



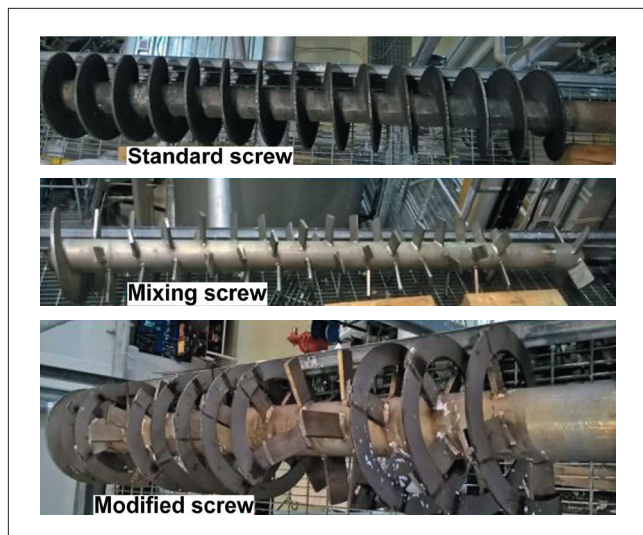
The papers summarized here are from *TAPPI Journal*'s February 2021 issue and March 2021 special issue featuring content from the 2020 PEERS Conference. *TAPPI Journal* is an online publication of relevant and timely peer-reviewed research delivered via email and free to all TAPPI members. To receive *TAPPI Journal*, join TAPPI at www.tappi.org.

FEBRUARY

BYPRODUCTS

Continuous tannin extraction by use of screw reactor

Markku Kuosa, Antti Heikkinen, Tapio Tirri, and Lasse Pulkkinen



Screw types used in continuous screw reactor during the experimental runs.

A pilot-size screw reactor (extraction unit) was used for tannin extraction of spruce. Yield of the same magnitude or better was obtained when comparing a screw reactor with batch reactors. A longer presoaking time in water seemed to be better than a short one for obtaining higher yield. A higher yield is obtained with lower dry-water ratio, which suggests that the internal diffusion in bark does not determine mass transfer as much as is the case without presoaking of bark. The higher dry-water ratio decreased the yield. The prior soaking of the bark also minimized the mechanical reactor feeding problems (clogging).

The benefits of a screw reactor likely are that run time changes for different process conditions are flexible; it simplifies design and construction of an industrial unit for tannin production; and it saves space because of the need for fewer and smaller intermediate storage tanks.

In this study, researchers show that presoaking has a crucial effect on yield in tannin extraction. This knowledge is important for further development of tannin extraction processes.

ENVIRONMENTAL

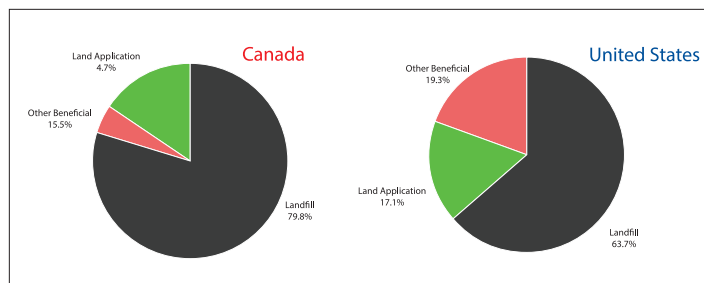
A case study review of wood ash land application programs in North America

Ilich Lama and Derek Sain

Several regulatory agencies and universities have published guidelines addressing the use of wood ash as liming material for agricultural land and as a soil amendment and fertilizer. This research summarizes the experiences collected from several forest products facility-sponsored agricultural application programs across North America.

Reported benefits associated with land-applying wood ash include increasing the pH of acidic soils, improving soil quality, and increasing crop yields. Farmers apply wood ash on their land because, in addition to its liming value, it has been shown to effectively fertilize the soil while maintaining soil pH at a level that is optimal for plant growth. It also improves soil tilth, and it has proven to be a cost-effective alternative to agricultural lime, especially in rural areas where access to commercial agricultural lime is limited.

Some of the challenges identified in the review of case studies include lengthy application approvals in some jurisdictions; weather-related issues associated with delivery, storage, and application of wood ash; maintaining consistent ash quality; potential increased equipment maintenance; and other factors covered in this research paper.



Options North American pulp and paper facilities use to manage boiler ash. (Source: 2018 NCASI data.)

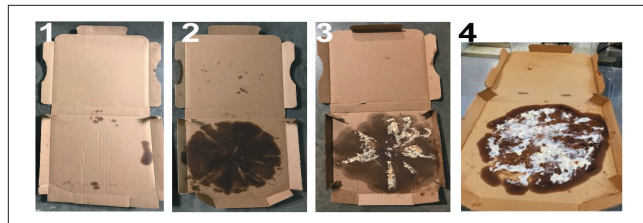
The information in this paper is especially useful for forest products manufacturing facilities that would like to consider beneficial use of wood ash as a soil amendment. It also informs discussions between ash generators, those engaged in agriculture, and regulators regarding alternative approaches used in other jurisdictions.

MARCH

RECYCLING

Incorporation of post-consumer pizza boxes in the recovered fiber stream: Impacts of grease on finished product quality

Ashok Ghosh, Peter W. Hart, Adele Panek, Tran Nguyen, and Meredith Dooley



Preconsumer boxes were used as control in testing against boxes where pizzas were meat (images 1 and 2) and cheese (images 3 and 4); without box inserts (images 2-4); topping side down (image 4); and different crusts, among other scenarios.

Grease and cheese contamination of used pizza boxes has led to misunderstanding and controversy about the recyclability of pizza boxes. Some collection facilities accept pizza boxes while others do not.

The purpose of this study was to determine whether typical grease or cheese contamination levels associated with pizza boxes impact finished product quality. Grease (from vegetable oil) and cheese are essentially hydrophobic and, in sufficiently high concentration, could interfere with interfiber bonding, resulting in paper strength loss.

Findings from this study will be used to determine the viability of recycling pizza boxes at current and future concentrations in old corrugated containers (OCC) recovered fiber streams. These findings will also be used to inform the acceptability of pizza boxes in the recycle stream and educate consumers about acceptable levels of grease or cheese residue found on these recycled boxes.

Implementation of this work will increase the available amount of high-quality post-consumer fiber. The current work is an important step towards the creation of a true circular economy.

RECOVERY CYCLE

Development of converging-diverging multi-jet nozzles for molten smelt shattering in kraft recovery boilers

Eric Jin, Tony Habib, Simon Youssef, Steve Osborne, and Honghi Tran

The effective shattering of molten smelt is highly desired in recovery boilers systems. Ideally, shatter jet nozzle designs should: i) generate high shattering energy; ii) create a wide coverage; and iii) minimize steam consumption.

This study proposes a novel converging-diverging multi-jet nozzle design to achieve these goals. A laboratory setup was established, and the nozzle performance was evaluated by generating jet pressure

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PAPERMAKING

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José L. Rodríguez-Alvarez, Rogelio Lopez-Herrera, Iván E. Villalon-Turrubiates, Gerardo Grijalva-Avila, and Jorge L. García Alcaraz

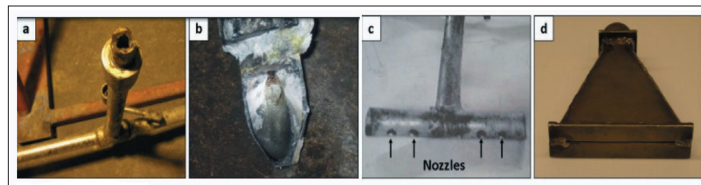
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BLEACHING

Extension of a steady-state chlorine dioxide brightening model for Z-ECF bleaching of softwood kraft pulps

Brian N. Brogdon and Lucian A. Lucia

profiles from the measurement of a pitot tube array. The results show that the shatter jet strength is greater with a large throat diameter, high inlet pressure, and a short distance between the nozzle exit and impingement position. Increasing the number of orifices generates a wider jet coverage, and the distance between the orifices should be limited to avoid the formation of a low-pressure region between the orifices. The study also demonstrates that an optimized



While there is no consensus on which type is best, mills use various nozzle types, including: (a) full cone, (b) flat with a guard, (c) multi-hole, and (d) slit.

converging-diverging multi-jet nozzle significantly outperformed a conventional shatter jet nozzle by achieving higher energy and wider coverage while consuming less steam.

This study showed the development of a shatter jet nozzle design that achieves better performance than traditional jets achieve. Readers can refer to this paper to understand the development process and theories behind the design. The data also allows future work to be conducted to further optimize the product.

RECOVERY CYCLE

Boiler retrofit improves efficiency and increases biomass firing rates

Samit J. Pethe, Paul W. Cloninger, Ryan R. Shortreed, and Ken M. Hardison

Domtar's Plymouth, NC, fluff pulp mill operates two biomass/hog fuel fired boilers (HFBs). For energy consolidation and reliability improvement, Domtar wanted to decommission the No. 1 HFB and refurbish/retrofit the No. 2 HFB.

The No. 2 HFB was designed to burn pulverized coal and/or biomass on a traveling grate. Steaming capacity was 500,000 lb/h from coal and 400,000 lb/h from biomass. However, it had never sustained this design biomass steaming rate. As the sole power boiler, the No. 2 HFB needed to sustain 400,000 lb/h of biomass steam during peak loads.



New dry electrostatic precipitator.

Researchers performed an extensive evaluation involving field testing, analysis, and computational fluid dynamics (CFD) modeling. The identified bottlenecks and deficiencies included: an inadequate combustion system; insufficient heat capture; excessive combustion air temperature; inadequate sweetwater condenser (SWC) capacity; and limited induced draft fan capacity.

Various upgrades were engineered and implemented to address the deficiencies, including: modern pneumatic fuel distributors; a modern sidewall, interlaced overfire air (OFA) system; a new, larger economizer; modified feedwater piping to increase SWC capacity; replacement of the scrubber with a dry electrostatic precipitator; and upgraded boiler controls.

With deployment of these upgrades, the No. 2 HFB achieved the targeted biomass steaming rate of 400,000 lb/h, along with lowered stack gas and combustion air temperatures. All mandated emissions limit tests at 500,000 lb/h of steam with 400,000 lb/h of biomass steam were passed, and Domtar reports a 10 percent reduction in fuel firing rates, representing significant fuel savings. In addition, the mill was able to decommission the No. 1 HFB, substantially lowering operating and maintenance costs. **36**

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