malaysia is among the largest wood-based product exporter in the international market. In 2020, Malaysia Timber Industry Board (MTIB) has targeted RM 53 billion in the export of timber and timber related products (MTIB, 2012). In 2010, the value of exported timber and timber related products was RM 20.52 billion. However, in 2011, the value of exported timber and timber related products dropped to RM 20.06 billion (MTIB, 2012). In 2011, the exported particleboard was 524,386 m^3 and the value was RM 3.11 billion (MTIB, 2012).

Nowadays, the main raw material in particleboard industry is the rubber wood or *Hevea brasiliensis* (Hong, 1995). Rubber wood was first introduced in Malaysia in 1876, and the first rubber tree was planted in Kuala Kangsar Perak. Since then, rubber tree has become a major crop in Malaysia until today (Hong, 1995). Rubber trees aged between 25 – 30 years are uneconomical for latex production and should be felled down. In the early years, these wastes were used as fuel wood or just burnt away (Hong, 1995). Forest Research Institute Malaysia, FRIM has started a research on another usage of this waste in 1953 (Hong, 1995). Malaysia started to export sawn timber from rubber wood in 1970s, and it has now been accepted as environmentally friendly timber because it is grown in plantations (Hong, 1995). The pale light cream colour of this timber makes it popular, beside its good overall wood working and machining qualities. Now the rubber wood is not only used as sawn timber but also