

Suitability of medium density particle board from *Acacia catechu* (Khair)

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Abstract

Particleboard provides the opportunity to use the greatest possible volume of forest resources and industrial waste. The main aim of this work was to use *Acacia catechu* waste wood chips from which katha and cutch were already extracted. Different combinations of heat, temperature, and resin were used to manufacture the particleboard. Particleboards were examined for their mechanical and physical properties. Two different pressures of 17.5 Kg cm⁻² and 21 Kg cm⁻² with a resin content of 10 percent and 12 percent were used for their processing. The density of the particleboards ranged from 0.69 to 0.76 g cm⁻³. Particleboard made from *Acacia catechu* at 21 kg cm⁻² at 10 percent resin showed the highest physical and mechanical properties. The results showed that it is important to establish future research along these lines that waste material should be suitable for manufacturing high-quality particleboards with high strength and dimensional features. Further treatments may be necessary for improving the quality of a panel, particularly its dimensional stability.

Introduction

Wood is an environmentally friendly, cost-effective building material, which may be utilized for many structural and ornamental uses both indoors and outdoors. The demand of composite wood products particularly particle board has been significantly increasing owing to their use in construction, cabinets, tabletops, and other industrial products Alam *et al.* (2015). Particleboard provides a means of using as many forest resources and industrial waste as feasible. Ghalehno *et al.* (2012) evaluated the feasibility of making particleboard from *Acacia catechu* wastes.

Materials and Methods

The present investigation was carried out in the Department of Forest Products, Forest Research Institute, Dehradun. The raw material used for the preparation of particles was offcuts of Khair, derived during making of katha i.e. from Khair (*Acacia catechu*). The chemical raw material used for the preparation of phenol-formaldehyde (PF) resin was phenol, formalin and sodium hydroxide. The wood was chipped & was being conduced in the conduxor. Resin binders or adhesives were added to bond individual particles together. The particleboards were produced using PF resin at 10 & 12 percent resin using two different pressures of 17.5 kg/cm² and 21 kg/cm². Physical and mechanical properties of the board were tested according to the Indian Standard (3087-2005).

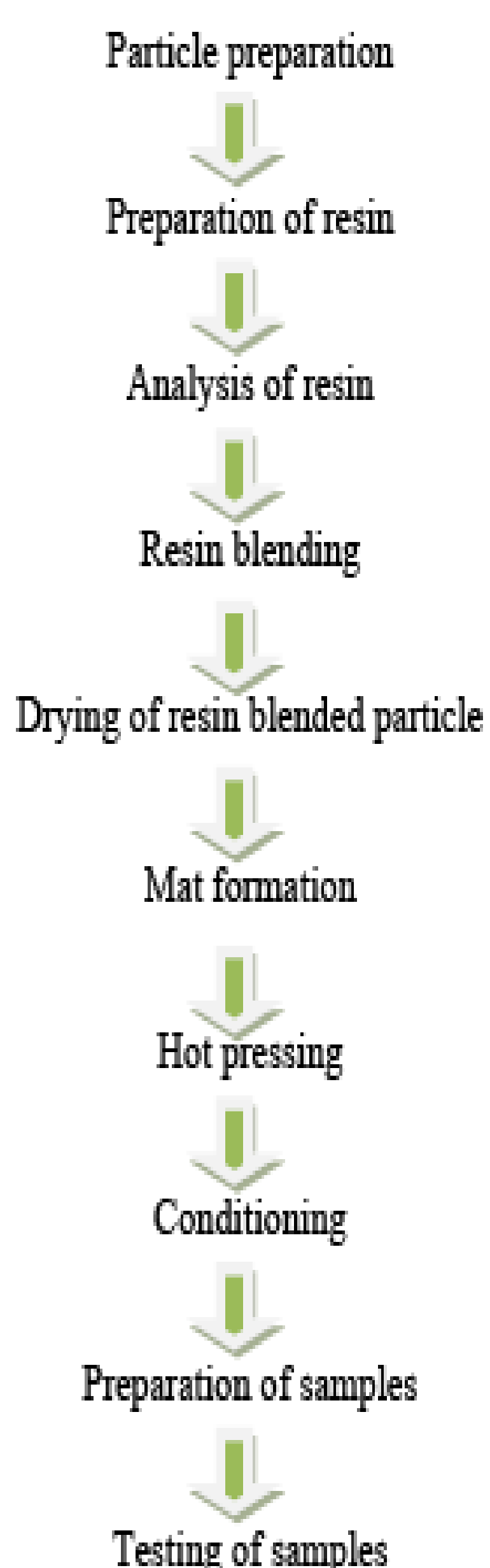


Table 1: Details of the particleboards

Sl. No	Board No (Sample No)	Resin Content	Pressure used
1	1	12%	21 Kg/cm ²
2	2	10%	21 Kg/cm ²
3	3	12%	17.5 Kg/cm ²
4	4	10%	17.5 Kg/cm ²

Results and Discussions

Total 4 types of boards were prepared using *Acacia catechu* with 10% & 12% resin content at 17.5 Kg/cm² and 21 Kg/cm² pressure for 15 minutes at 150°C. The overall physical and mechanical properties of all the particleboards produced are appended in Table 1 and Table 2. Table 1 revealed that the physical properties were in agreement with Warmbier *et al.* (2013) who studied the effects of density and resin content on the mechanical properties of particleboards, where the core layer was made from willow, *Salix viminalis*. Board 2 showed highest moisture content, density whereas lowest thickness swelling and surface swelling. Table 2 revealed that Modulus of Rupture (MOR) & Modulus of Elasticity (MOE) was highest for board no. 2. The MOR & MOE increased as the resin content increased. The particle board with 10% resin content and 21 Kg/cm² pressure had highest MOR & MOE. Board 4 showed highest screw withdrawal strength whereas board 2 showed highest Internal Bonding (IB) strength.

Table 2: Physical properties of particle boards from *Acacia catechu* at different resin content and pressure

Board No.	Moisture Content	Density	Water Absorption		Thickness Swelling (In mm)	Surface Swelling (In mm)
			2hrs	24hr		
			1	3.46		
2	4.05	0.76	46.28	57.02	15.67	0.47
3	2.34	0.72	51.18	61.77	18.56	1.25
4	4.07	0.72	56.10	64.90	15.29	1.68

Table 3: Mechanical properties of particle boards from *Acacia catechu* at different resin content and pressure

Board No.	MOR (N/mm ²)	MOE (N/mm ²)	SCREW WITHDRAWAL TEST(N)	
			FACE	EDGE
			1	13.20
2	18.17	2021.82	248	250.5
3	12.13	1394.98	184.5	233.5
4	16.15	1681.07	275.5	243

Conclusions

- Result showed that the suitable particle board can be prepared from the particles of katha extracted chips of *Acacia catechu*. Best results were showed by board no. 2.
- Swelling properties can be improved by adding suitable sizing material at the time of board preparation. Further treatments may be necessary for improving the quality of a panel, particularly its dimensional stability.
- It may be a suitable substitute of solid wood as the particle boards were prepared from the waste material left after extraction of katha from the chips of *A. catechu* (Khair).
- It is important to establish future research along these lines that waste material should be suitable for manufacturing high-quality particleboards with high strength and dimensional features.

References

- Alam, P. "Biomimetic composite materials inspired by wood." *Wood Composites*. Woodhead Publishing, 2015. 357-394.
- Ghalehno, Mohammad Dahmardeh, and Morteza Nazeriasn. "Physical and mechanical properties of particleboard from roselle (*Hibiscus sabdariffa*) stalks and eucalyptus (*Eucalyptus camaldulensis*) wood particles." *Wood Material Science & Engineering* **7.1** (2012): 25-29.
- Warmbier, Krzysztof, Arnold Wilczyński, and Leszek Danecki. "Properties of one-layer experimental particleboards from willow (*Salix viminalis*) and industrial wood particles." *European Journal of Wood and Wood Products* **71.1** (2013): 25-28.