WOOD

NPARR 5(2), 2014-0196 Extracellular activities and wood component losses during *Pinus taeda* biodegradation by the brown-rot fungus *Gloeophyllum trabeum*

*Gloeophyllum trabeum* is a brown-rot fungus that may hold promise for use in biorefineries. In the present work, *G. trabeum* was grown on *Pinus taeda* wood chips under solid-state fermentation conditions to study the degradative mechanisms used by this fungus. Metabolite secretion, Fe$^{3+}$-reducing activity and wood component losses were evaluated in the cultures. The average mass loss ranged from 4% to 7% (m/m) during the period of 1–4 weeks. Polyoses were degraded preferentially. Cellulases and xylanases were secreted, but no correlation between hydrolytic enzymes and wood polysaccharide losses was observed. No phenol-oxidizing enzyme activity was detected. Soluble oxalic acid was detected in trace quantities. The residual lignin content remained unchanged (28.5% m/m), but mass balance studies indicated that *Pinus taeda* wood chips were partially delignified. This delignification was not accompanied by the accumulation of water-soluble phenols with Fe$^{3+}$-reducing activity. The data suggest that Fenton-based biodegradation of wood polysaccharides by *G. trabeum* may be independent of lignin degradation products with Fe$^{3+}$-reducing activity [André Aguiar*, Daniela Gavioli and André Ferraz (Departamento de Química, Biotecnologia e Engenharia de Bioprocessos, Alto Paraopeba, Universidade Federal de São Joao Del-Rei, CP 131, 36420-000 Ouro Branco, MG, Brazil), *International Biodeterioration & Biodegradation*, 2013, 82, 187-191].

NPARR 5(2), 2014-0197 Effects of wood fiber esterification on properties, weatherability and biodurability of wood plastic composites

Poplar wood fibers were chemically modified by esterification (acetate, propionate, benzoate) and then compounded with high density polyethylene (HDPE) into wood plastic composites (WPC). The esterified fibers were characterized (spectroscopy, TGA and contact angle) and shown to be more thermally stable and hydrophobic than unmodified fibers. The WPC were characterized for their mechanical and rheological properties, adhesion factor, water resistance, accelerated weathering and biodurability performance. Color change, surface morphology and extent of oxidation on the surface of weathered WPC were monitored using colorimetry, microscopy and FTIR spectroscopy, respectively. Benzoylated fiber based WPC experienced the least surface crazing and color change due to weathering. Esterification of fibers significantly reduced weight losses in the resulting WPC when it was exposed to brown-rot and white-rot fungi as compared to unmodified fiber WPC. Esterification of wood fibers resulted in more biodurable and photostable WPC [Liqing Wei, Armando G. McDonald*, Camille Freitag and Jeffrey J. Morrell (Renewable Materials Program, Department of Forest, Rangeland and Fire Sciences, University of Idaho, Moscow, USA), *Polymer Degradation and Stability*, 2013, 98(7), 1348–1361].

NPARR 5(2), 2014-0198 Development of Wood-Crete building materials from sawdust and waste paper

This study was to develop a new building material, Wood-Crete, using sawdust, waste paper and TradiCal lime. The paper presents the processing technologies, factors which affect the performance of the developed composites, and properties of Wood-Crete. The results showed that lightweight sustainable blocks can be produced with good insulating and other relevant properties for building construction with density ranging from 356 to 713 kg/m$^3$ and compressive strength from 0.06 to 0.80 MPa. The properties were closely related to the composition of Wood-Crete with an addition of waste paper being a
dominant influence on both strength and thermal conductivity, reflecting its effect on the structure of composite and contribution of self strength of paper fibres. The combined effect of sawdust and waste paper and Tradical lime had a direct effect on the strength properties of Wood-Crete. Of significant importance was the contribution of self strength of Wood-Crete due to the influence of the size of sawdust particles used. The developed Wood-Crete was able to withstand considerable amount of impact load and considered, like hempcrete, most suitable for wall panelling or other non- and semi-structural applications with good thermal insulating properties [Eboziegbe Patrick Aigbomian* and Mizi Fan (Civil Engineering, School of Engineering and Design, Brunel University, Uxbridge, Middlesex, UK), Construction and Building Materials, 2013, 40, 361–366].

NPARR 5(2), 2014-0199 Effects of anatomical and chemical properties of wood on the quality of particleboard

The objective of this study was to investigate the effects of anatomical and chemical structures of wood on the quality properties of particleboard containing different mixture of wood species. Urea–formaldehyde adhesive was used as a binder for manufacturing of test panels. Anatomical and chemical properties of wood species, and physical and mechanical properties particleboards were evaluated. The anatomical and chemical structures were found to be effective on the all of the properties of particleboards. Panels made from the particles including more amount of pine wood had highest mechanical strength properties and lowest thickness swelling values. Cellulose, hemicellulose and lignin contents, acidity and solubility values (in hot–cold water, dilute alkali and alcohol benzene) of wood significantly affected all of the properties of particleboards. The physical and mechanical properties of particleboards showed statistically differences related to the length, thickness and number of the cells and fibers [Mehmet Baharoğlu, Gökay Nemli*, Bünyamin Sarı, Turgay Birtürk and Selahattin Bardak (Karadeniz Technical University, Faculty of Forestry, Trabzon, Turkey), Composites Part B: Engineering, 2013, 52, 282–285].

NPARR 5(2), 2014-0200 Influences of wood preservation, lumber size, and weather on field leaching of red pine lumber

Alkaline copper quaternary (ACQ) is a widely used wood preservative. This study evaluated leachate volume generation and contaminant leaching from ACQ-treated lumber during rainfall events in comparison to untreated lumber. The influences of wood preservation with ACQ, lumber size, and weather on leachate generation ratio and contaminant concentrations in wood leachate were investigated with four red pine lumber piles exposed to natural weather conditions. The average volumetric ratio of leachate to rainfall was significantly higher for the large-lumber piles (0.62) compared with the small-lumber piles (0.35). Less leachate was generated in the ACQ-treated lumber piles (0.42) than the untreated lumber piles (0.55). Leachate volume could be predicted with rainfall depth, air temperature, and wetted lumber surface area. Lumber size did not make a statistically significant difference in leachate quality except for zinc concentration. The average copper concentrations were 4034 µg/L in the leachate from the ACQ-treated lumber piles and 87 µg/L in the leachate from the untreated lumber piles. Moreover, ACQ treatment significantly increased leaching of arsenic and total dissolved solids. Copper concentration in leachate from ACQ-treated lumber can be predicted with rainfall intensity, the time interval between two consecutive leachate-generating events, rain copper concentration, and rain pH [Wendong Tao*, Shun Shi and Charles N. Kroll (Department of Environmental Resources Engineering, College of Environmental Science and Forestry, State University of New York, 1
NPARR 5(2), 2014-0201 Thermal analysis of Pinus sylvestris L. wood samples treated with a new gel–mineral mixture of short- and long-term fire retardants

The aim of this paper is to assess the effectiveness of a new fire retardant mixture, which consists of a short-term (gel) and a long-term (carbonate mineral) fire retardant. Its thermal degradation behaviour was examined on Pinus sylvestris L. wood and compared to three known fire retardant products alone (DAP (NH₄)₂HPO₄, sodium polyacrylate and huntite/hydromagnesite in a commercial form). Thermal analysis (TG and DTG) was employed for accurate screening of the samples’ flammability properties. The results indicate that the proposed mixture of a gel (sodium polyacrylate) and a carbonate mineral (huntite/hydromagnesite) leads to improved fire retarding efficiency for wooden materials by combining water insulation and chemical retardation, thus decreasing mass loss rate and increasing char production [S. Liodakis*, V. Tsapara, I.P. Agiovlasitis and D. Vorisis (Laboratory of Inorganic & Analytical Chemistry, School of Chemical Engineering, National Technical University of Athens, 9 Iroon Polytechniou Street, Athens, Greece), Thermochimica Acta, 2013, 568, 156-160].