

Needleboards

An Exploratory Study

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Abstract

Medium-density hot-pressed boards were prepared from slash pine needles that had been: 1) flattened, 2) benzene-soaked, 3) flattened and then benzene-soaked, 4) mercerized, or 5) given no treatment. None of the boards had satisfactory properties for conventional uses. Mercerization improved bending strength and internal bond of the boards, but stiffness and dimensional stability were poor. All other boards were poorly bonded.

RECENT ATTENTION to the quantity of needles produced by southern pines, their properties, and the prospect of large-volume separation of needles from whole-tree chips (Howard 1973; Koch 1972, ch. 14; Sturos 1973) raises the question of how needles might be used. Their physical form and certain other properties suggest use in composition boards. To investigate this possibility, 1/2-inch-thick

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Table 1. — PROPERTIES OF NEEDLEBOARDS (DENSITY OF 45 POUNDS PER CUBIC FOOT) MADE FROM SLASH PINE NEEDLES GIVEN FIVE TREATMENTS.^a

Needle pretreatment	Resin solids	MOE	MOR	Toughness	Internal bond	VPS soak ^b	
						Thickness swell	Linear swell
		— — — Psi — — —	— — —	In.-lb.	Psi	— — — Percent — — —	— — —
Rolled	7% phenolic	158,000	750	15	7	38 ^c	1.4
Benzene bath	11% phenolic	129,400	555	15	11	69 ^c	2.0
Benzene, rolled	6.4% phenolic	164,700	1,060	15	16	29	1.5
Caustic bath	8.7% phenolic	173,500	2,265	18	55	41	3.8
None	6.8% urea	108,800	525	14	8	(^d)	(^d)

^aTests according to ASTM 1037-64 except for vacuum-pressure-soak (VPS).

^bHeebink, B. G. 1967. A procedure for quickly evaluating dimensional stability of particleboard. Forest Prod. J. 17(9):77-80

^cLoosened surface.

^dDisintegrated.

exploratory boards were prepared at a density of 45 pounds per cubic foot. Mature needles of slash pine (*Pinus elliottii* Engelm. var. *elliottii*) were cut to a length of 1-1/2 inches and given one of several treatments:

- 1) Rolled through a sheet-metal roller set at 0.015-inch clearance.
- 2) Immersed in hot benzene for 5 minutes.
- 3) Rolled, then given a benzene bath.
- 4) Mercerized in 10 percent NaOH solution.
- 5) No pretreatment.

All materials were oven-dried before board formation. Boards were pressed at 325°F for 7 minutes.

Results

Mercerization

Mercerization modified needles greatly. They became black, flexible, greatly reduced in cross section, twisted, and curled; and they emitted a strong tea-like fragrance. Preliminary tests of tensile strength showed a 172 percent increase in elongation (compared with untreated samples from the same needle) after treatment for 1 hour at 80°C. Fiber yield was about one-third of air-dry weight, as extractives and hemicellulose were largely removed by treatment.

Board Properties

None of the boards demonstrated satisfactory physical properties for conventional uses (Table 1). The commercial particleboard standard for this density requires an MOE at least one-and-one-half times greater than the stiffest board.

Even though mercerization substantially improved certain properties (MOR and internal bond approached commercial standard values), stiffness and dimensional stability when saturated were far from adequate.

Of particular note was the low degree of bonding in unmercerized boards. This was visually evident and was reflected in the very low internal bond values and other tests. Crushing by rolling and treatment with benzene to remove surface waxes did not appreciably improve bonding with the resins used.

It appears from these results that efforts to utilize pine needles might be more promising if directed toward chemical processes rather than bulk fiber products.

Literature Cited

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