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OIL PALM WOOD: SOME PRELIMINARY ASSESSMENT OF ITS SUITABILITY AS AN INSULATION BOARD

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INTRODUCTION

There is a large density variation in the different parts of the oil palm trunk. The outer zone of the oil palm trunk is denser than the inner zone. Based on the density variation within the oil palm trunk, density lower than 400kg/m³ forms the bigger amount of the cross section of the trunk. The percentage of the low density part in the trunk is high, which renders biomass recovery less economically viable.

Realizing this condition, efforts to utilize this biomass was conducted. Among the successfully produced products from the empty fruit brunches and fronds of oil palm, are paper, particle board and cement block. From its trunk, the process of converting it into primary products, such as sawn lumber has also been carried out. However, the output is not encouraging and as economical as required, especially with the poor quality and recovery after drying. Further efforts are therefore required to explore the quality of the sawn lumber from the oil palm trunk.

One such possibility, is to use the low density portion of the oil palm wood as an insulation board.

Therefore, the main objective of this study was to evaluate some properties of the sawn lumber from oil palm wood as an insulation board.

MATERIALS AND METHODS

The oil palm woods used in this study were taken from Kulai, Johor. The age of the oil palm trunks was 25 years old. The trees were cut into lumbers and dried using a kiln dryer (K.D) and reconditioned to a moisture content (M.C) of 13-15%. The dried lumbers were planed and trimmed to 2 cm in thickness, 10 cm in width and 40 cm in length. The OPW were left for at least seven days in a room, which was well ventilated (air conditioned room) before conducting the tests.

Four tests were conducted in this study:
1. Moisture content test,
2. Bending strength test
3. Swelling in thickness after immersion in water, and
4. Change in length after immersion in water

These tests were conducted in accordance with the Japanese Industrial Standard, JIS A 5905 (JSA, 2003). The quality of insulation board was categorized into few classifications. Each classification has a specific density and other property requirements. To fit in all the density qualification for each classification, density ranges as below was determined. Five density ranges (in kg/m³) were used in this study: 250 to A300, 301 to 350, 351 to 400, 401 to 450 and 451 to 500. Each density range has conducted three replications for bending strength test, and six replications for the other tests.

The OPW (2 x 10 x 40 cm) were weighed and measured for volume, to obtain the density for whole piece of OPW. Then, each piece of wood was cut 2 cm at both ends to make sure the density variation was in the range selected. 15 pieces of OPW (2 x 10 x 40 cm) per range were needed to conduct the tests.

I. Moisture Content Test

The sizes of moisture content test samples were 10 x 10 x 2 cm. The mass (m1) of the test piece was measured. The test piece was kept in the oven at a temperature of 103±2°C. The mass (mo) at constant weight was then measured.

II. Bending Strength Test

Test piece was cut into 5 x 35 x 2 cm. The load applied was at a rate of 10 mm/min on the surface of the test piece.

Formula : Bending Strength (N/mm^2) =3PL / 2bt2

where, P is the maximum load (N) ; L is the span (mm) ; b is the width of test piece (mm) and t is the thickness of test piece (mm).

III. Test for Swelling in Thickness after Immersion in Water

The test piece was cut into 5 x 5 x 2 cm pieces. The thickness of the centre part of the test piece was measured. The test piece was placed in water, horizontally at a depth of about 3 cm below the water surface at a temperature of 20±1°C. The samples were placed in an air conditioned room to maintain the temperature. After 2 hours, the test piece was taken out of the water. The water on the test piece was wiped off and the swelling in thickness after immersion in water was calculated.

IV. Test for Change in Length after Immersion in Water

The test piece was cut to samples of 7 x 20 x 2 cm. These test pieces were immersed in water for 24 hours and placed in water, horizontally at a depth of 3 cm below the water surface at a temperature of 20±1°C.

RESULTS

Table 1: Average properties value in each density range.

Densities Range (kg/m^3)	Average M.C (%)	Bending strength					Average Swelling (%)	Average Change In Length (%)
		b (mm)	t (mm)	Max. load (N)	MOR (N/mm^2)	MOE (N/mm^2)		
250-300	14.3	49.85	20.47	547.9	12.7	1612.3	1.89	0.06
301-350	13.9	50.26	20.46	837.3	15.9	2460.1	3.52	0.06
351-400	13.5	50.23	20.54	958.4	18.6	3105	3.08	0.06
401-450	13.3	50.33	20.55	1277.2	28	4285.1	4.9	0.05
451-500	13.4	50.17	20.54	1371.9	30.3	4743.7	4.06	0.05

DISCUSSION AND CONCLUSION

Table 2: The comparison between the standard and the data obtained.

Properties	JIS A 5905	Data obtained	Meet minimum requirement?
Bending strength	≥ 3.0 N/mm²	12 - 30 N/mm²	yes
Swelling in thickness after immersion in water	≤ 10%	2- 5 %	yes
Change in length after immersion in water	≤ 0.5%	0.06%	yes

From the table above, it appears that the sawn lumber OPW has potential as an insulation board. With increasing density range, the bending strength and percent of swelling in thickness will also increase. However, the percent of change in length was not obviously affected by the density.

In this study, the results obtained exceeded the requirement of the standard. When the OPW is dried to a low moisture content, it will give much better properties. Finally, the suitability of OPW as an insulation board can be confirmed after the thermal resistant test.

REFERENCE

JSA, 2003. JIS A 5905:2003, Fibreboards. Japanese Standards Association, Tokyo.