

Summaries from TAPPI Journal October and November 2025 Issues



screened or unscreened pulps. Notably, the delignification rate in the oxygen stage was the same for the non-standard procedure as for pulp from the standard procedure with the reject fraction removed prior to the oxygen stage. No significant differences were seen in fiber morphology, brightness level, or brightness stability. The amount of total fiber charges in pulps not screened before oxygen delignification was slightly higher than in screened pulps.

Applying oxygen delignification directly to unscreened pulp with high lignin content can enhance yield, when applied on high kappa numbers; and reduce energy demand, since the wood chips do not need to be mechanically refined to continue the process. This change can offer a more sustainable and efficient approach to kraft pulp production.

The papers summarized here are from TAPPI Journal's October issue and the special November issue on Coating, Printing, and Surface Enhancement. TAPPI Journal is an online open access publication of relevant and timely peer-reviewed research. To receive TAPPI Journal, visit tappi.org/subscribe or search the archive of previously published papers at tappi.org/tj. Authors can submit research for publication in TAPPI Journal at tappi.org/tjsubmit. There is no fee to publish and copyright remains with the authors.

OCTOBER

PULPING

The effect of pulp screening on oxygen delignification of high lignin content pulps

Cláudia Vicente Esteves and Elisabet Brännvall

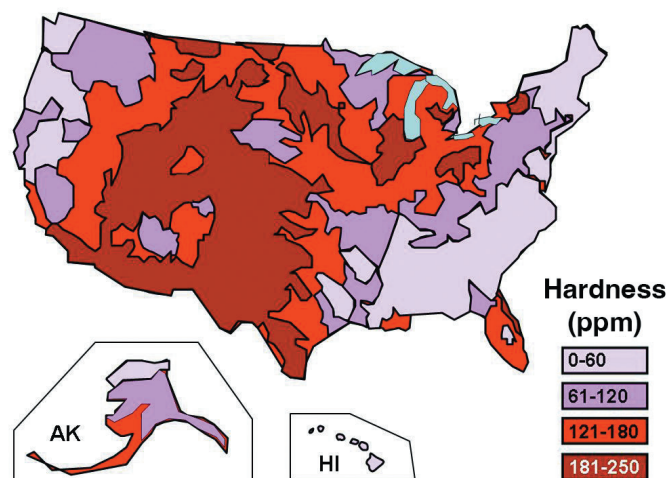
This study investigates the impact of pulp screening on oxygen delignification of high lignin content kraft pulps from spruce wood. The authors propose an alternative process: terminating kraft cooking at higher kappa numbers and applying oxygen delignification directly to unscreened and non-defibrated pulp. The objective is to evaluate whether this non-standard approach can maintain delignification efficiency while improving yield and reducing energy input.

The findings demonstrate that screening prior to oxygen delignification is not essential for effective lignin removal or pulp quality. Similar delignification degrees and ISO brightness levels were obtained after oxygen delignification, whether it was performed on

ADDITIVES

Effects of water hardness (CaCl₂ addition) on performance of papermaking additives for fine-particle retention, dewatering, and flocculation

Sky F. Johnson, Nathan J. Gillespie, Daniel Zhang, Kimberly D. Goodwin, Cori G. Sutton, and Martin A. Hubbe



Map of US water hardness based on 1975 US Geological Survey, as redrawn by study authors.

Water hardness, which can be defined as the concentration of calcium and magnesium ions, is known to vary greatly depending on

geographical locations. Researchers did laboratory tests to evaluate effects of large differences in water hardness on the performance of certain wet-end additives to the paper machine process. Tests were carried out at hardness levels of 25, 125, and 225 ppm (as calcium carbonate equivalents).

Researchers found that increased water hardness had a generally negative effect on the performance of a cationic acrylamide-type retention aid, although the extent of performance loss depended on experimental details. Likewise, rates of dewatering in systems containing cationic retention aid were adversely affected by increasing hardness, though the effects were not statistically significant in all cases considered. The tendency of bridge-forming flocculants (cationic retention aid or sequential addition of a cationic additive and then anionic retention aid) fell slightly with increasing water hardness.

Cationic acrylamide-type retention aids appear quite tolerant of different water hardness conditions. Such products can promote both retention and drainage in paper machine systems even when operating under very low or very high water hardness conditions, as are often found at mill sites in different regions.

NOVEMBER

BARRIER COATING

Influence of base sheet properties on barrier coating performance

Dustin Burton, Alan Piwowar, and Greg Welsch

Paper packaging offers a sustainable alternative to standard plastic-based materials, particularly for food and beverage applications. With reduced fiber treatment options like fluorochemicals, uncoated base stock often provides little-to-no effective barrier against liquid water, oil/grease, or moisture transmission. Despite the lack of natural barrier performance, base sheet properties can significantly influence the efficiency of applied water-based barrier coatings.

In this study, various base stock properties, such as caliper, porosity, roughness, and ash content, are reported to influence the barrier performance of styrene-acrylic and a copolymer of styrene-butadiene/styrene-acrylate based barrier coatings. These findings will help paper and board producers design better, more cost-effective, purpose-built substrates for barrier applications in the packaging industry. The findings support more data-driven substrate selection and process optimization across barrier-coating research and production.

COATING PROCESSES

A method to produce paperboard with a lightweight low-density coating

Gary Fugitt and Scott Ginther

In this work, the authors describe a method to produce a coating layer that consists of a network of bubble-shaped air-filled voids within the coating. This is accomplished by instantaneously flash-drying all the water in the coating as it exits the application nip.

The nip is formed between a polished chrome drum and a deformable press roll. The combination of the drum temperature, nip pressure, and nip width allow for sufficient energy to be transferred to the coating to completely flash-dry the coating material. The pressure within the nip is sufficient to allow the coating to superheat within the nip, then

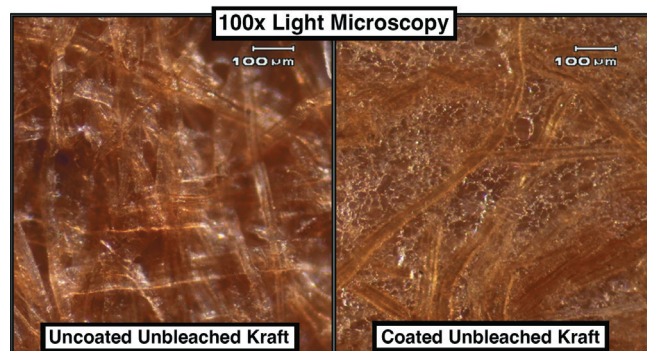
flash boil as it exits the nip. This boiling effect and resulting expansion are constrained by the roll surface, resulting in a coated surface that mirrors the polished chrome surface. The coating immobilizes while in the process of boiling, which preserves the bubble structure. With a coat weight of 5 g/m², a flat, smooth surface is produced.

This process was scaled up to a mill production machine layout and run at speeds as high as 450 m/min. Considering current trends toward lightweight and functional barrier coatings, this technology may provide an avenue to pursue both.

COATING PROCESSES

A laboratory-scale automated vacuum-assisted device for coating of cellulose nanofibrils onto paper

Sandro Zier, Zechariah Hoeft, Jamieson Snape, Douglas Bousfield, and Caitlin Howell



The 100x microscopic images of untreated (left) and treated solid unbleached kraft board clearly show the bubbles contained in the coating (right).

An automated vacuum-assisted coating system was developed to deposit cellulose nanofibril (CNF) layers onto paper substrates, simulating potential industrial geometries while allowing precise control of web speed (10–20 m/min), vacuum time (up to 30 s), and applicator gap (0.5–0.9 mm). Vacuum assistance makes it possible to obtain coat weights over 5 g/m² in a single pass and increases solids after coating from less than 10 percent to over 28–30 percent, reducing drying demand by more than 60 percent.

Coat weights were tuned from 6 to over 11 g/m² by varying suspension solids (0.4–0.6 wt%), line speed, and filtration length (20–40 mm), with strong agreement between experimental data and model predictions. Barrier testing showed Kit test values for double folded samples of 9–12 and Gurley air resistances above 4 × 10⁴ s once coat weights exceeded 7 g/m². Comparable performance was achieved with lower fines content CNF (60 percent) by increasing coat weight, providing technical flexibility and cost advantages for industrial scale-up.

The unique method for coating CNF onto paper described here produces high-enough coat weights in a single pass to obtain good barrier properties.

BARRIER COATING

Designing paper and board barrier constructions for food contact applications

Alan M. Piwowar and Greg Welsch

This study examines the effect of multiple factors on barrier performance for purpose-built paper and paperboard constructions

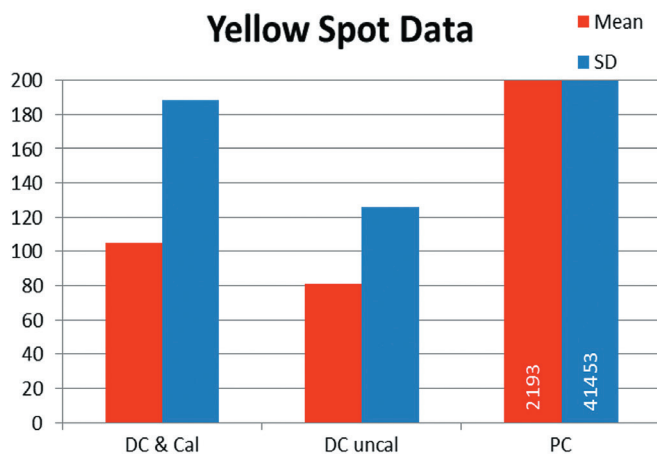
produced on an industrial pilot coater machine. Researchers studied impacts from precoat latex chemistry, application method (flooded nip with bevel blade metering, jet with bevel blade metering, grooved rod pre-metered film coater, and laboratory rod drawdown coater), and precoating calendering in relation to resulting porosity, roughness, and barrier (liquid water, moisture, and oil).

Results revealed a complex interaction between controllable and uncontrollable factors, offering insight for designing advanced barrier coatings on cellulosic substrates.

PRINTING

Pre-damping effects on water absorption and drying dynamics in flexographic printing

Janet Preston, Eli Gaskin, and Martti Toivakka



Yellow spot trapping results, showing the best performer to be the double-coated but uncalendered sample.

Optimizing flexographic printability can involve the ink and the substrate, as well as the printing process. It has been widely reported that controlling topography of the substrate and its porosity are vital for good flexographic printability, especially when using water-based inks.

Other Research Appearing in *TAPPI Journal's* October Issue

LIGNIN

Determination of aliphatic and phenolic hydroxyl groups in lignin by chemometric analysis of FTIR spectroscopic data

Mohammad Nashir Uddin, M. Nur Alam Likhon, M. Mostafizur Rahman, Yangcan Jin, Bo Jiang, M. Tushar Uddin, and M. Sarwar Jahan

ADDITIVES

Effects of salinity (Na_2SO_4) on performance of paper-making additives for fine-particle retention, dewatering, and flocculation

Kimberly D. Goodwin, Daniel Zhang, Nathan J. Gillespie, Sky F. Johnson, Cori G. Sutton, and Martin A. Hubbe

This study focuses on how pre-damping a surface impacts liquid absorption and improves wet trapping (ink-on-ink, with no intermediate drying) in flexographic printing. Researchers adapted a Prüfau universal print tester to analyze flexographic wet-on-wet ink printing and trapping using yellow and magenta inks for contrast. Slow drying of the first ink layer (yellow) leads to mottle when the second layer (magenta) is applied.

The study explores the “wet sponge” hypothesis: a pre-damped surface should absorb liquid faster. While the Lucas-Washburn equation describes long-term absorption, it does not capture short-term uptake, which instead follows a linear dependence on time. 56



10, 9th Road, Industrial Park, Taichung, Taiwan 40755
TEL: +886-4-23591221 FAX: +886-4-23598734
Email: sales@mail.yueli.com.tw

Pulp & Paper Machine and
Corrugated Machine
Designing Manufacturing
& Commissioning

Total pulp and
paper solution
provider

YUELI
www.yueli.com.tw

