

Calhoun

U.S. Department of Agriculture Accomplishments Report AD-421 U.S. Dept. of Agriculture, State Agricultural Experiment Stations and Other Institutions			Date (Month, Day, Year) 03/22/2012
1. Accession 0213555	Agency Identification No. 2. SAES 3. LA.B	5. Work Unit/Project No. LAB03896	6. Status Annual Report
7. Title Development of a Reverse Supply Chain System for Decommissioned Preservative-Treated Wood			
12. Investigator Name(s) (Last Name and Initials) Piao, C.			
20. Termination Date 09/30/2012		40. Period Covered (mo/da/year): 01/01/2011 TO 12/31/2011	
Outputs: Four articles were published in peer-reviewed journals. Two new treatment methods (ZnO nano rods and silane nanoparticles) increased the compatibility of lignocellulosic fibers with plastic, thereby reducing volumetric swell and increasing the strength of fiber-reinforced plastic composites. Other outputs of this project included two presentations at the Forest Products Society International Convention.			
Outcomes/Impacts: Reusing decommissioned treated wood offers economic and ecological advantages. Results of this project demonstrated the feasibility of using decommissioned pentachlorophenol-treated utility pole wood as materials for making laminated structural beams. The MOR and MOE of utility pole wood were 33.7 and 68.1 percent lower than the published MOR and MOE values of virgin loblolly pine wood, respectively. The shallow, aged surface layers of poles, particularly of older poles, had low strength and relatively high penta retention, suggesting that surface layers should be removed from the recycled poles. Most of the remaining pole portions had medium to high strength, and therefore, were reusable for other products. The interactions between wood and water vapor or wood and liquid water have profound impacts on the physical properties, mechanical properties, utility, and service life of wood and wood-based products. The transformation of the wood surface from hydrophilicity to hydrophobicity is often associated with the blockage, modification, or removal of the hydroxyl groups present in wood substance. Acetylation, metal oxides, the sol-gel process, alkylchlorosilanes, grafting of silicone polymers, micro emulsion, layer-by-layer deposition, and plasma treatment have been used to modify wood for hydrophobicity. Most chemicals currently used for hydrophobic transformation are alkoxysilanes, which act as coupling agents to modify the hydroxyl groups and to chemically anchor hydrophobic alkyl groups or other functional molecules to the surface of wood. ZnO-stearate is a cost-effective and more environmentally friendly wood preservative than other metallic-based formulations. Treatment with ZnO-stearate imparts superhydrophobicity to wood surfaces, thereby providing triple protection to wood products, i.e., superhydrophobicity, inhibition to insects and microorganisms, and UV radiation protection. ZnO-stearate superhydrophobic treatment of southern pine wood samples received excellent visual ratings and weight loss values. The mean termite mortality was moderate. These findings suggest that ZnO-stearate treatment can be a new, environmentally benign method for wood protection and preservation.			
Publications: Piao C, Monlezun CJ, Wang JJ, Groom LH (2011) Recycling of pentachlorophenol-treated southern pine utility poles. Part I: Preservative retention and mechanical properties. Forest Prod. J. 61(1):38-45. Shupe TF, Piao C, Lucas C (2011) Termite resistance of superhydrophobic wood treated with ZnO nano rods. Euro J Wood & Wood Prod 69. DOI:10.1007/s00107-011-0563-x. Wang C, Piao C (2011) From Hydrophilicity to hydrophobicity: A critical review. Part II. Hydrophobic conversion. Wood Fiber Sci. 43(1):41-56. Wang C, Piao C, Lucas C (2011) Synthesis and characterization of superhydrophobic wood surfaces. J. Appl. Polym. Sci. 119(3):1667-1672.			

<p>Participants:</p> <p>Cheng Piao (PI), Neal Hickman, Bentley Fitzpatrick, Chris Thomas, LSU AgCenter.</p>		
<p>Target Audiences:</p> <p>Target audiences include other researchers, personnel in power and wood preservation industries, forest landowners, and educators.</p>		
<p>Project Modifications:</p> <p>Nothing significant to report during this reporting period.</p>		
Approved (Signature)	Title	Date
		