The papers summarized here are from *TAPPI Journal*'s October and November 2021 issues. *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.

OCTOBER

TECHNICAL BRIEF: RECOVERY CYCLE

Corrosion damage and in-service inspection of retractable sootblower lances in recovery boilers

Flávio A. Paoliello

Lance support rollers should freely turn to avoid external mechanical damage.

Several reports of accidents involving serious mechanical failures of sootblower lances in chemical recovery boilers are known in the pulp and paper industry. These accidents mainly consisted of detachment and ejection of the lance tip, or even of the entire lance, to the inside of the furnace, toward the opposite wall. At least one of these cases resulted in a smelt-water explosion in the boiler.

In other events, appreciable damage or near-miss conditions have already been experienced. The risk of catastrophic consequences of the eventual detachment of the lance tip or the complete lance of a recovery boiler sootblower has caught the attention of manufacturers, who have adjusted their quality procedures, but this risk also needs to be carefully considered by the technical staff at pulp mills and in industry committees.

This study briefly describes the failure mechanisms that prevailed in past accidents, while recommending inspection and quality control policies to be applied in order to prevent further occurrences of these dangerous and costly component failures. This technical brief raises awareness for an insidious type of component failure and for the consequent threats to recovery boiler safety. Readers may also benefit from understanding the damage mechanisms behind internal corrosion of sootblowers. Recommended inspection and quality control practices and methods complete this brief's preventive scope, helping mills to enhance safety of their recovery boilers.

RECYCLING

Application of spruce wood flour as a cellulosic-based wood additive for recycled paper applications—A pilot paper machine study

Klaus Dölle and Sandro Zier

This study gives a first insight into the use of wood flour as a plant-based and cellulosic-based alternative additive for newsprint and paperboard production using 100 percent recycled fibers as a raw material. The study compares four varieties of a spruce wood flour product serving as cellulosic-based additives at addition rates of 2, 4, and 6 percent during operation of a 12-in. laboratory pilot paper machine. Researchers then analyzed strength properties of the produced newsprint and linerboard products.

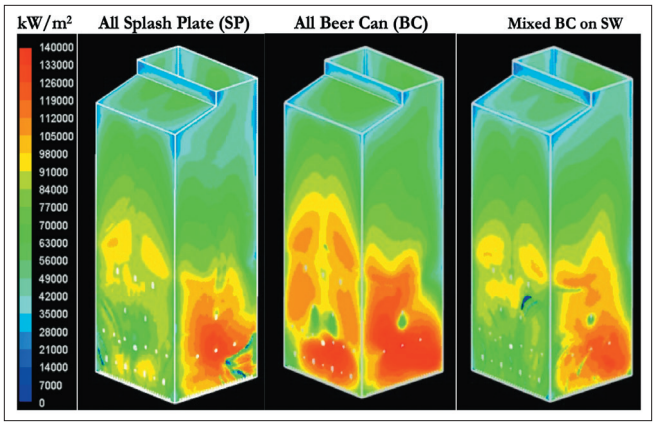
Results suggested that spruce wood flour as a cellulosic-based additive represents a promising approach for improving physical properties of paper and linerboard products made from 100 percent recycled fiber content. This study shows that wood flour pretreated with a plant-based polysaccharide and untreated spruce wood flour product with a particle size range of 20-40 µm and 40-70 µm can increase the bulk and tensile properties of newsprint and linerboard applications.

RECOVERY CYCLE

Kraft recovery boiler operation with splash plate and/or beer can nozzles—a case study

Viswamoorthy Raju, Markus Engblom, Eetu Rantala, Sonja Enestam, and Jarmo Mansikkasalo

In this work, researchers study a boiler experiencing upper furnace plugging and availability issues. To improve the situation and increase boiler availability, the liquor spray system was tuned/modified by



The cases using only splash plate and mixed nozzle types showed lower and more uniform heat flux than beer can type only.

testing different combinations of splash plate and beer can nozzles. The tested cases included: 1) all splash plate nozzles (original operation), 2) all beer can nozzles, and 3) splash plate nozzles on front and back wall and beer cans nozzles on side walls. The researchers found that operating according to Case 3 resulted in improved overall boiler operation as compared to the original condition of using splash plates only.

Additionally, the researchers carried out computational fluid dynamics (CFD) modeling of the three liquor spray cases. Model predictions show details of furnace combustion characteristics such as temperature, turbulence, gas flow pattern, carryover, and char bed behavior. Simulation using only the beer can nozzles resulted in a clear reduction of carryover. At the same time, the predicted lower furnace temperatures close to the char bed were in some locations very low, indicating unstable bed burning.

Compared to the first two cases, the model predictions using a mixed setup of splash plate and beer can nozzles showed lower carryover, but without the excessive lowering of gas temperatures close to the char bed.

This study demonstrates that CFD modeling can be used for better understanding of boiler process and furnace behavior with different liquor spray scenarios before actual modifications. Also, the most suitable liquor spray scenario can be identified with CFD modeling in terms of number/type/location of splash plate nozzles and beer can nozzles.

NOVEMBER

PAPERMAKING

Determining operating variables that impact internal fiber bonding using Wedge statistical analysis methods

Sergio Giuste, Joel Panek, Babak Mirzaei, and Peter W. Hart

In this study, Wedge statistical analysis tools were used to collect, collate, clean up, plot, and analyze several years of operational data from a commercial paper machine. Researchers chose the z-direction tensile (ZDT) and Scott bond tests as representative of fiber bond strength.

OTHER RESEARCH IN *TJ*'S OCTOBER 2021 ISSUE:

EMISSIONS

Control of malodorous gases emission from wet-end white water with hydrogen peroxide

Huang Shan-Cong, Liu Chang, Dai Lei, Dou Sheng, Ding Ming-Qi, and Xia Xin-Xing

OTHER RESEARCH IN *TJ*'S NOVEMBER 2021 ISSUE:

PAPERMAKING

Temperature profile measurement applications of moving webs and roll structures with intelligent roll embedded sensor technology

Tatu Pitkänen

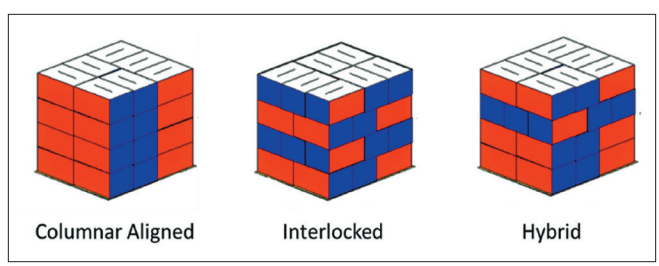
After analyzing thousands of operational parameters, they found that the ones with the most significant impact upon ZDT involved starch application method, starch penetration, and the amount of starch applied. Scott bond was found to be significantly impacted by formation and refining. Final calendering of the paper web has also shown an impact on internal fiber bonding.

Readers may use this study to understand paper machine variables affecting internal bond of paper fibers, as well as to troubleshoot internal bond issues in paperboard operations.

CORRUGATED PACKAGING

Influence of pallet pattern on top-to-bottom compression performance of unitized loads

Kyle Dunno, Changfeng Ge, Glenn Rogers, and Steve Johnson



Pallet patterns used in the experiment.

Environmental scaling factors estimate a corrugated container's ability to withstand various conditions it will encounter during the storage and distribution process. In this project, researchers examined the compressive resistance of unitized loads using differing pallet stacking patterns.

To simulate real-world failure scenarios in laboratory tests, the researchers used two different nominal board grades of single-wall C-flute regular slotted containers loaded with a plywood panel and

bagged salt to direct the failure location to the bottom of the stack. The results showed that the columnar aligned pattern provided the greatest compressive resistance and the interlocked stacking arrangement yielded the lowest of the patterns evaluated. Based on the study results, the researchers calculated box compression retention multipliers for each pattern and compared them to scaling factors published by the Fibre Box Association.

This work highlights how the pallet pattern used for stacking corrugated containers affects the overall compression strength of the unit load. This paper provides environmental scaling factors based on different pallet patterns used for unitizing loads.

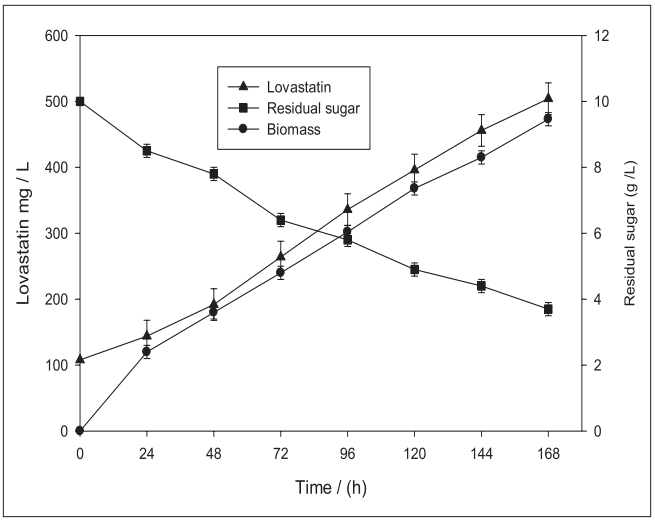
BIOPRODUCTS

Evaluation of rice straw for purification of lovastatin

Wen-Ta Su and Chin-Chuan Yi

Cholesterol synthesis in the human body can be catalyzed by the coenzyme HMG-CoA reductase, and lovastatin, a key enzyme inhibitor, can reduce hypercholesterolemia. Lovastatin can be obtained as a secondary metabolite of *Aspergillus terreus* ATCC 20542.

In this study, rice straw of lignocellulose was used in aeration and agitation bath fermentation in a 1-L flask, and a maximal crude extraction rate of 473 mg/L lovastatin was obtained. The crude extract was treated with silica gel (230—400 mesh) column chromatography. Ethyl acetate/ethanol (95 percent) was used as the mobile phase, and isolation was performed through elution with various ethyl acetate/ethanol ratios. The highest production rate of 153 mg/L was achieved with ethyl acetate/ethanol in a ratio of 8:2. The lovastatin gained from the crude extract was added to 12 fractions treated with 0.001 N alkali, and acetone was then added. After 24 h of recrystallization at 4°C, the extract underwent high-performance liquid chromatography. The purity had increased from 25 to 84.6 percent, and the recovery rate was 65.2 percent.



Time courses of mycelial growth and the production of lovastatin in 1 percent acid-treated rice straw culture.

This study devised a process for producing lovastatin in its pure form from a culture of *Aspergillus terreus* ATCC 20542, and a new extraction procedure was designed for the isolation of lovastatin.