FLATTENING WAVY EUCALYPTUS VENEER DURING FINISH-DRYING

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ABSTRACT

Sliced Eucalyptus globulus veneer 0.5 mm (1/50 in.) thick, which had been pre-dried in a conventional non-pressure dryer, was finish-dried in an inexpensive, continuous press dryer for thin veneer, resulting in reduced waviness and improved grade. When finish-drying was started at about 30 percent moisture content (MC), using 240°F and 2.4 psi for 2 minutes, the result was flat, A-grade veneer (instead of C-grade as in conventional drying), at a final MC below 10 percent. Data variability, however, was a problem, and further trials are warranted.

Recently, Steinhagen et al. (9) addressed the opportunity of flattening wavy eucalyptus veneer 0.5 mm (1/50 in.) thick through pressure and heat during finish-drying, starting at about 20- to 30-percent dry-basis moisture content (MC). The authors concluded that important variables for reducing veneer waviness in their laboratory experiments were drying temperature (given fixed pressure), as well as MC and veneer waviness at the start of the test.

The objective of this paper is to discuss the results of a follow-up industrial trial. After predrying green eucalyptus veneer in a conventional non-pressure dryer (causing the veneer to buckle), we used, for finish-drying at various initial MCs, a continuous press dryer for thin veneer and tested its effectiveness to reduce waviness and to improve grade. An additional press dryer for pre-dried veneer can be relatively inexpensive and economically attractive to mills that do not want to replace their presently available, conventional dryer with a new, one- or two-stage press drying system for green veneer (1,2,4-7). For completeness, we also tested the press dryer on green eucalyptus veneer that had not been pre-dried.

PROCEDURE

As in the previous laboratory study (9), we used in the industrial trial, sliced Eucalyptus globulus veneer 0.5 mm thick from Chile. Specimens were cut to 14 inches in the fiber direction and 8 inches across. Three drying test levels were conducted each in temperature (T = 150°, 200°, and 240°F), pressure (P = 0.6, 1.2, and 2.4 psi), exposure time (t = 2, 4, and 6 min.), and initial MC at the start of the test (MC = 10%, 30%, and 100%, approximately), and we used three replications at each level. In total there were 243 specimens. Veneer to be used at MC = 10 and 30 percent respectively, had been pre-dried in a conventional non-pressure veneer dryer to about 10 percent MC and was, on average, wavy C-grade veneer. Half of this veneer was rewetted to the test level of 30 percent MC. Veneer at MC = 100 percent had not been pre-dried.

MC was determined for each specimen using the oven-drying method (initial weight was determined before the trial, and oven-dry weight after the trial). Associated with MC was W, the initial veneer waviness defined as the ratio of wave thickness to veneer thickness and dimensionless as such. W was determined as shown in Figure 1 and described in the previous study (9). Also associated with MC and W was Grade, the initial grade. A-grade veneer may have a waviness ratio up to 3, B-grade up to 7, and C-grade up to 10 (9).

The trial was conducted at Pacific Burl & Hardwood Co., Grants Pass, Oregon, using the plant’s continuous press dryer for thin veneer (Fig. 2). The design of this dryer was based on the modular veneer press (MVP) continuous dryer by

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Loehnertz (4,5,7). It had been con-
strueted in-house from used parts for less 
than $10,000. The dryer had a rotary cy-

inder that measured 80 inches in width 
and 36 inches in diameter and could be 
heated up to 240°F. A belt held the ve-

een tightly (up to 2.4 psi) against the 
cylinder. As the hot cylinder rotated, the 
belt moved along with it, and the veneer’s 
trajectory during a pass described the let-
ter “C.” The 1-minute pass was repeated 
with the veneer being turned around so 
as to heat it from the other side as well, 
using multiples of the 2-minute double 
pass. All veneer was fed with its grain 
parallel to the feed direction (longitu-
dinal feed).

After the trial, final MC (MCf) and 
final waviness (Wf) were determined us-
ing the methods just mentioned.

Percent waviness reduction was deter-
mert for each specimen according to 
the following formula:

$$\left( \frac{W_l - W_f}{W_l} \right) \times 100\%$$

This data was statistically processed to 
determine if waviness reduction was sig-
nificantly affected by T, P, t, or MC. The 
statistical methods used were exploratory 
factor analysis, analysis of variance, and 
multiple comparison procedures for 
group means of waviness reduction using 
the Tukey honest significant difference 
(HSD) and Fisher least significant differ-
ence (LSD) procedures (3,8).

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**Figure 1. — Apparatus for determining veneer waviness.**

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<thead>
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<th>Test</th>
<th>T (°F)</th>
<th>P (psi)</th>
<th>t (min.)</th>
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<th>$\text{MC}_f$</th>
<th>$W_l$</th>
<th>$W_f$</th>
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* T = temperature; P = pressure; t = time; MC = moisture content; W = waviness ratio; subscripts: i = initial; f = final.

* Three replications (a, b, c) at each test level.

* The 6-minute test data are omitted because benefits were insignificant.
RESULTS AND DISCUSSION

Statistical analysis of data suggested somewhat hazy results. Exploratory factor analysis indicated a significant effect of T and MC on waviness reduction, but no significant effect of P and t. Analysis of variance suggested a highly significant group effect of T and MC (significance level: 0.0000), and a marginal effect of P and t.

Trends in group means “X” of waviness reduction as a function of T and MC appeared obvious to the eye (Fig. 3). However, the HSD procedure yielded no significant difference between these contrasting means due to the large data variability. In the Figure 3 data ranges, the rectangle includes 50 percent of the data and each of the outer lines 25 percent; it should also be noted that the arithmetic mean value “X” usually differs from the median value “---”, indicating an asymmetric distribution of data. Follow-up LSD procedure, contrary to the more rigorous HSD procedure, suggested that all these differences are significant.

It appears that the effect of T on waviness reduction can be increased by applying more than 240°F (Fig. 3); the previous study (9) had identified an optimum at around 280°F.

Maximum effect of MC on waviness reduction occurred at 30 percent MC (Fig. 3b). Using 10 percent MC yielded significantly less waviness reduction (Fig. 3a). In contrast, when MC was 100 percent, little waviness and waviness reduction was observed but the dry veneer had checks throughout, and was therefore, unacceptable in grade.

In addition to these comprehensive results, Table 1 gives more specific results from eight test combinations that were relatively effective in reducing waviness and uplifting grade. These tests were conducted with T = 200 and 240°F, P = 1.2 and 2.4 psi, t = 2 and 4 minutes, and MC = 30 percent, approximately. Resulting MC was at target (less than 10% MC), with the exception of Test 1. W was usually much below W, so that percent waviness reduction was considerable (although quite variable). Grade was either A or B; particularly when 240°F was used Grade was A (one exception out of 12), regardless of Grade.

CONCLUSIONS

The inexpensive, continuous press dryer for thin veneer, used in the mill trial, performed well in a number of tests.
to flatten wavy eucalyptus veneer 0.5 mm thick during finish-drying. Over the test range, temperature and MC at test start were important for waviness reduction, but pressure and exposure time had a marginal effect at best. Based on this study, it is recommended that finish-drying of thin eucalyptus veneer in the press dryer be started at about 30 percent MC, and that 240°F (or perhaps more) and 2.4 psi be applied for 2 minutes. This procedure should considerably reduce waviness and likely result in A-grade veneer (instead of C-grade as in conventional drying), at a final MC below 10 percent. Exceptions to the rule are to be expected however, due to data variability. Further trials are warranted.

LITERATURE CITED