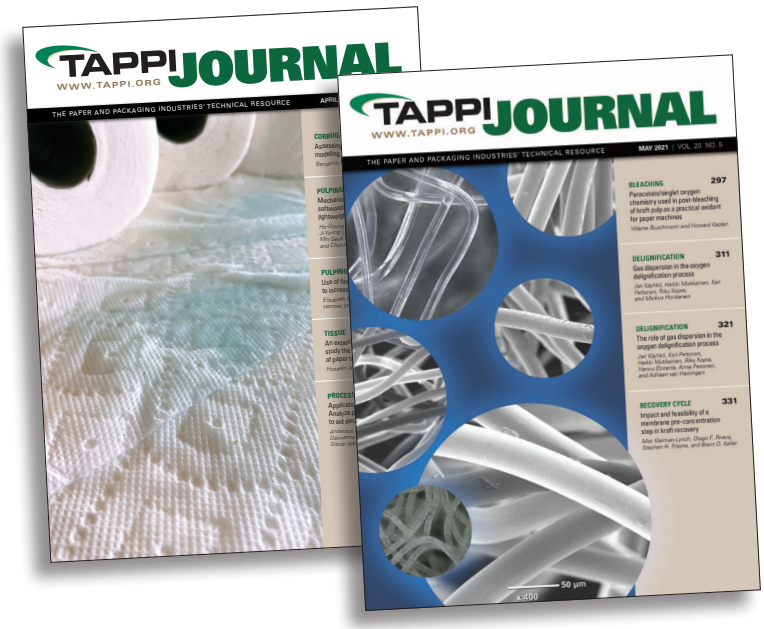


The papers summarized here are from *TAPPI Journal*'s April 2021 issue and May 2021 special issue featuring content from the 2020 PEERS Conference. *TAPPI Journal* is an online publication of relevant and timely peer-reviewed research delivered via email and free to all TAPPI members. To receive *TAPPI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

APRIL

CORRUGATED PACKAGING

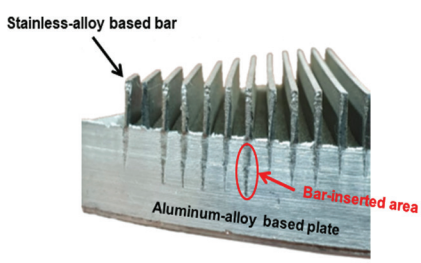
Assessing variation in package modeling
Benjamin Frank and Kyle Kruger

Predictions from empirical models are affected by variability in the input parameters for the data set used to build the models. For corrugated boxes, the difference between actual and modeled compression strength creates a real cost associated with box production, often resulting in boxes that may need to be over-designed to compensate for a lack of model precision. No work to date has attempted to assess the limitation in these compression estimates due to input parameter testing variability.

In this paper we approach that problem, initially for the McKee equation and then conceptually for other box models. For our industry to do a better job at meeting the needs of our corrugated packaging customers, we need to reduce the variation in the tests we all rely on, particularly for evaluating material strength (edge crush test [ECT]) and package compression performance (box compression test [BCT]).

Though there are many models for estimating box compression strength, few include an assessment of the limitations on modeling accuracy based on variations in measured inputs. This paper provides an assessment of estimation accuracy, as well as what must be done from a testing perspective to reduce the inherent uncertainty in model output arising from testing variation.

PULPING



Lateral view of a new refiner plate segment.

Mechanical modification of softwood pulp fibers using a novel lightweight vertical bar plate
Ho-Gyung Gu, Byung-Gul Min, Ji-Young Lee, See-Han Park, Min-Seok Lee, Chang-Young Lee, and Chul-Hwan Kim

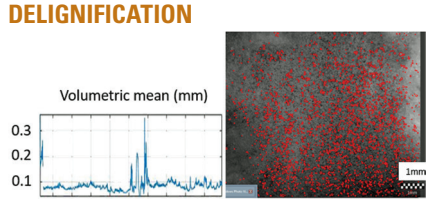
Refiner plates made using sand casting have a draft angle, which results in a trapezoidal bar shape. These trapezoidal bar plates have a limited throughput compared to the vertical bar plates, and eventually the edges of the bars become dull, resulting in longer time to reach the target freeness and shorter service life.

The new lightweight refiner plate with a bar insertion method into a plate base was developed by selecting an aluminum-based alloy as the plate base material and a stainless-steel alloy with high wear resistance as the bar material. The lightweight plate with sharp bar edges was very effective in reducing refining energy by reaching the target freeness faster than the sand-cast bar plate. Finally, the lightweight sharp bar plate, which weighed only about half the weight of the cast bar plate, was expected to significantly contribute to easy replacement, improved paper quality, and larger throughput without excessive loss of fiber length.

By combining aluminum alloy and stainless-steel alloy, a lightweight vertical bar plate suitable for softwood pulp was introduced. The lightweight vertical bar plate has a sharper bar edge, unlike the general cast plate, and it allows a large amount of material to pass, which is much more advantageous in terms of energy savings and production. In particular, even if the bar surface wears out during the continuous refining process, the sharpness of the bar edge is maintained and the life of the plate can be extended.

MAY

DELIGNIFICATION



Average volumetric bubble size measured in the softwood line after the second stage oxygen mixer over a period of one month (left); example of the imaged bubble sizes highlighted in red (right).

The role of gas dispersion in the oxygen delignification process
Jari Käyhkö, Kari Peltonen, Heikki Mutikainen, Riku Kopra, Hannu Eloranta, Anna Pesonen, and Adriaan Van Heiningen

Oxygen delignification is an essential part of the pulp production process. Delignification occurs with the aid of alkali and dissolved oxygen. Dissolved oxygen is obtained by dispersing oxygen gas into the pulp suspension by using efficient mixers. Little is known about the state of oxygen gas dispersion and its effect on oxygen delignification kinetics and efficiency.

This research presents results for the effect of gas bubble size on the performance of oxygen delignification. The results are mainly based on detailed studies made in a Finnish hardwood

mill where the oxygen bubble size distribution could be altered at the feed of the reactor. An essential aspect of these studies was use of a new continuous inline gas bubble size measurement system to simultaneously determine the bubble size distribution at the feed and top of the reactor. Researchers could also obtain information about oxygen consumption in the reactor through the bubble size measurements. Accordingly, these studies quantify the effect of oxygen bubble size on the kappa reduction of the pulp. The authors also studied the effect of different chemical factors on the oxygen bubble size.

Finally, we present the relationship between the gas bubble size and the liquid phase oxygen mass transfer coefficient (*kLa*). This connects the bubble size to the kappa reduction rate. Based on the presented modeling approach and the evaluation of practical factors that are not taken into account in the modeling, we concluded that the volumetric average oxygen bubble size should preferably be smaller than 0.2 mm in practice.

The information obtained with the new gas bubble size measurement system and the presented modeling approach give a very new basis for understanding, monitoring, adjusting, and designing oxygen delignification processes.

OTHER RESEARCH APPEARING IN *TAPPI JOURNAL*'S APRIL 2021 ISSUE:

PROCESS CONTROL

Application of fuzzy TOPSIS in the Analyze phase of the DMAIC cycle to aid decision-making

Anderson Idacir Dos Santos, Dalmarino Setti, and Gilson Adamczuk Oliveira

PULPING

Use of fines-enriched chemical pulp to increase CTMP strength

Elisabeth Björk, Mikael Bouveng, Hannes Vomhoff, and Per Engstrand

OTHER RESEARCH APPEARING IN *TAPPI JOURNAL*'S MAY 2021 ISSUE:

RECOVERY CYCLE

Impact and feasibility of a membrane pre-concentration step in kraft recovery

Max Kleiman-Lynch, Diego F. Rivera, Stephen H. Frayne, and Brent D. Keller

DELIGNIFICATION

Gas dispersion in the oxygen delignification process

Jari Käyhkö, Heikki Mutikainen, Kari Peltonen, Riku Kopra, and Markus Honkanen

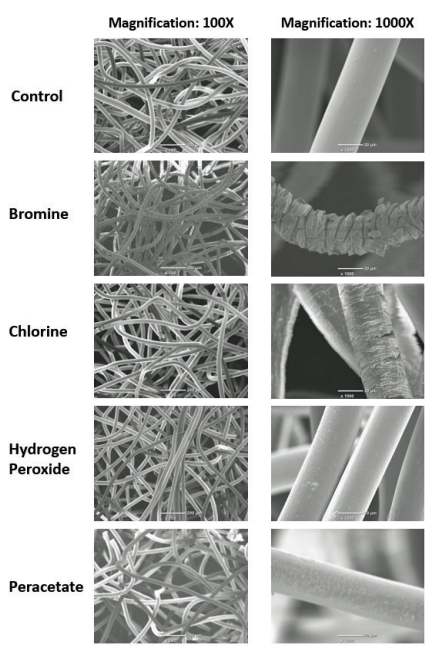
BLEACHING

Peracetate/singlet oxygen chemistry used in post-bleaching of kraft pulp as a practical oxidant for paper machines

Wayne Buschmann and Howard Kaplan

The use of a novel sodium peracetate/singlet oxygen chemistry for brightening bleached kraft pulp shows exciting potential for technical performance, supply logistics, safety, and cost reduction. Potential chemical carryover to the paper machine raises questions about whether peracetate will impact paper machine performance, such as metal corrosion, useful press felt life, and interference with existing biocide programs or paper machine chemistry.

Mills can use sodium peracetate/singlet oxygen chemistry in high-density storage chests for brightening/whitening and to increase color stability. Any oxidant used directly before the paper machine has potential to impact paper machine operations. Traditional oxidants used in bleaching, such as chlorine dioxide and hydrogen peroxide, are known to cause corrosion on machinery metals and press felts. Hydrogen peroxide residuals can interfere with common biocide programs. Traditional oxidants used in biocide treatments themselves



Scanning electron microscope (SEM) comparison of chemical degradation at 100X and 1000x magnifications for high charge treated samples.

significantly degrade press felt life when the rule-of-thumb concentration thresholds are exceeded. This research evaluates sodium peracetate for its impact on nylon press felt fiber degradation, metal corrosion, and interference with typical biocide programs.

Laboratory results indicate that sodium peracetate/singlet oxygen chemistry is less corrosive than chlorine, bromine, and hydrogen peroxide on press felt nylon fiber and can therefore be used at higher levels than those chemistries to increase brightness without increasing negative downstream impact. Sodium peracetate can also be used with current biocide programs without negative impacts such as consumptive degradation. Higher residuals of peracetate going to the paper machine may be useful as a biocide itself and can complement existing programs, allowing those programs to stay within their safe operating levels and thereby extend press felt useful life.

This research introduces readers to sodium peracetate/singlet oxygen chemistry, which is a novel, sustainable, oxidant that is new to the pulp and paper industry and can substitute, or complement, oxidants already in mills. The article covers sodium peracetate use in the pulp mill for brightening pulp and follows through to examine implications of potential oxidant carryover on the paper machine.