



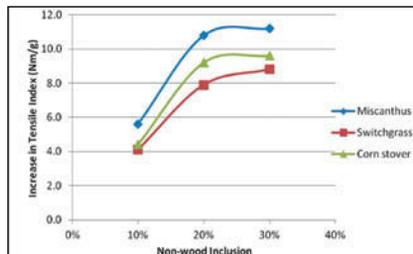
TJ SUMMARIES

THE PAPERS SUMMARIZED HERE ARE from the June and July 2014 issues of TAPPI Journal, an online publication of relevant and timely peer-reviewed research delivered via email and free to all TAPPI members. To receive TAPPI Journal, join TAPPI at www.tappi.org

JUNE

NONWOOD PULPING

Co-cooking nonwoods with hardwoods
Troy Runge and Chunhui Zhang



▲ **NONWOOD PULPING.** Tensile increase with nonwood inclusion.

This study examines the potential of co-cooking nonwood materials with hardwoods as means to incorporate nonwood material into a paper furnish. Specifically, miscanthus, switchgrass, and corn stover were substituted for poplar hardwood chips in the amounts of 10 wt%, 20 wt%, and 30 wt%, and the blends were subjected to Kraft pulping experiments. The pulps were then bleached with an OD(EP)D sequence and then refined and formed into handsheets to characterize their physical properties.

Surprisingly, all three co-cooked pulps showed improved strength properties (up to 35%). Sugar measurement of the pulps by

high-performance liquid chromatography suggested that the strength increase correlated with enriched xylan content.

NONWOOD FIBERS

Chemical and morphological characterization of sugar cane bagasse
Marcela Freitas Andrade, Jorge Luiz Colodette, and Hasan Jameel

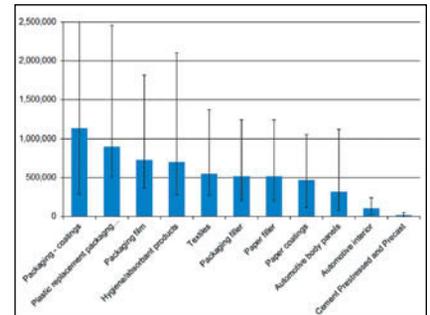
The main goals of this study were to characterize the chemical (pith and fibers fractions) and morphologic (fibers fraction) properties of sugar cane bagasse and the structure of the depithed bagasse lignin by two-dimensional nuclear magnetic resonance spectroscopy. Industrial whole bagasse was separated into two fractions: pith and depithed bagasse. The pith was only characterized chemically. The depithed bagasse was chemically and morphologically characterized.

The cellulose, hemicelluloses, and lignin contents of the two materials varied significantly. The lignin composition of the depithed bagasse showed very high contents of phenolic cinnamic acids (PCAs). The depithed bagasse lignin presented fractions with different structural monomer distributions. The morphological analyses of the depithed bagasse indicated a short fiber material, similar to hardwoods.

NANOCELLULOSE MARKETS

Market projections of cellulose nanomaterial-enabled products — Part 2: Volume estimates

John Cowie, E.M. (Ted) Bilek, Theodore H. Wegner, and Jo Anne Shatkin



▲ **NANOCELLULOSE MARKETS.** Annual U.S. tonnage estimates for nanocellulose (metric tons).

This study builds on previous work by the same authors in which likely high-volume, low-volume, and novel applications for cellulosic nanomaterials were identified. In particular, this study creates a transparent methodology and estimates the potential annual tonnage requirements for nanocellulose in previously identified applications in the United States.

High, average, and low market penetration estimates are provided for each application. Published data sources of materials use in the various applications provide the basis for estimating nanocellulose market size. The study found that the majority of the near-term market potential for nanocellulose appears to be in its fibrillar versus crystalline form.

JULY

COATING

Thin coatings for paper by foam coating
Karita Kinnunen-Raudaskoski, Tuomo Hjelt, Eija Kenttä, and Ulla Forsström



▲ **COATING.** Researchers used a narrow slot type applicator to apply foam to the paper web.

Foam coating technology, widely used in the textile and nonwovens industries, offers a unique opportunity to apply coating on the web surface thinly enough to be economically viable. Pilot-scale studies show that a thin coating of nanomaterial at a thickness of 1 μm or less and coat weight of 0.3-2.0 g/m^2 is enough to change paper surface properties and enable the functionalization of the paper surface. This report describes the applicability of the curtain-like foam coating technology in unmodified cellulose nanofiber (CNF) applications.

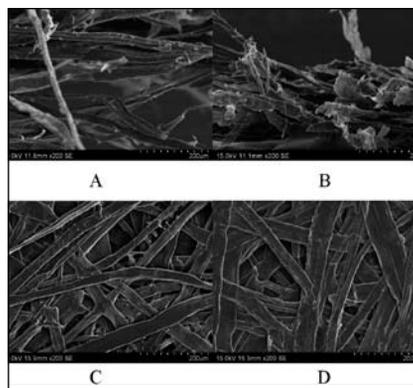
PAPERMAKING

Cationization of oat β -D glucan as a dry-strength additive for paper

Xianliang Song and Martin A. Hubbe

Oat β -D glucan was treated with 3-chloro-2-hydroxypropyl-trimethyl ammonium chloride (10%, 20%, 30%, or 50% of beta glucan) to obtain a range of cationic β -D glucan samples. The derivatization was confirmed by the results of fourier transform infrared (FTIR) tests and elemental analysis.

Addition of 1% cationic β -D glucan based on the mass of unbleached pine Kraft fiber increased burst, tensile, and folding endurance properties of the resulting paper. Similar effects were observed at pH 5 and pH 8.5, showing that the system can be considered robust relative to typical acidic and alkaline



▲ **PAPERMAKING.** SEM fracture images and surface images of a paper sample: (A) control, (B) with cationic β -D glucan, (C) control and (D) with cationic β -D glucan.

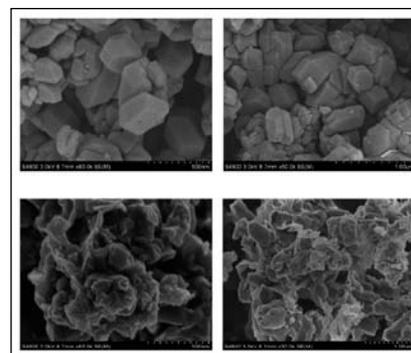
papermaking conditions. The strength benefits were also observed in recycled sheets made by reslurrying paper prepared with cationic β -D glucan, even when the initial drying conditions had been severe.

Treating a hemicellulosic byproduct of oat processing to give it a positive charge can improve its effectiveness as a dry-strength agent for wet-end addition.

NONWOOD PULPING

Effect of silicon on properties of causticized calcium carbonate produced in wheat straw soda pulping

wz Xia, Xing Wang, Mingzhu Du, and Zhaoqing Lu



▲ **NONWOOD PULPING.** SEM images of causticized calcium carbonate with a 0.31% silica content (top images) and 6.40% (bottom images).

Green liquor in the chemical recovery process of wheat straw pulping, was treated with carbon dioxide to precipitate silicon. The researchers report on the properties of causticized calcium carbonate (CCC) with different silicon contents, as well as its impact on paper quality when used as filler.

The research results showed that silicon content had no significant effect on the crystal form of CCC, and all crystals were formed as calcite. Calcium silicate itself did not polymerize to form crystal in the course of causticization. Instead, silicon existed as a solid solution in CCC. The morphology of CCC changed gradually from amorphous to square with the decrease of silicon content. 360

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NONWOOD PULPING

Co-cooking moso bamboo with hardwoods
Troy Runge, Jackie Heinricher, and Dan Meier

NONWOOD FIBERS

Production of printing and writing paper grade pulp of sugar cane bagasse
Marcela Freitas Andrade, Jorge Luiz Colodette, Rubens Chaves de Oliveira, Carolina Marangon Jardim, and Hasan Jameel

NANOCELLULOSE

Nanocellulose in polymer composites and biomedical applications
Yuan Lu, Halil Levent Tekinalp, Claude Clifford Eberle, William Peter, Amit Kumar Naskar, and Soydan Ozcan

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ENVIRONMENTAL

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Ivan Sretenovic, Masoumeh Farkhondehkavaki, Mark Kortschot, and Honghi Tran

COATING

Characterization of thin pigment coating layers produced by foam coating
Eija Kenttä, Karita Kinnunen-Raudaskoski, and Tuomo Hjelt

MICROFIBRILLATED CELLULOSE

Fractional study of the microfibrillated cellulose
Ossi Laitinen and Jouko Niinimäki