

PRODUCTION OF HIGH DENSITY FIBREBOARD (HDF) FROM EMPTY FRUIT BUNCH FIBRES

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In 2016, a total of 86.3 million tonnes of fresh fruit bunches were processed by oil palm mills in Malaysia (MPOB, 2017), generating more than 6 million tonnes (dried weight) of empty fruit bunches (EFB). At present EFB are used in sectors such as renewable energy (bio-pellets and bio-briquettes), bio-composites (particleboard and fibreboards), bio-fertiliser and fine chemicals. There are still many new products that could be explored especially in the bio-composite area and one of the potential product is high density fibreboard.

Malaysian Palm Oil Board (MPOB) has developed a high performance panelboard called high density fibreboard (HDF). The product has high density, improved mechanical properties and is dimensionally stable. It is suitable as material for flooring and other heavy duty applications.

PROCESS DESCRIPTION

EFB fibres of 50 mm length were mixed with a known quantity of wood chips at different ratios of 10% to 40% loading mixture. Chips from tropical hardwood were fixed at a 30% loading ratio whereas the EFB fibres were proportionately varied with rubberwood (RW) chips. During refining, the mixed raw material were subjected to steam pressure at 5 – 6 bar for 5 min in the inclined digester, followed by actual refining to convert the material into refined fibres.

After refining, the fibres were dried to 4% moisture content, and then blended with known quantities of melamine urea formaldehyde (MUF, E1 formaldehyde standard emission) and wax emulsion in a mechanical blender. After glue blending the fibres were formed into a mat, and consolidated to 8 mm thick in a hot press at 200°C for 5 min. *Figure 1* illustrates the process flow of the production of HDF.-

BENEFITS

- The product is suitable as material for flooring and other heavy duty applications due to high density and high moisture resistance.
- EFB fibres as an alternative raw material for wood based industry.
- EFB offers a lower cost material with abundant supply compared to wood.
- Extend the use of EFB for various higher value products and hence would generate extra income for the industry.

STRENGTH PROPERTIES

With the EFB loading ratio of 30% and below, mechanical properties such as modulus of rupture (*Figure 2a*), modulus of elasticity (*Figure 2b*), and internal bond (*Figure 2c*) of the HDF meet the standard requirements as stipulated in JIS A 5905: 2003.

However, panelboard with 40% EFB loading ratio seemed to increase the swelling properties (*Figure 2d*). It was noted that the maximum of 30% EFB loading ratio is technically feasible for HDF production.

The product has high surface density exceeding 1000 kg m⁻³ (*Figure 3*) and it is suitable for various end uses, particularly in heavy duty application. The product produced with adhesive of low formaldehyde emission (E1 resin type) is suitable for indoor applications such as flooring and kitchen cabinet.

COST OF PRODUCTION

The estimated cost of delivered shredded EFB to HDF plant within a 50 km radius is RM 50/t whereas for RW, the average price is at RM 130/t. Therefore, for HDF production, cost of using shredded EFB compared with RW is cheaper by RM 90/t.

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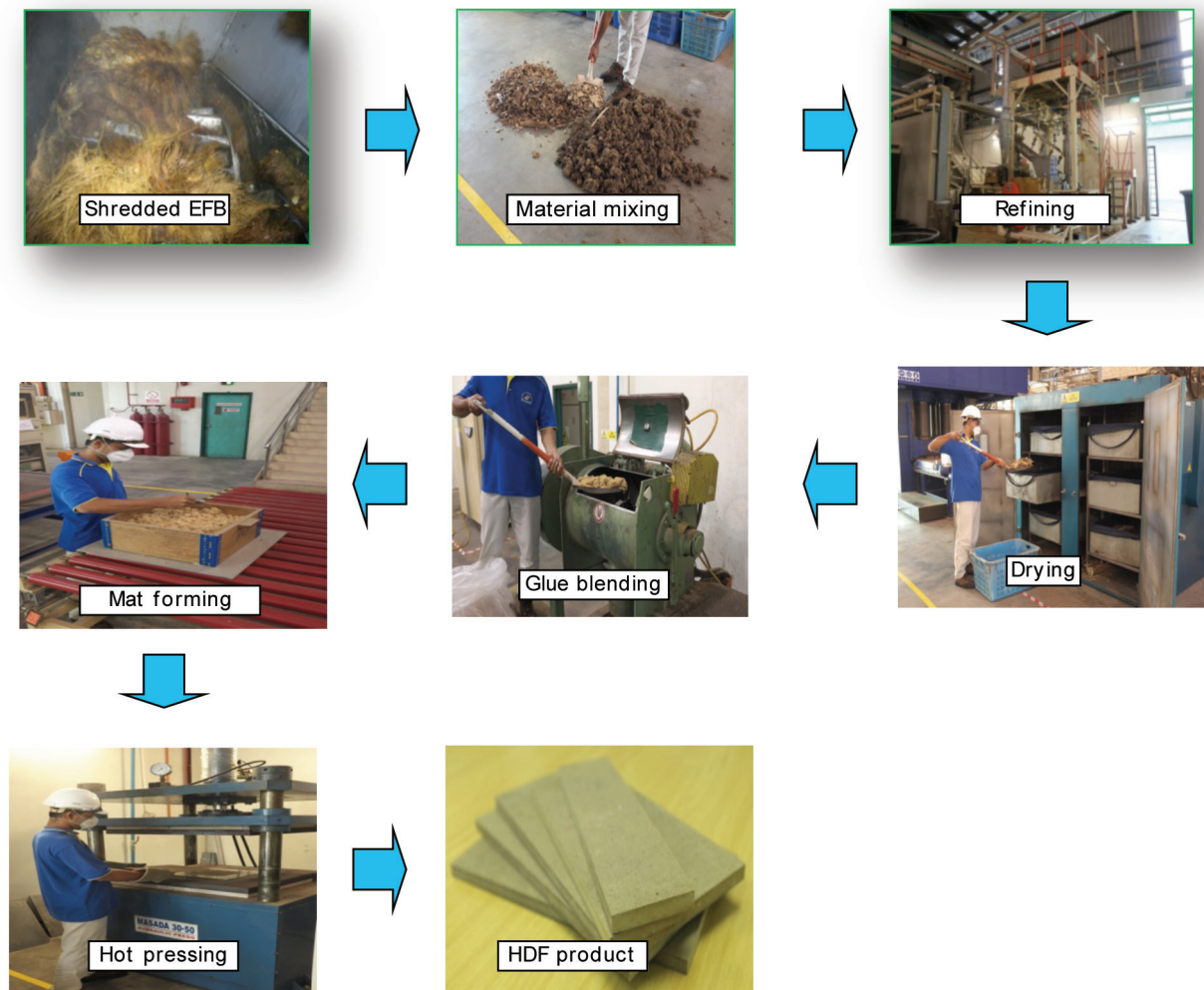


Figure 1. Process flow the production of high density fibreboard (HDF).

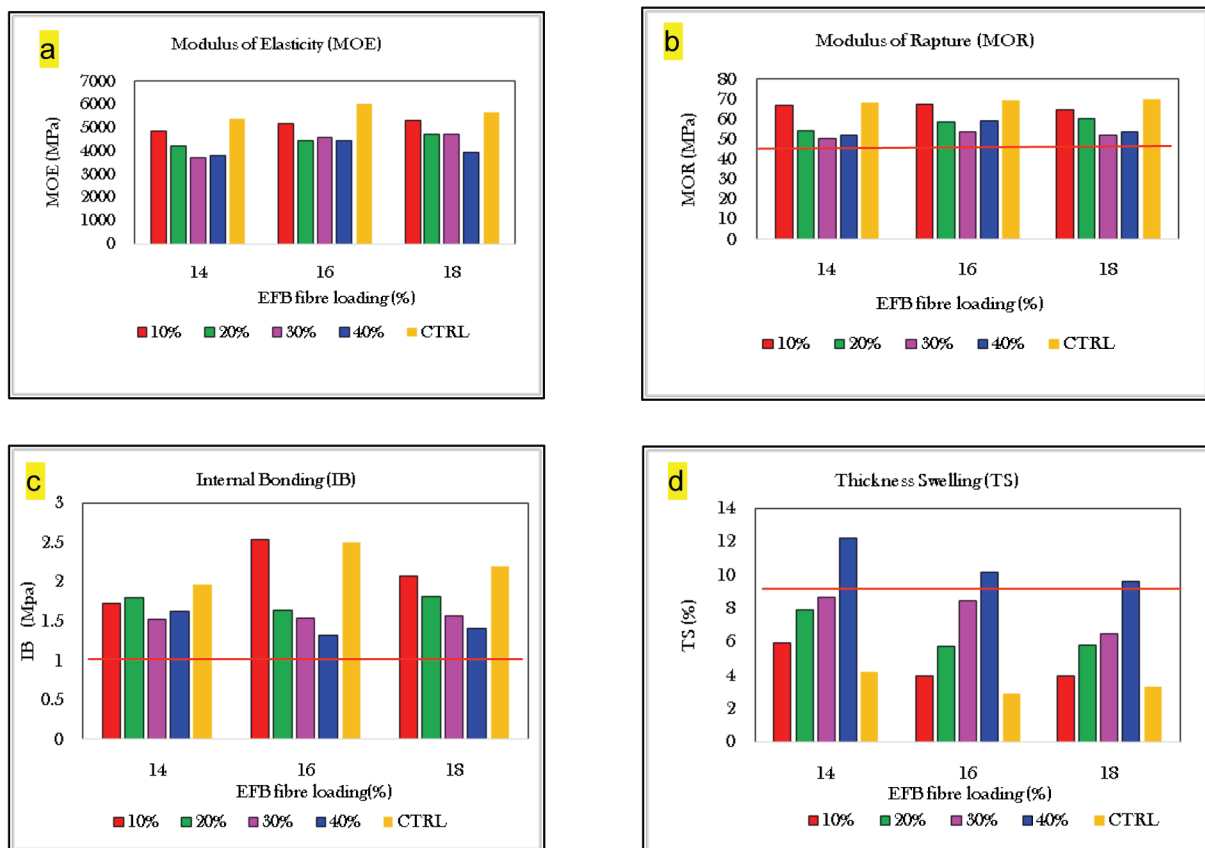


Figure 2. Mechanical and physical properties of high density fibreboard (HDF).

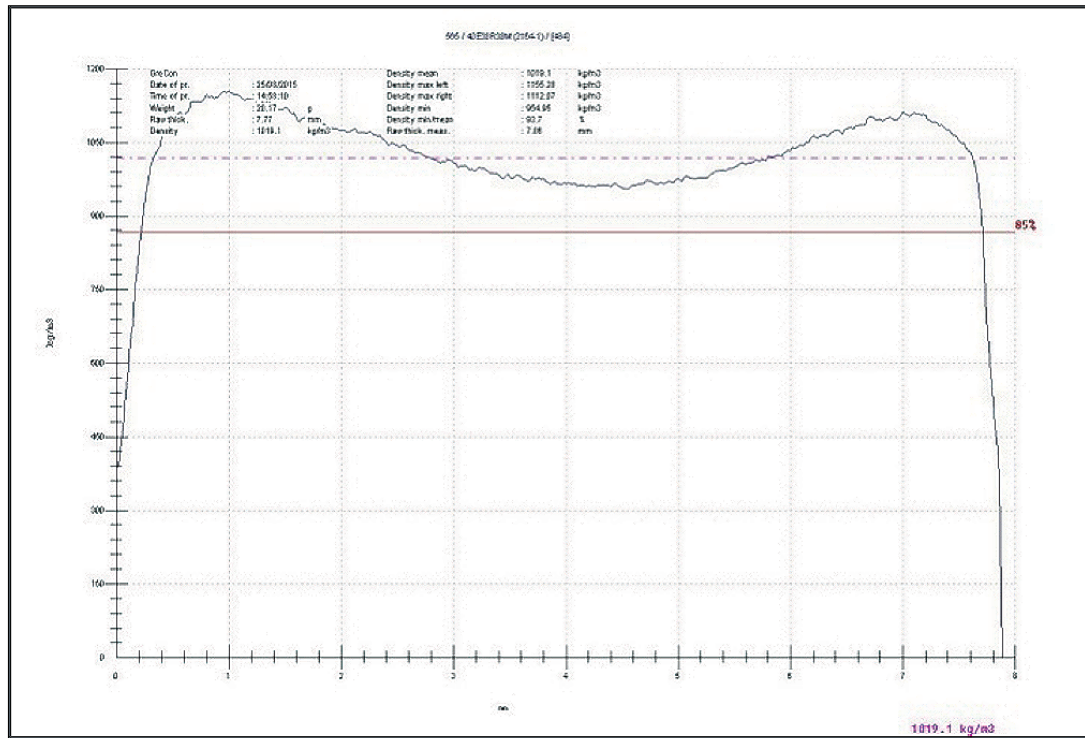


Figure 3. Vertical density profile of high density fibreboard (HDF).

TABLE 1. COMPARISON OF MATERIAL COSTS BETWEEN EFB AND RW FOR HDF PRODUCTION

	Shredded EFB	RW
Initial M.C (%)	110	60
RM/t (green)	50	130
Dry weight (t)	0.476	0.625
Dry tonne price (RM)	105	208
Loss (%) (Debarking + fine chip)	10	20
Dry yield (t)	0.429	0.500
Price after loss (RM/t)	117	260
Weight at 60% M.C (t)	0.686	0.800
Price at 60% M.C (RM/t)	73	162.50
Price Difference (RM/t)	≈90.00	

M.C – Moisture content, calculation based on 1 t (green)

CONCLUSION

- EFB has potential as renewable raw material for HDF production.
- Maximum of 30% EFB loading ratio (in admixture of tropical hardwood and RW) is technically feasible for HDF production.
- The strength properties of HDF is inversely proportional to the EFB fibres loading ratio.
- The addition of paraffin wax in the glue recipe will reduce moisture absorption in finished board.

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