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INNOVATIONS IN THE TREATMENT OF SOUTHERN PINE HEARTWOOD

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ABSTRACT

Whereas the sapwood of southern yellow pine (*Pinus* spp.) is readily treatable, the heartwood is essentially impermeable to preservatives such as chromated copper arsenate (CCA). Preliminary studies at the Mississippi Forest Products Laboratory indicate that increases in penetration and retention of preservative in pine heartwood can be obtained by subjecting kiln dried dimension stock to varying mechanical stresses using the patented TASK Process machine. The TASK Process machine incorporates varying levels of compression and/or vibration to mechanically stress lumber.

Keywords: Southern pine, treatability, heartwood, TASK Process, mechanical stress

INTRODUCTION

Although the sapwood of southern yellow pine (SYP) (*Pinus* spp.) is readily treatable, the heartwood is essentially impermeable to preservatives such as chromated copper arsenate (CCA). This has led the American Wood Preservers' Association (AWPA) to create a standard regulating the use of SYP heartwood in contact with salt water (AWPA 1996). This standard states that bulkhead material shall have two sapwood edges and one sapwood face, clearly marked "this side towards water." Other publications specify that heartwood faces on treated SYP members be limited and be oriented away from direct exposure to rain wetting (Quintana 1994). Reduced drying time, reductions in drying defects, and increased treatability have been observed in studies where lumber was subjected to mechanical stresses prior to drying and treatment.

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In one study, nominal two-inch (38-mm) thick unseasoned samples of *Picea glauca* (Moench.) Voss (white

spruce) were subjected to varying compression forces prior to treatment with a water-borne preservative. It was determined that cross-sectional deformation (compression) amounts of 5% or higher produced an increase in retention and penetration (Cech and Huffman 1969). A slight reduction in modulus of rupture (MOR) occurred in some samples at higher levels of compression or deformation, but lower compression was associated with an increase in retention of 19% with no reduction in MOR. The compression apparatus was the same one used in earlier studies to investigate reductions of drying time and drying defects (Cech and Goulet 1968). Later studies with *P. glauca* and *Picea sitchensis* (Bong) Carr. (Sitka Spruce) also indicated increased retention could be obtained by stressing boards with mechanical compression forces prior to preservative treatment (Cech and Huffman 1971 and Gunzerodt, Walker, and Whybrew 1988).

Another study conducted on *P. glauca* heartwood dried to 25% moisture content resulted in a 45% increase in retention in wood that had been compressed prior to treatment. Wood with lower moisture contents (17-17.5%) was subjected to those same compression forces and an increase in retention of 210% was recorded. (Cech, Plaff, and Huffman 1973).

MISSISSIPPI STATE UNIVERSITY STUDIES

Studies conducted at the Mississippi Forest Products Laboratory (MFPL) have evaluated the effects of multiple mechanical stresses on the treatability of SYP heartwood (*Pinus* spp.). Our studies differ from those cited above in that test samples were stressed using various levels of compression and/or vibration. The objective of the research conducted at the MFPL was to determine if the treatability of SYP heartwood could be increased by stressing kiln-dried stock prior to treatment using the "TASK PROCESS" machine developed at MFPL (U. S. Patent #5697414) (Figure 1). This machine combines various levels of compression and vibration to mechanically stress lumber (Kitchens and Amburgey, 1996; Kitchens, 1997). This research was conducted using nominal two-inch (38-mm) thick kiln-dried SYP samples containing mostly heartwood. All

test samples had end-matched controls which were not

Figure 1. Prototype II TASK Process machine being used to mechanically stress SYP heartwood.

mechanically stressed. The test samples were mechanically stressed using varying combinations of compression and/or vibration prior to treatment with CCA-type C (AWPA 1996) solution using a conventional full-cell process. Retention data were calculated on a weight gain basis. A spray-on copper indicator (chrome azurol) was used to determine penetration of both stressed samples and their end-matched controls (Sanders, Amburgey, and Barnes 1998).

In these preliminary studies, it was found that the treatability of SYP heartwood can be improved, and an increase in both average retention and cross-sectional penetration could be obtained, by subjecting kiln-dried dimension stock to mechanical stresses by the patented TASK Process (Amburgey and Kitchens 1995; Forest Products Laboratory 1995) prior to being treated with CCA (Sanders 1996) (Figure 2). The authors also believe that subjecting SYP heartwood to the TASK Process may relieve many growth stresses that cause defects such as warping, a major defect in treated decking containing heartwood faces as documented in a decking study conducted at the MFPL (Amburgey and Sanders 1997). Studies to determine whether or not

strength loss resulted from mechanically stressing the SYP samples have not been completed at this time. However, previous studies to determine the effects of mechanical stresses on various hardwood species indicated that no significant reductions in modulus of rupture or modulus of elasticity were found to exist in samples stressed using the Corley commercial prototype (Corley Manufacturing Co., Chattanooga, TN) TASK Process machine (Figure 3). Future studies are planned to determine the effects of the TASK Process on the finishing properties of stressed, kiln-dried SYP as well as the treatability of other refractory species. U. S. Patent (Serial No. 09/234,715) and PCT (international protection) applications based on this technology are in process.

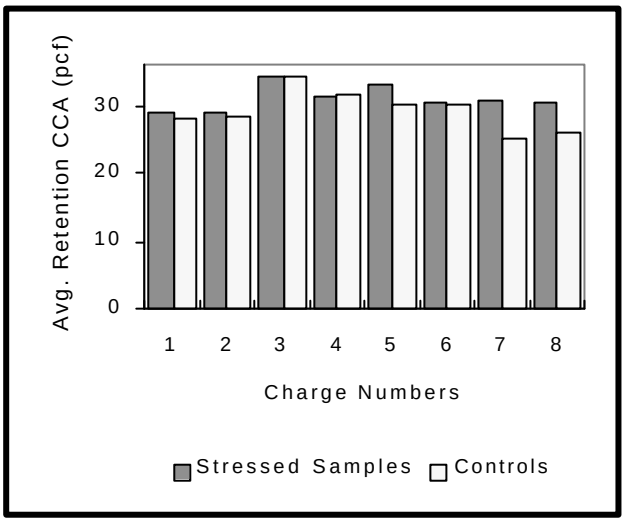

Figure 2. Samples from initial studies at MSU had increased retention of preservative in the mechanically stressed pieces.

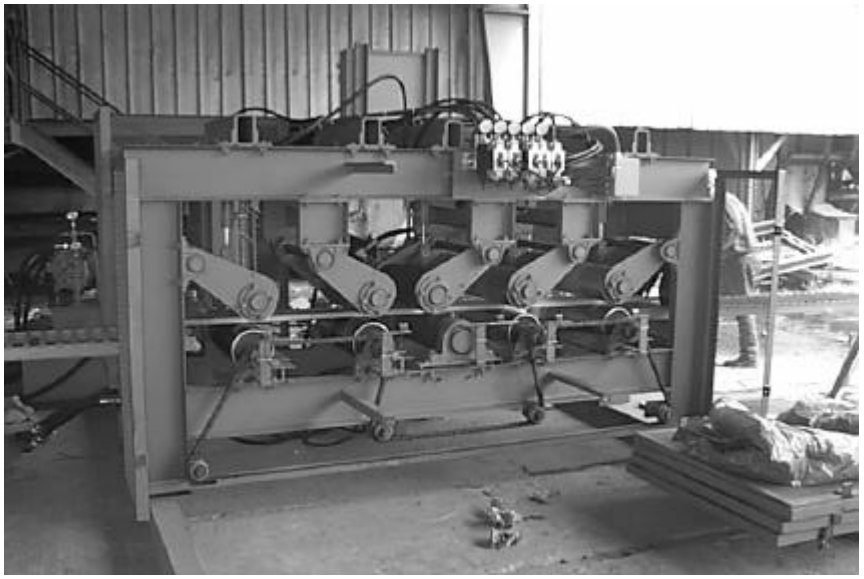

Figure 3. Corley commercial prototype TASK Process machine being used to mechanically stress lumber with compression and/or vibration.

CONCLUSION

Applying mechanical stresses to kiln-dried southern yellow pine prior to treatment resulted in increased retention and penetration of CCA in SYP heartwood.

LITERATURE CITED

Amburgey, T. L. and S. C. Kitchens. 1995 Method for Preventing and/or Controlling Staining in Lumber, Apparatus Therefore and Non-Stained Lumber. U. S. Patent Office Serial No. 08/437/371.

Amburgey, T. L. and M. G. Sanders. 1997. Field tests with CCA treated southern yellow pine decking. Final report submitted to Southern Forest Products Association, Kenner, LA.

AWPA. 1996. Standard C2-96. Book of Standards. American Wood-Preservers' Association, Granbury, TX, p.33.

Cech, M. Y. and M. Goulet. 1968. Transverse compression treatment of wood to improve its drying behavior. Forest Prod. J. 18(5):90-91.

Cech, M. Y. and D. R. Huffman. 1969. Dynamic transverse compression treatment of spruce to improve intake of preservatives. Forest Prod. J. 20(3):47-52.

Cech, M. Y. and D. R. Huffman. 1971. Dynamic compression results in greatly increased creosote retention in spruce heartwood. Forest Prod. J. 22(4):21-25.

Cech, M. Y., F. Plaff, and D. R. Huffman. 1973. CCA retention and disproportioning in White Spruce. Forest Prod. J. 24(7):26-32.

Forest Products Laboratory. 1995. Novel methods for controlling gray stain in logs and lumber. Forest Products Laboratory, Forest & Wildlife Research Center, Mississippi State University. Research Advances 4(1).

Gunzerodt, H. J., C. F. Walker, and K. Whybrew. 1988. Compression rolling of Sitka spruce and Douglas-fir. Forest Prod. J. 38(2):16-18.

Kitchens, S. C. and T. L. Amburgey. 1997. Prevention of non-microbial sapwood discoloration in hardwood lumber: chemical and mechanical treatments. International Research Group/WP97-30137, 5pp.

Kitchens, S. C. 1997. Use of mechanical forces to control non-microbial enzymatic sapstains in hardwood lumber. Masters of Science Thesis, Department of Forest Products, Mississippi State University, 73pp.

Quintana, S. C. 1994. The potential of producing prefabricated, modern timber bridge components in Mississippi. USDA Forest Service, Timber Bridge Information Resource Center, publication NA-TP-08-94.

Sanders, M. G. 1996. Improving the treatability of southern yellow pine heartwood and transition wood using the MSU TASK Process machine. Graduate Research Proposal, Department of Forest Products, Mississippi State University. Unpublished.

Sanders, M. G., T. L. Amburgey, and H. M. Barnes. 1998. Mechanically stressing southern yellow pine dimension stock to improve treatability. Poster Presentation, Forest Products Society Annual Meeting, Merida, Mexico, June 19-27, 1998.