OPTIMUM PARAMETERS FOR THE PRODUCTION OF MDF USING 100% OIL PALM TRUNKS

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High demand for medium density fibreboard (MDF) in the world market has led MDF manufacturers to increase their production capacity. This has resulted in an increased requirement for raw materials to fulfill the market demand. In Malaysia, MDF manufacturers are using rubberwood as their main raw material, and currently the supply of this material is getting scarce. It is feared that with the decline in raw material supply, the industry would be relocated to other countries where the raw material is plentiful.

Manufacturers must find alternative resources that are in constant supply as well as are economical to use. Of paramount importance is that the board prepared from the new material meets the existing product standard requirements. Currently, Malaysia has a planted area of oil palm amounting to approximately 4.7 million hectares, and the estimated availability of oil palm trunks (OPT) from annual replanting is 14.89 million tonnes (dry weight). OPT has the potential for use as a raw material in MDF production, providing there is an adequate supply throughout the year, and more importantly, it has fibre characteristics which are almost similar to those of rubberwood. Research has been conducted by MPOB on the use of OPT as a raw material in MDF manufacture. From the evaluations carried out, it has been found to be suitable as a substitute for rubberwood used as the raw material in MDF production.

MDF MANUFACTURING PROCESS

Pilot-scale trials have been carried out in the MPOB MDF pilot plant on the production of MDF using OPT. The processes include an appropriate chipping process, refining, gluing, forming, pre-pressing and hot-pressing as shown in *Figure 1*.

The advantage of using OPT is that it requires a lower steam pressure of 6 bar for the refining process, compared with the current process

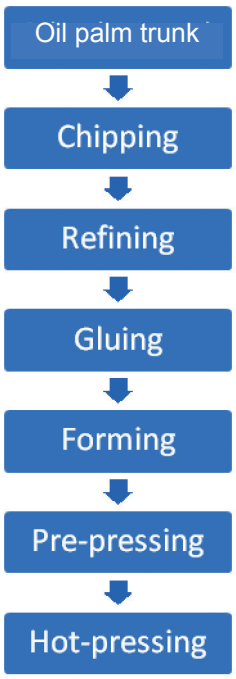

Figure 1. Process flow of MDF manufacture from oil palm trunks.

used in a commercial plant which is 8 bar for rubberwood. This will reduce the operation costs.

PROPERTIES OF MDF FROM OIL PALM TRUNKS

The evaluation of MDF from OPT indicates that its properties are quite similar to the existing product made from rubberwood. OPT is compatible with rubberwood and other materials for MDF manufacture in an actual commercial plant. Apart from that, the board produced from OPT meets the minimum requirements of the European Standard (EN 622-5, 2006).

The test results revealed that MDF produced from this material offers good mechanical as well as swelling properties (*Table 1*). Through these findings, some manufacturing process steps for making MDF from OPT have been optimised to meet the standard requirements as shown in *Table 2*. The modulus of elasticity (MOE) and

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TABLE 1. PROPERTIES OF MDF FROM OIL PALM TRUNKS

Property	Value	European Standard
Density (kg m^{-3})	720	
Modulus of elasticity (N mm^{-2})	3344.91	>2500
Modulus of rapture (N mm^{-2})	37.50	>22
Internal bonding (N mm^{-2})	0.7	>0.6
Thickness swelling (%)	14.82	<15

TABLE 2. SETTING VALUES OF THE PROCESS PARAMETERS

Constant parameter	Value
Steam pressure (refining)	6 bar
Cooking time	300 s
Glue content	9%
Wax content	0.5%

modulus of rapture (MOR) test results exhibit higher values as compared with the standard, indicating that the product is suitable for load-bearing applications. The inclusion of a higher amount of hydrophobic substance is required for MDF from OPT to ensure better dimensional stability of the product.

ECONOMIC ANALYSIS

Currently the cost of delivering OPT to the MDF plant within a 100-km radius is approximately RM 35.00 to RM 40.00 for a 5.5 m long trunk. A recent review indicates that the cost of transporting OPT appears reasonable at that range.

Table 3 shows that OPT has a lower material cost as compared with rubberwood, being cheaper by RM 13.00 t^{-1}. It is calculated that for an MDF plant with a daily production capacity of 400 m^3, material cost savings, using OPT, will add up to about RM 8320.00 day^{-1}.

Figure 2. Medium density fibreboard (MDF) from oil palm trunks.

TABLE 3. AVERAGE ESTIMATED MATERIAL COST FOR OPT AND RUBBERWOOD

	Oil palm trunks	Rubberwood
Initial M.C.* (%)	300	60
Price at RM t^{-1} (green)	50	120
Dry weight (kg)	250	625
Price at RM t^{-1} (dry)	200	192
Loss (debarking + fine chips) (%)	5	17
Dry yield (kg)	238	519
Price after loss (RM t^{-1})	211	231
Weight at 60% M.C.	380	830
Price at 60% M.C. (RM t^{-1})	132	145
Price difference (RM t^{-1})	±13.00	

Note: *M.C = moisture content; calculation based on 1 t (green).

Daily plant production capacity = 400 m^3
Material required day^{-1} = 640 t
Cost difference t^{-1} = RM 13.00
Therefore, 640 t day^{-1} x RM 13.00 = RM 8320.00 day^{-1}

For more information, kindly contact:

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