

*PRELIMINARY EVALUATION OF  
PARALLEL LAMINATED VENEER LUMBER  
MADE FROM PRESERVATIVE TREATED VENEERS*

By

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## ABSTRACT

The use of preservative treated veneer in the manufacture of plywood or parallel laminated veneer lumber (PLVL) should have potential in specialty applications where a high value, high priced product is appropriate. The challenge in dealing with treated veneers is finding a resin which is compatible with the preservative. The veneer product desired for this project could not be post treated because a flat panel was needed for machining and subsequent manufacturing.

Three veneer types, two preservatives, and three adhesives were selected for evaluation. Aspen, birch, and red pine veneers were treated with disodium octoborate tetrahydrate and copper naphthenate to a retention level of 0.60 pounds per cubic foot or greater. Prior to treatment, green veneer was dried to between 20 and 25 percent moisture content and following treatment it was dried to near 5 percent for gluing.

Three adhesives types, phenol formaldehyde, catalyzed melamine, and emulsion polymer isocyanate were used to bond the treated veneers. Three ply plywood glue shear specimens were used to evaluate bond quality after a one cycle vacuum-pressure-soak. PLVL specimens approximately one-inch thick were manufactured to test strength and stiffness in bending.

Acceptable wood bonds were developed for treated aspen and red pine, however the tightness of the birch created difficulty in forming a consistent glue bond.

In most instances strength and stiffness compared favorably with the controls. In many cases PLVL averages exceeded Wood Handbook values for clear wood specimens

## MATERIALS AND METHODS

### Materials

Three types of veneer were used in the study, 1/8-inch aspen and red pine and 1/10-inch white birch.

The two types of preservatives used were Copper Naphthenate in a solvent carrier and water soluble Tim-Bor.

The three adhesives evaluated for this study were standard phenol-formaldehyde plywood resin, a catalyzed melamine, and emulsified polymer isocyanate (EPI).

### Pressure Treating Cycle

Veneers were dried to between 20 - 25% M.C. before treating.

The cycle used to obtain nominal retention of 0.6 lbs. of preservative per cu. ft. of wood was: vacuum of 25 in. of mercury for 30 min., add treating solution, follow with 110 psi for 30 minutes.

After the pressure cycle the retort was drained and a 5 min. vacuum was drawn to remove excess liquid between the veneers.

Veneers were stickered at room temperature for 24 hours to allow for fixation and penetration of the preservative into the cell walls.

Veneers were then dried down to approximately five percent moisture content in a forced-air oven at 150° F before manufacture into PLVL.

### Panel Manufacturing

Both the phenol-formaldehyde and catalyzed melamine are hot set adhesives while the EPI is a cold setting adhesive.

The hot set adhesives were spread at 40 pounds per thousand square feet (MSF) of single glue line. The press conditions were: platen temperature 300° F, pressure 200 psi, time 12.5 minutes for 8 and 9 ply PLVL and 5 minutes 3-ply plywood shear samples.

The EPI was spread at 50 pounds per MSF of single glue line. The press pressure was 200 psi for 10 minutes and then reduced to 150 psi for 50 minutes.

All aspen and pine PLVL had one A-grade face veneer and seven C-grade veneers. Birch PLVL were similar but with nine 1/10-in. plys.

### Test Methods

ASTM standard D 143-83 was used to evaluate the strength and stiffness of the PLVL samples. Thirty bending samples were tested for each combination of wood, preservative, and adhesive for the aspen and pine while 15 bending samples were tested for each combination of birch, preservative, and adhesive.

The APA standard PS 1-83 for plywood shear in exterior type bonds was used to evaluate wood failure. Twenty five shear samples were tested for each combination of wood, preservative, and adhesive.

## RESULTS - BORATE TREATED VENEER

### Wood Failure

Aspen treated veneer had 85% or better wood failure for two of the adhesives used in the study. Phenol-formaldehyde bonding was inhibited by the borate as expected.

Red pine treated veneer had the same bonding characteristics as the aspen.

Birch treated veneer had less than 85% wood failure (including untreated controls) for the phenol-formaldehyde resin. The EPI and catalyzed melamine adhesives provided adequate bonding. The birch was generally difficult to bond as previously described.

### Modulus Of Elasticity

In general, the average stiffness values for borate treated aspen PLVL were lower than the control (expected for P-F), with the catalyzed melamine greater. The MOE is greater than the Wood Handbook value for clear aspen except when EPI, a cold set adhesive, was used.

For red pine, the stiffness for treated PLVL was below control values except for pine bonded with catalyzed melamine. All values were below the Wood Handbook published MOE.

The stiffness for treated white birch specimens was generally similar to the control, with the cold set EPI value falling off. Using catalyzed melamine resulted in greater stiffness which is attributed to its ability to provide greater bond strength.

### Modulus Of Rupture

The strength of the treated aspen PLVL bonded with catalyzed melamine was similar to the control. P-F, as expected, and EPI bonded veneers exhibited lower strength.

Treated red pine strength was well below the control for all adhesives but the treated groups were similar. As previously mentioned, the treated red pine was from a different lot of veneer. All values except the control were below Wood Handbook.

The strength of the birch samples were greater than Wood Handbook values and greater than expected considering the poor bonds achieved with the P-F resins. These bending samples exhibited shear failures along the glue line.

## RESULTS - COPPER NAPHTHENATE TREATED VENEER

### Wood Failure

Aspen treated veneer had 85% or better wood failure for all adhesives used in the study.

Red pine treated veneer had 85% or better wood failure for all adhesives used in the study.

Birch treated veneer had less than 85% wood failure (including untreated controls) for all adhesives except catalyzed melamine. The birch was generally difficult to bond because its extreme tightness appeared to inhibit glue penetration and its waviness caused by air drying made it difficult to achieve an even spread of adhesive.

### Modulus Of Elasticity

The average stiffness values for treated aspen PLVL was somewhat greater than the controls for all adhesives. The MOE for PLVL is greater than the Wood Handbook value for clear aspen because of densification and the engineered veneer layup.

For red pine, the stiffness for treated PLVL was below control values except for pine bonded with catalyzed melamine. All values were below the Wood Handbook published MOE.

The stiffness for treated white birch specimens was generally similar to the control and surpassed the Wood Handbook values. Using catalyzed melamine resulted in greater stiffness which is attributed to its ability to provide greater bond strength.

### Modulus Of Rupture

The strength of the treated aspen PLVL was similar to the controls for all adhesives and greater than Wood Handbook values.

Treated red pine strength was below the control for all adhesives but the treated groups were similar. The treated red pine was from a different lot of veneer and displayed a tight knot pattern indicative of plantation grown wood. All values were below Wood Handbook.

The strength of the birch samples were greater than Wood Handbook values and greater than expected considering the poor bonds achieved with the P-F resins. Shear failures along the glue line were observed in P-F bonded material. More typical tension failures were seen with the better bonding EPI and catalyzed melamine.

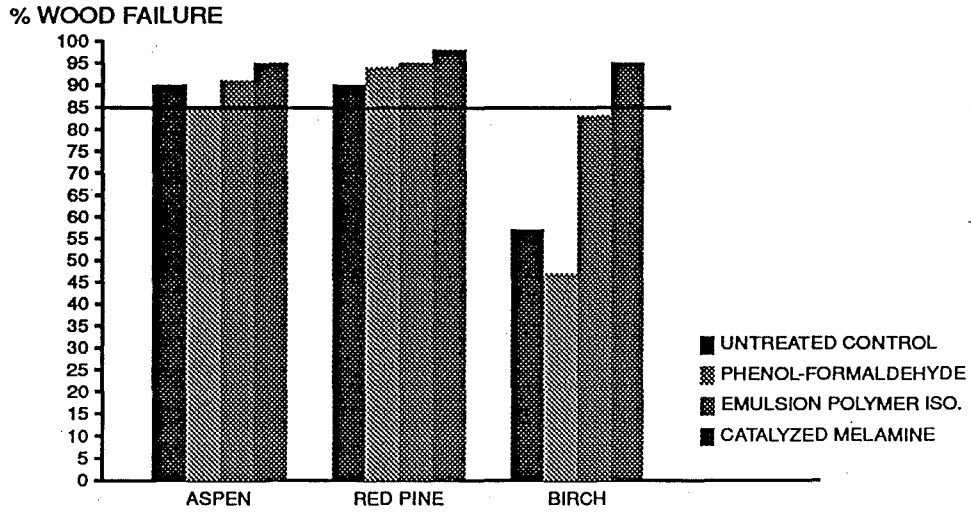
## CONCLUSIONS

Manufacturing of PLVL from treated veneer is possible given the appropriate combination of preservative and adhesive.

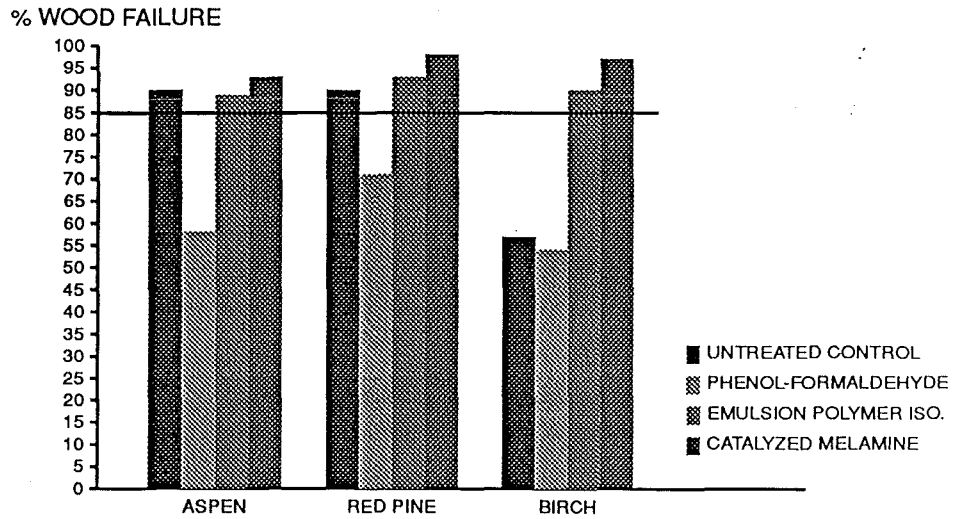
PLVL provides an engineered product that can be used where high strength and stiffness is justified.

Production of PLVL billets from treated veneer allows for the remanufacture of products which can be used where decay or insect infestation is a concern.

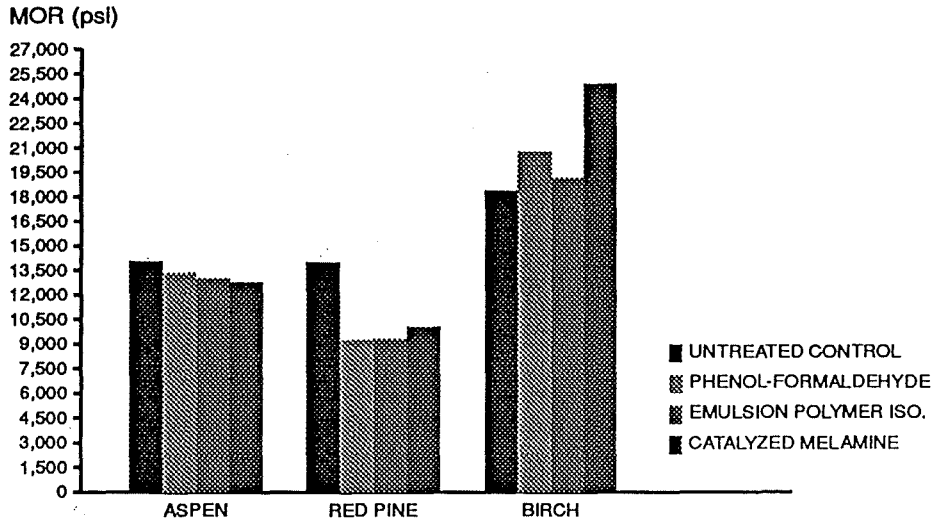
PERCENT WOOD FAILURE FOR COPPER NAPHTHENATE  
TREATED PARALLEL LAMINATED VENEER LUMBER  
BONDED WITH VARIOUS ADHESIVES



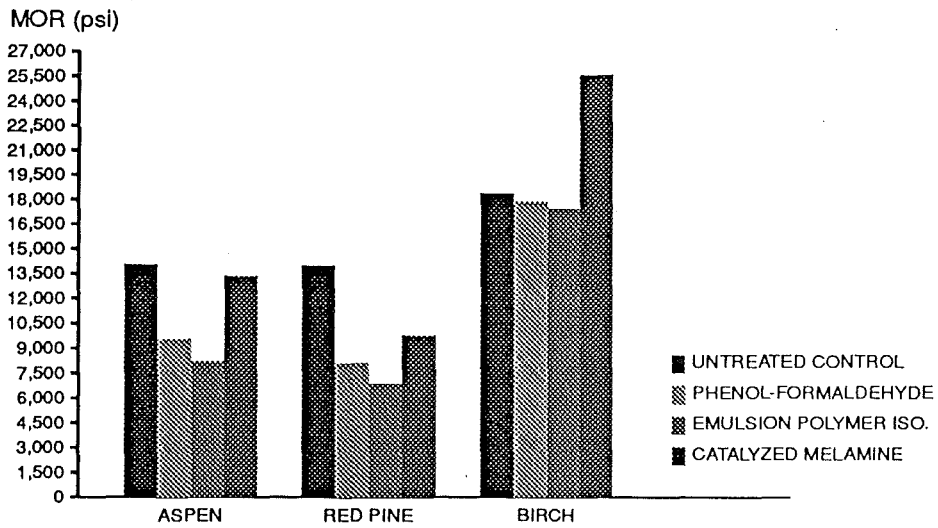
PERCENT WOOD FAILURE FOR TIM-BOR TREATED  
PARALLEL LAMINATED VENEER LUMBER  
BONDED WITH VARIOUS ADHESIVES



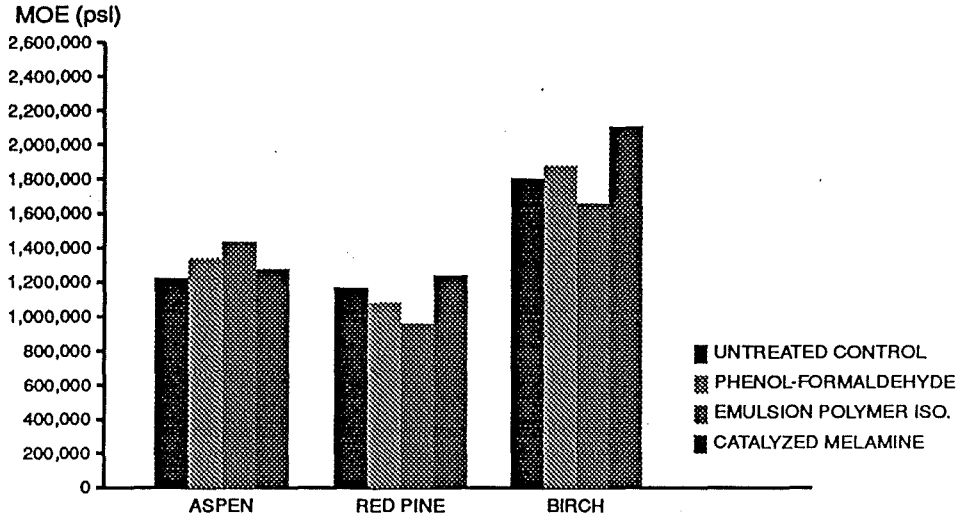
**MODULUS OF RUPTURE FOR COPPER NAPHTHENATE  
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**MODULUS OF ELASTICITY FOR COPPER NAPHTHENATE  
TREATED PARALLEL LAMINATED VENEER LUMBER  
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**MODULUS OF ELASTICITY FOR TIM-BOR TREATED  
PARALLEL LAMINATED VENEER LUMBER  
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