MECHANICAL PROPERTIES OF ORIENTED STRAND BOARD FROM KELEMPAYAN WOOD AT DIFFERENT RESIN CONTENT

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ABSTRACT

Wood innovation in manufacturer spans a very wide range of science and technology. Oriented strand board (OSB) is a new type of wood composite, which is yet to be commercially produced in Malaysia or South East Asia region. OSB is made from long thin and narrow wood strands bonded with resin and converted into panel during the hot pressing operation. This study was carried out with the objective of obtaining the mechanical properties (MOE, MOR and IB) of OSB from Kelempayan wood with 650 kgm^{-3} at three different resin content (3%, 5% and 7%). Among the three levels of resin content, specimens with 7% has the highest value of MOE, MOR and IB. It was observed that the higher resin content in the board specimen gives better mechanical properties. All test results of the specimen (MOE, MOR and IB) passed the standard. As a conclusion to this study, Kelempayan wood is a potential and suitable species as a raw material for the production of OSB.

INTRODUCTION

The forest industry has contributed significantly towards the socio-economic development of Malaysia. However, due to limited natural resources today, the trend is to change from solid wood to wood composite which encourages the use of small diameter logs, juvenile wood and variety plantation species of wood. The use of solid timber for structural purposes may not last for long. The properties of alternative lumbers such as plywood, laminated veneer lumber (LVL), oriented strand board (OSB), particleboard and glulam need to be understood fully, so that proper utilization can be achieved to ensure efficient product design and safety to the users.

Oriented strand board is a non-veneer panel manufactured from reconstituted wood strands or wafers. The strand-like or wafer-like wood particles are compressed and bonded with phenolic resin. As the name implies, the wood strands or wafers are directionally oriented. The wood fibers are arranged in perpendicular layers (usually three to five) and are thus cross-laminated in the same manner as plywood (Breyer, 1993).

A number of Asian wood species have been tested in Siempelkamp's laboratories, and most of them produce OSB of good quality, for instance, yellow and red *Meranti* and rubberwood (Anon., 1997). Very low-density woods of less than 350 kg/m^3 do not have sufficient strength to produce OSB of good quality. For very heavy and hardwood species, densities of more than 750 kg/m^3 create difficulty when flaking and produce a lot of fines (Anon., 1997).

PROBLEM STATEMENT

Studies on the performance of oriented strand board from temperate countries species have been done and specifications on the appropriate use of this material have been established. But, study on OSB from Kelempayan wood is not ever done before by any researcher. Since OSB is a new wood composite in Malaysia, there is a lack of published information on OSB made from tropical species. With this in mind thus the study on the mechanical properties of OSB from kelempayan was carried out

OBJECTIVE

The main objective of the study was to determine the suitability of the specie asaw material in the manufacture of OSB. The mechanical properties (MOE, MOR and IB) of OSB from Kelempayan wood with 650 Kg/m^3 at three different resin content (3%, 5% and 7%) was also studied.

MATERIALS AND METHODS

For this study, Kelempayan wood was use as the raw material and phenol formaldehyde resin was use as a binder with solid content of 45%, for making the OSB boards of density 650 kg/m^3. The OSB boards of size 340 mm x 340 mm x 12 mm were fabricated at Wood-based Panel Products Laboratory of chemistry division, Forest Research Institute of Malaysia (FRIM).

This study used three level of resin content with density at 650 Kg/m^3. Each treatment consisted 3 replications of OSB board.

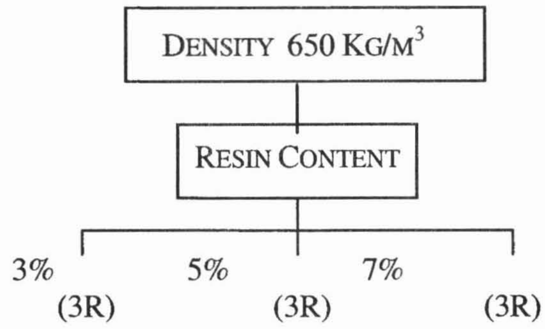

FIGURE 4.1 : TREATMENT

In general, manufacturing process for OSB start from debarked logs and then sliced into thin wood elements. The strands are dried, blended with resin, and formed into thick, loosely consolidated mats that are pressed under heat and pressure into panels. Figure 2 shows the flow process of OSB from Kelempayan wood.

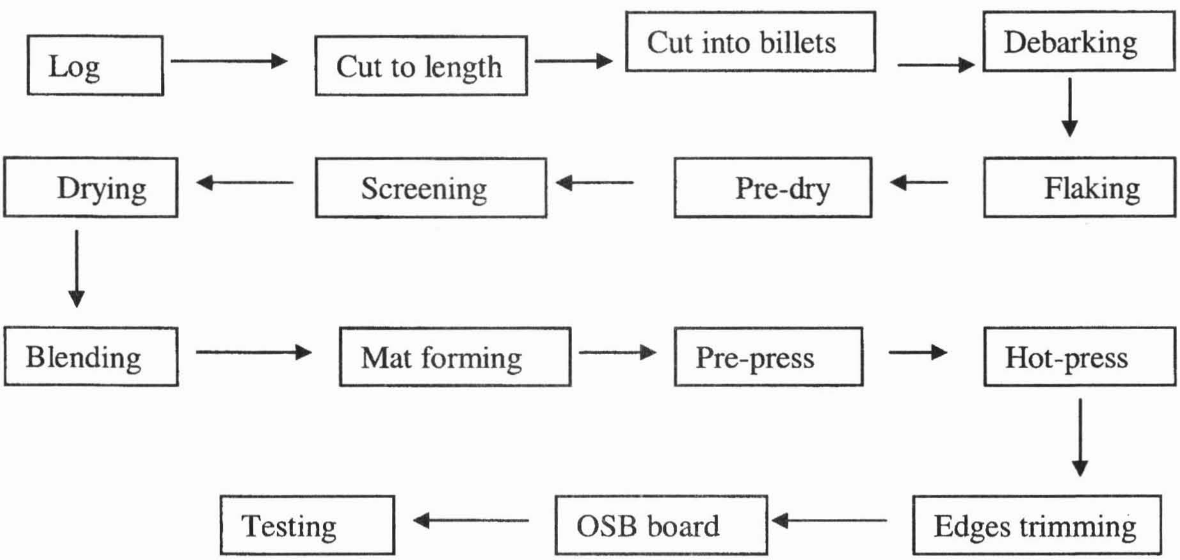

FIGURE 2 : OSB BOARD MAKING PROCESS

MECHANICAL TEST

OSB was destructively tested by bending and tensile. The modulus of elasticity (MOE) and modulus of rupture (MOR) were obtained based on deformation and load measurement. IB value measured by tensile strength perpendicular to the plane of the OSB sample which place the testing assembly in the grips and apply a force until rupture occurs.

RESULTS AND DISCUSSION

MECHANICAL PROPERTIES

The mechanical properties of OSB produced at a target density of 650 kgm^{-3} and three different resin content is shown in Table 1 OSB board produce with 7% resin content shows the highest value for MOE (7919 MPa), MOR (46.92 MPa) and IB (2.98 MPa) while boards with 3% resin content had the lowest value.

TABLE 1: MECHANICAL PROPERTIES OF OSB FROM KELEMPAYAN WOOD

RESIN	MOE (MPA)	MOR (MPA)	IB (MPA)
3%	5455	26.42	0.69
5%	7300	42.53	1.55
7%	7919	46.92	2.98

PROPERTIES OF MOR AND MOE ACCORDING TO RESIN CONTENT

According to Chugg (1964) and Schodek (1998), there are three types of stresses, which occur in static bending tests. These stresses are tension, compression and shear. The MOE was computed by assuming that the deflection of all of the I-joist specimens arises from flexural deformations. Figure 3 shows the properties of MOR at different resin content. An increase of about 77.60% for the value of MOR was observed when the resin content was increased from 3 to 7%. This tremendous increase in strength is due to the better bonding of the strands in the presence of more resin.

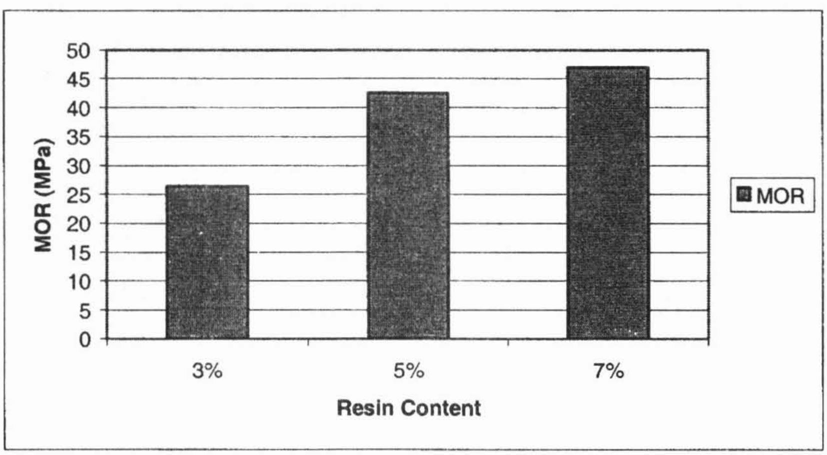

FIGURE 3: PROPERTIES OF MOR ACCORDING TO RESIN CONTENT

Figure 4 shows the properties of MOE at different resin content. Increasing the resin content from 3 to 7% increases the MOE by about 45.17%. As for MOR, the MOE value also increases due to the more resin being available for bonding the strands together. It was found that the distribution of MOR and MOE in the OSB was consistent with the theory on the strength of timber (Bodig and Jayne, 1982; Madsen, 1997).

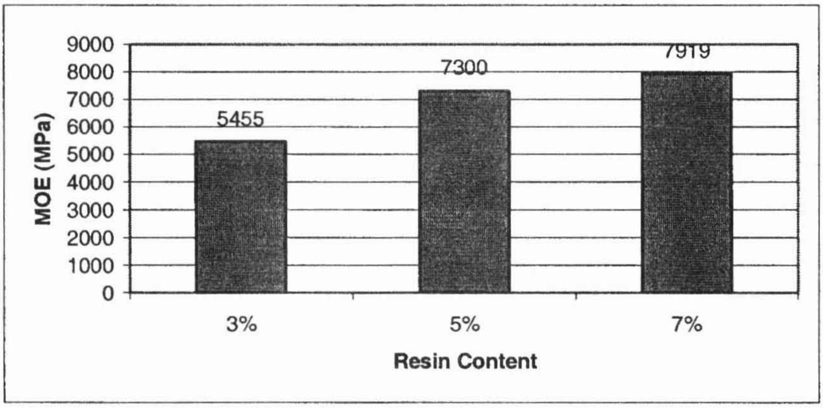

FIGURE 4: MODULUS OF ELASTICITY ACCORDING TO RESIN CONTENT

INTERNAL BOND

The properties of internal bond (IB) according to resin content are shown in Figure 5.3. The IB was observed to increase positively with an increase in the amount of resin used. It was observed for an increased from 3 to 7%, an increased of about 332% in IB was noted. This is an exceptional increased in strength. This increase in IB is due to the resin being available at higher resin content to give better bonding among the strands.

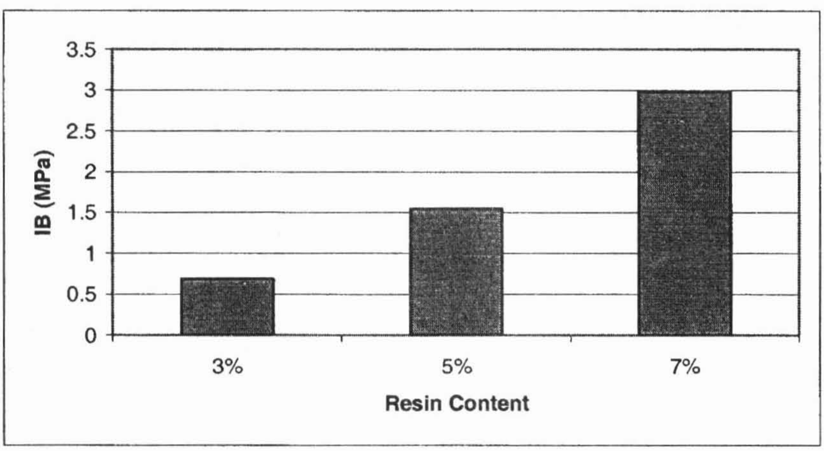

FIGURE 5: PROPERTIES OF INTERNAL BOND AT DIFFERENT RESIN CONTENT

CONCLUSION AND RECOMMENDATIONS

As a conclusion to this study, specimens with 7% was the highest value of MOE, MOR and IB followed by specimen with resin content of 5%and 3%. It was observed that higher resin content in the board specimen give better mechanical properties. Compared to, BS 5669, only board density 650 kg/m3 with resin content 5% and 7% suitable to make OSB from Kelempayan wood. It is recommended that specimens of 650 kg/m3 with resin content 5% had a potential to be commercialize because of effective strength and economical to produce.

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