

## CONTENTS

### The Special Issue of the 65<sup>th</sup>—2022 JAPAN TAPPI Annual Meeting at Makuhari Messe, Chiba

6 Keynote Speech

The 65<sup>th</sup>—2022 JAPAN TAPPI Annual Meeting  
A New Leap in the Pulp and Paper Industry  
—Challenge to Promote Innovation and Accelerate Transformation—  
……Kazumori Fukushima

10 General Review of the 65<sup>th</sup>—2022 JAPAN TAPPI Annual Meeting at Makuhari Messe, Chiba……Planning Subcommittee, JAPAN TAPPI

20 Lecture by Winner of 50<sup>th</sup> SASAKI Prize

26 Lecture by Winner of 2021 JAPAN TAPPI Prize

#### Technical Report

32 ANDRITZ FibreSolve FSV (U) Pulper for Hard-to-pulping paper  
……Yosuke Takeshita

36 The Detrashing Technology by IntensaMaXX<sup>TM</sup>……Satoshi Orido

41 Development of Online Pulp Color Dirt Observation Equipment  
……Michihiro Fujiyama

47 Introduction of a Conveyor Bearing Temperature Monitoring System using an Optical Fiber Temperature Sensor……Nobuyuki Hiroyoshi

51 Next Generation Preventive Maintenance by The Remote Condition Monitoring  
……Kenichi Ishihara, Tomonori Miyako and Ulrich Gensicke

#### Topics & Information

59 Corporate Profile & Product Information (49)  
SGS Japan Inc.

03 Committee report

63 Coffee break

64 Papyrus

67 Industry News (Domestic and International)

72 List of Patents issued and Laid-open Publication

80 Price list of Domestic Logs and Wood Chips by District

81 Other Monthly Statistics

83 News from the Association

### **The detrashing technology by IntensaMaXX™**

Satoshi Orido  
Voith IHI Paper Technology Co., Ltd.

For the detrashing system of pulping stage, more effective machine is required because the contaminants ratio of raw material is getting increase recently. The IntensaMaXX™ is the detrashing machine which fulfills the requirement for better detrashing operation. The rotor and screen plate are located at the top of the tank, and this layout prevents wearing and jamming by heavy contaminants. The rotor axis is located as eccentric against the center axis of the vat. This layout prevents strong centrifugal flow and also growth of long contaminants. The piping layout is also considered for the better reject removal. At the actual operation, IntensaMaXX™ is saving much power consumption and the cost of wearing parts as well. At the same time, the machine can be operated without any trouble for long time.

### **ANDRITZ FibreSolve FSV(U)pulper for hard-to-pulping paper**

Yosuke Takeshita  
Andritz K.K. Capital Systems Sales Group

Water-proofing paper is a very effective countermeasure to reduce the amount of plastic products. However, it is necessary to convert essentially from water-soluble paper to water-resistant paper, which requires the application of water-resistant chemicals in the paper-making processes. The treatment of waste papers in the paper machine contributes significantly to the productivity of the paper machine, and it is necessary to treat this hard-to-pulping waste papers as quickly as possible. This paper describes a case in which the treatment of wastepaper in the process was accelerated by using our FibreSolve FSV (U) C-type pulper.

### **Development of online pulp color dirt observation equipment**

Michihiro Fujiyama  
Control System Division Nippon Paper Unitec Co., Ltd.

The method of measuring dirt in pulp is performed which are visually confirmed and measured by humans. However, with this method, there is a large time lag when managing dirt on a production line and continuous measurement is difficult. Therefore, OMRON has started manufacturing system that can monitor dirt in pulp in real time. After that, OMRON discontinued the product, and we developed the system as a successor to the product, released the product as a monochrome version of the online dirt meter.

On the other hand, the ratio of DIP used has increased due to the increasing recycling momentum and environmental measures, the operation department needs to manage color dirt that are difficult to detect with monochrome versions such as UV ink and color impurities. Therefore, we worked on colorization of the online dirt meter in collaboration with Nippon Paper Industries Iwanuma Mill, and started developing system that "visualizes" color dirt in pulp in real time. This paper introduces the development of product and functions of this system.

## **Introduction of a Conveyor Bearing Temperature Monitoring System using an Optical Fiber Temperature Sensor**

Nobuyuki Hiroyoshi  
Yonago Mill, Oji Paper Co., Ltd.

In August 2013, the Oji Group experienced a chip conveyor fire at one of its mills. To prevent the reoccurrence of similar problems, the Oji Group decided to install fiber-optic temperature monitoring equipment at selected chip conveyors that would affect mill-wide operations if they were to stop. Between 2019 and 2020, the Yonago Mill has equipped five conveyors that match the condition with the system and devised the method of laying fiber-optic cables, which has prevented conveyor fires. This report illustrates an installation of an optical fiber temperature monitoring system on the Line 1 tube conveyor at the Yonago Mill.

## **Next Generation Preventive Maintenance by The Remote Condition Monitoring**

Kenichi Ishihara  
Valmet K.K. Automation Systems Business Line

Tomonori Miyako  
Neles Japan Co., Ltd.(Part of Valmet) FCBL Business

Ulrich Gensicke  
Development Valmet Flow Control OY FCBL VC&A

In the pulp and paper industry, decentralized digitization and control using DCS has been widely spread and has been operated in a mixed form with manual control by operators. In recent years, with the decline in the workforce and the difficulty of passing on technology, optimized control, in which several control processes are automatically controlled on top of decentralized control by DCS, has also begun to be introduced. In order to promote this digitalization and eventually expand it to DX, the important thing is to collect as much data as possible at the end of the process (number of sensing) and to manage the operation without stopping the collection. This paper describes the next generation of preventive maintenance services provided by the Valmet Performance Center, one of the functions of the Valmet Industrial Internet, and the Asset Performance Manager, which is linked to the Valmet Performance Center, as well as the Flow C

## CONTENTS

### CNF and Household Paper

- 1 Properties and Application Development of Phosphorylated Cellulose Nanofibers  
.....Keiko Okuda
- 6 Paper with Antiviral Performance  
—An Application of CNF Technology—.....Takehiro Yoshimatsu
- 11 Efforts of the Installation CNF for Racing Car.....Taisaku Nagano
- 15 Microporous Membrane with Cellulose Nano-fibers for Li-ion Battery  
.....Yohta Mori
- 21 Development and Application of Weather Resistant Wood-paint using Cellulose Nanofibers.....Hironari Ohki and Tomoko Shimokawa
- 25 CNF Dispersion Evaluation by Particle Size Distribution Measurement Using High Resolution Disc Centrifugal Sedimentation Method.....Kazumi Tanikawa
- 28 OnGuard VBX Advance Vibration Monitoring for Improved Yankee Coating Performance.....Nick Ince, Timothy Patterson, Brendan Cysewski and Yuto Shirahata
- 35 Latest Paper Machine Clothing Development for Tissue and Toilet Papers  
.....Ulf Bengs, Clemens Stortelder, Tim Simpkin and Koji Kawashima
- 41 Felt Designs for a Wide Range of Products, from Toilet to Over 40 g Towels  
.....Shingo Ohashi
- 45 A New Approach for Stable Operation of Yankee Coating on Tissue Machines  
—Solutions with Chemical and Digital Tools—.....Gary Furman and Tomonori Tani
- 51 Application of Fiber Recovery Basket with Screen for Tissue Line  
.....Toshio Dousaka
- 55 The Latest Technology of Double-Drum Winder and KAWANOE Pilot Converting Line.....Shinichiro Kaji

### Introduction of Research Laboratories(149)

- 60 Forestry and Forest Products Research Institute, Center for Advanced Materials

### Research Report

- 64 Preparation and Functionalization of Cellulose Nanofibers/Polymer Composite Particles Using Various Kinds of Core Polymers.....Yumi Hayashi, Yasushi Yabuhara, Yumi Oota, Makoto Kume, Mie Shimizu and Shuji Fujisawa

### Pulp and Paper Mills in Japan(101)

- 83 Tonegawa Division Paper Mill, Rengo Co., Ltd.

- 03 Committee report
- 62 Essay on Intellectual Property
- 63 Coffee break

- 87 Industry News (Domestic and International)
- 91 List of Patents issued and Laid-open Publication
- 99 Price list of Domestic Logs and Wood Chips by District
- 100 Other Monthly Statistics
- 102 News from the Association

## **Properties and Application Development of Phosphorylated Cellulose Nanofibers**

Keiko Okuda

Innovation Promotion Division, Oji Holdings Corporation

Recently, woody biomass is expected to be used in multiple ways as a carbon-neutral and renewable resource. Among them, cellulose nanofibers (CNFs) are attracting attention as a new nanomaterial derived from cellulose, one of the major components of trees. We have established a unique CNFs production method by introducing phosphate groups to the hydroxyl groups of some of the cellulose molecules in wood pulp and mechanically processing the resulting phosphorylated pulp. The obtained phosphorylated CNFs were completely nanosized (about 3 nm in width) with high yield, and its aqueous dispersion was highly transparent, highly viscous, and stable at pH 3-11. Analysis of the surface chemical structure revealed the presence of cross-linked phosphate group as well as monophosphate group, which are selectively introduced only at the C2 and C6 positions of the hydroxyl group of the cellulose molecule. The aqueous dispersion of phosphorylated CNFs can be dehydrated and dried to form transparent CNFs sheet with densely intertwined CNFs. This sheet has high transparency, strength, and thermal dimensional stability, and at the same time, it has paper-like flexibility. In order to promote the practical use of this technology, we are currently operating a demonstration plant for the production of phosphorylated CNFs aqueous dispersion and phosphorylated CNFs sheet. As the first stage of practical application, the aqueous dispersion of phosphorylated CNFs is used as a thickening agent for cosmetics and a leading agent for concrete pumping, and the sheet is used as a material for table tennis rackets. We will continue to take advantage of the features of phosphorylated CNFs to develop further applications.

## **Paper with antiviral performance -An application of CNF technology -**

Takehiro Yoshimatsu

Nippon paper Industries Co., LTD

A continuous decrease in the demand for printing paper is inevitable due to the trend of electrification. On the other hand, a constant increase in the need for different types of paper, such as wrapping paper and transport materials, is expected because switching from plastic to paper is a trend. Paper is a sustainable natural resource made from wood that can fix CO<sub>2</sub>. Therefore, we believe that developing paper-based materials with various functions will significantly contribute to the world from the perspective of SDGs and GHG reduction.

The philosophy of the Nippon Paper Group is "Contributing to better living and cultural progress everywhere it does business." The slogan is "Constantly creating new value and contributing to better living and cultural progress, as a comprehensive biomass company shaping the future with trees." Under this philosophy and slogan, we have combined paper manufacturing technologies, our primary business, and "cellulose nanofiber," the ultimate ultra-fine material manufactured from wood. This approach led to the development of antiviral paper, one of the most required properties worldwide. This paper material exhibits high antiviral properties against influenza virus, feline calicivirus, as well as new coronavirus. It also shows antibacterial and deodorant effects. In November 2021, we obtained the industry's first SIAA certification of antiviral-processed products in the category of "paper, copper and other inorganic materials, by embedding." It has now begun to be adopted for items, such as business cards and envelopes, requiring familiar infection prevention because unspecified people may touch it. It would be great if we could prevent contact infections in people's lives and contribute to safety.

## **Efforts of the installation CNF for racing car**

Taisaku Nagano,  
Cellulose Nanofiber Project, Daio Paper Corporation

Since 2018, we have provided CNF materials to SAMURAI SPEED, which participates in US races, and have evaluated them by mounting them on electric vehicles. We have expanded the mounting locations every year and promoting the mounting of new products. In 2022, CNF composite resin for door mirrors, CNF molded plate for body, CNF products have contributed to weight reduction by mounting a continuous molded plate. In addition, even when driving in a harsh environment, it was possible to drive without any problem in terms of durability, similar to a normal vehicle. The CNF molded plate used in the body of a race vehicle is a material made by compounding CNF and pulp fiber into a sheet, and has mechanical properties far superior to those of general plastic materials. Moreover, since it is composed only of CNF and pulp, it is an environmentally friendly material. The CNF composite resin used in the door mirror, ELLEX-R55, is a CNF composite resin having a cellulose concentration of 55%. Since the resin reinforcing effect can be obtained by compounding cellulose as a resin filler, a plastic reducing effect can be expected. Utilizing the characteristics of CNF such as plant origin, high strength, high elastic modulus, and recyclability, we will contribute to CO<sub>2</sub> reduction by reducing plastics and weight of vehicles, and we will expand the CNF business in the medium-term business plan after 2024.

## **Microporous membrane with cellulose nano-fibers for Li-ion battery**

Yohta Mori  
FIBLIC Business DIV, Tokushu Tokai Paper Co., Ltd.

It is widely said that the non-woven fabric has a large pore diameter and hard to be applied as a separator for lithium ion batteries. In this study, we actually made some battery cells using non-woven fabric and conducted a confirmation test on the occurrence of defects. A hand-made PET non-woven fabric and a cellulose non-woven fabric were used for the test as a Lithium ion battery separator. A commercially available polyolefin microporous membrane and a developed microporous membrane with cellulose nanofiber (FIBLIC) were evaluated for comparison. As a result, in the PET non-woven fabric, a decrease in discharge / charge efficiency, which is guessed to be poor electrical insulation property, was observed in the initial aging process. No problem occurred in the aging process for the cellulose non-woven fabric, but in the 0 °C float test (Charging on Constant Voltage at 4.2V), voltage fluctuations that seemed to be a slight short circuit due to dendrite formation were observed. The developed microporous membrane with cellulose nanofiber did not show any problems as in the polyolefin microporous membrane.

## **Development and Application of Weather Resistant Wood-paint using Cellulose Nanofibers**

Hironari Ohki  
Technical Group, GEN GEN Corporation  
Tomoko Shimokawa  
Department of Forest Resource Chemistry, Forestry and Forest Products Research Institute

Development of the wood paint superior in weatherability was achieved using unmodified cellulose nanofiber (CNF) made from domestic cedar chips. We used soda-anthraquinone cooking to prepare the pulp, and enzymatic pretreatment was performed prior to mechanical treatment for nanosizing process. The CNF water suspension prepared by the integrated process showed high dispersibility and was suitable for water-based paints compared to other CNFs. The accelerated weathering test with the coated wood panel using the CNF-blended water-based paint revealed that the degree of discoloration was suppressed to less than 1/2 than in the case without CNF.

## **CNF dispersion evaluation by particle size distribution measurement using high resolution disc centrifugal sedimentation method**

Kazumi Tanikawa  
Sanyo Trading Co., Ltd

It is important to evaluate dispersibility since CNF are generally miniaturized by mechanical treatment under wet conditions. The particle size distribution evaluation is one of them, and it is important for controlling the physical properties of CNF and making effective use of it.

There are various principles and method for particle size distribution measurement, and each of them has a particle size range, a particle concentration and a dispersion medium, which they are good at. It is necessary to use it properly according to the sample to be measured and the purpose. CNF often has various particles size at the same time in the defibration process. Therefore in order to measure CNF with different particle size at the same time, it is necessary to select a particle size measurement method with high resolution. The centrifugal sedimentation method particle size distribution measurement method is attracting attention as a method for directly observing particles without using a fitting algorithm.

We prepared a sample that was mechanically processed in six steps from 1 to 30 times, and confirmed the difference in distribution using a disc centrifugal type particle size distribution analyzer. It was confirmed that the CNF was defibrated and the median diameter became smaller as the number of treatments increased. It can be expected to be used for physical property control and effective utilization of CNF.

## **OnGuard VBX Advance Vibration Monitoring for Improved Yankee Coating Performance**

Solenis(shanghai)  
Nick Ince  
Solenis(USA)  
Timothy Patterson , Brendan Cysewski

To provide improved process awareness, an advanced vibration monitoring system that includes proprietary software and analytical techniques has been developed. The utilization of this new monitoring system will be reviewed highlighting its capability to optimize overall Yankee cylinder operation. A case study will demonstrate the value of this new monitoring system, a system that includes remote monitoring and control capabilities. Specifically, it will address the correlation of vibration characteristics with Yankee coating performance and crepe blade chatter.

## **Latest paper machine clothing development for Tissue and Toilet Papers**

Ulf Bengs  
Albany International, Forming Eurasia  
Clemens Stortelder and Tim Simpkin  
Albany International, MC Eurasia

Tissue paper manufacturing cost and paper quality are main “key drivers” for the papermakers. With this reality it is imperative that suppliers of paper machine clothing must provide innovative solutions in order to reduce these paper manufacturing cost and attain high sheet quality.

Albany International has developed specific product solutions to high, medium, and low speed tissue machines and for different kind of forming and press technologies like Crescent former and a new machine concept NTT. This paper describes new technology of Paper Machine clothing of forming wire, press felt, and shoe press belt.

## **Felt Designs for a wide range of products, from toilet to over 40g towels**

Shingo Ohashi

ANDRITZ Fabrics and Rolls Limited\*<sup>2</sup>Sales and Marketing

In recent years, domestic paper manufacturers have continued to focus on the production of household paper. Among them, there has been a marked increase in the production of toilet paper and paper towels, i.e., medium- to high-basis-weight household paper products. New entrants into the household paper market are also continuing, and new types of paper machines are increasingly being installed in Japan. The domestic household paper market will continue to be a focus of attention in the future due to the aging of the population and the expected resurgence of inbound demand.

We have five large felt manufacturing bases around the world with global operations, and our Austrian mill, one of the largest in the world and established over 200 years ago, has the world's top share in the household paper market, especially in Europe.

The company is also aggressively expanding into the aforementioned medium- to high-basis-weight products and new machine-type fields.

In this issue, we will introduce the features of the felt design that has become the mainstream in this field.

## **A New Approach for Stable Operation of Yankee Coating on Tissue Machines -Solutions with Chemical and Digital Tools-**

Gary Furman

Sr. Corporate Scientist, Nalco Water, an Ecolab Company

Tomonori Tani

Katayama Nalco Inc.

Creping remains the most important unit operation in the tissue making process, particularly for conventional light dry crepe machines. As such, tissue makers should always be on the alert for new ways to improve this process. In this paper we introduce both a new creping adhesive and a new digital tool, vibration monitoring, to the Japan market as opportunities for process and product improvement.

The new Yankee coating adhesive is designed to provide a unique set of coating properties. The "TULIP<sup>TM</sup>" adhesive provides strong adhesion, soft film characteristics, good tolerance to moisture variation, excellent durability, and superior rewet qualities. These properties are demonstrated by lab studies and commercial case histories. The strong adhesion over a wide moisture range can be utilized to improve crepe structure (increased number of crepe structures per unit length) to positively influence softness or maintain softness at higher creping moisture levels for energy savings.

The new digital tool is called "Yankee Operations Intelligence" or YOI and helps tissue makers protect their Yankee dryers by alerting them to potentially damaging chatter events. Although asset protection is a focus for YOI, vibration monitoring also provides powerful insight to mechanical, operational, and chemical impacts to the health of the Yankee coating and creping process. Vibration monitoring can easily detect changes and provide guidance to operators to make adjustments if needed.



## **Application of Fiber Recovery Basket with screen for Tissue line**

Toshio Dousaka  
Voith IHI Paper Technology Co., Ltd.

The recent target of Stock Preparation System is to improve stock quality, to save energy and to save fiber loss. Also the importance of water saving is also getting higher as other target. This means that effluent treatment is also need to be improved to get better recycled water to reduce the usage of fresh water.

Typical effluent treatment has two steps as primary (with DAF: Dissolving Air Flotation) and secondary (with sedimentation). After water clarification, sludge comes out from the system. Sludge includes some short fibers which can be reused, and usually sludge is treated by landfilling finally. If short fibers are reused it would save the cost not only of fibers but also of landfill.

To recover the short fibers usually Disc Filter is applied, but a Disc Filter need big installation area and expensive cost of machine itself. Therefore it is not still applied for many customers yet, especially for the customers in small production.

To recover more short fibers at effluent treatment in relatively small flow ratio, smaller and easier machine is necessary. In this article, I introduce the latest fiber recovery technology with screen basket.

## **The latest technology of Double-Drum Winder and KAWANOE Pilot Converting Line.**

Shinichiro Kaji  
Design Dept, KAWANOE ZOKI CO.,LTD.

Kawanoe Zoki Co., Ltd. has been involved in paper manufacturing machinery for over 70 years since its founding in 1944 under the management philosophy of "Let's work together and prosper together" Paper manufacturing machines have five functions: paper making, paper winding, paper folding, paper slitting and cutting, and paper wrapping.

We design and manufacture all machines with 5 functions.

Among them, this time I would like to introduce high-speed and automation technology of the two-drum winder for tissue-paper, board and paper, non-woven.

## **Preparation and Functionalization of Cellulose Nanofibers/Polymer Composite Particles Using Various Kinds of Core Polymers.**

Yumi Hayashi, Yasushi Yabuhara, Yumi Oota, Makoto Kume, and Mie Shimizu  
Toppan Technical Research Institute, Toppan Inc.  
Shuji Fujisawa  
Graduate School of Agricultural and Life sciences, The University of Tokyo

In the present study, we investigated the development of dry powders comprising polymer particles covered with cellulose nanofibers (CNFs). CNFs with uniform widths can be prepared from wood cellulose by TEMPO (2,2,6,6-tetramethylpiperidine-1-oxyl)-mediated oxidation, which introduces carboxy groups onto the surface of the cellulose. Divinylbenzene (DVB) monomer droplets are stabilized by CNFs in an aqueous emulsion system, and it is possible to obtain poly-DVB (pDVB) microparticles that are densely covered with CNFs by polymerizing the DVB in such a system. Herein, we developed an approach to fabricating CNF-shelled composite microparticles with cores comprising various types of polymers, and investigated the properties of their carriers.

We found that it was easier to stabilize the monomer droplets in an emulsion if the CNFs were modified with quaternary ammonium (QA) cations. This strategy enabled us to produce CNF-shelled composite microparticles with various types of core polymers. Moreover, the mechanical properties of these composite particles were superior to those of polymer microparticles without a CNF shell.

The electronic interaction with the surface carboxy groups of the CNF shell endowed the composite particles with the pH-sensitive ability to adsorb/desorb various cationic molecules, such as antibacterial agents, metal ions, polymers, and fluorescent or redox dyes. Interestingly, when fluorescent dyes were adsorbed onto the composite particles, the emission wavelength was shorter than in the solid state, which suggests that interaction with the carboxy groups dissociated on the surfaces of the particles prevented the aggregation of the fluorescent dye.

The functionalized cellulose nanofibers/polymer composite particles produced by the process have desirable mechanical and carrier properties, and are therefore potentially very useful for industrial applications and in the security field.

## CONTENTS

### Process Control and Automation/IoT

- 2 General Review of 46<sup>th</sup> Pulp and Paper Process Control Symposium  
.....Process Control and Automation Committee, JAPAN TAPPI
- 7 Contribution to Carbon Neutrality through Optimization Technology 「Part II」  
—Challenges and Solutions in Utility Plant Operation Optimization—.....Soichi Iwamoto
- 15 TMEIC Product and Technology that Can Contribute to DX in the Paper Industry.....Yoshito Katsuki
- 24 Learning from Other Industries, Four Points for Success in Manufacturing DX from an Instrumentation Viewpoint.....Shougo Kataoka
- 27 Importance of Data Utilization and Environmental Measures at Manufacturing Shop Floor.....Tatsuya Terasawa
- 33 Visualize and Reduce Fiber Losses by OnView.MassBalance.....Kanato Mizukoshi
- 37 Steps into the Future as Seen in Global Digitalized Plants.....Taku Shigihara
- 43 Toward Data-driven Factory Automation as seen from Recovery Line Optimization.....Hisanori Bando
- 49 Effect of Introducing the Boiler Combustion Control Optimization System  
.....Kai Matsubara

### Topics & Information

- 56 Comprehensive Solutions for Utilizing Recycled Paper by KURITA  
.....Satoshi Wada
- 61 Proposal to Control Color Quality and to Reduce the Loss in the Production Line by High Precision Color Sensor.....Hiroyuki Fukuhara
- 65 DX Initiatives for In-house Power Generation Facilities.....Nobutaka Maki

### Research Report

- 69 Pulping of Mitsumata by using Twin Screw Extruder  
.....Naoichi Muto, Takashi Okuda and Takuma Teraoka

03 Committee report

86 Papyrus

91 Industry News (Domestic and International)

95 List of Patents issued and Laid-open Publication

102 Price list of Domestic Logs and Wood Chips by District

103 Other Monthly Statistics

105 News from the Association

## **Contribution to Carbon Neutrality through Optimization Technology 「Part II」 -Challenges and Solutions in Utility Plant Operation Optimization-**

Soichi Iwamoto

Advanced Solution Department, Engineering Headquarters, Advanced Automation Company, Azbil Corporation

Last year, we introduced energy conservation by optimization technology and demand response solution to support the clean energy transition towards carbon neutrality. This year, as the second report, we will focus on utility plant operation optimization by Azbil's optimization solution, which has a large effect for energy conservation and CO2 emission reduction.

Firstly, we realize utility plant operation optimization by using Multivariable Model Predictive Control (MPC). A hybrid system consisting automatic control and guidance built by using MPC provides flexibility that enhances receptivity among operators on-site. Additionally, our optimization solutions also utilize soft sensors, digital twins and AI technology to solve problems often occurred in utility plant operation optimization.

In this paper, we classify the problems that have been solved through our optimization solutions in many industries such as Pulp and Paper, Refinery, Chemical, into several topics which are "Boiler steam pressure control", "Building and updating model for MPC", and "Receptivity among operators on-site", and report the solutions for challenges indicated in these topics.

In particular, regarding "Building and updating model for MPC", which is directly linked to the effectiveness of implementation of MPC on-site, we will introduce in detail for the utilization of digital twins in building model expressing the equipment property which represent the actual behavior of the utility plant, and the newly developed automatic model updating function through AI technology to update the model for MPC according to changes in equipment property due to reasons such as aging and maintenance.

## **TMEIC product and technology that can contribute to DX in the paper industry**

Yoshito Katsuki

Toshiba Mitsubishi-Electric Industrial System Corp. (TMEIC) 

In recent years, the prices of all kinds of things have soared resulting in squeeze profits in the paper industry as well. In the future, optimizing the usage of all kinds of things will be inevitable with full use of AI and IoT technologies to promote digital transformation. Furthermore, the trend toward carbon neutrality is growing around the world, and we are now in an era in which companies are required to contribute to the realization of a sustainable society. This paper introduces six of our new products and technologies that enables to support initiatives aimed at further improving productivity in such circumstances.

## **Learning from Other Industries, Four Points for Success in Manufacturing DX from an Instrumentation Viewpoint**

Shougo Kataoka

Solution Business Division, Connected Industries Business Dev. Center, Methodology Development Dept., Yokogawa Solution Service corporation

The environment surrounding the manufacturing industry is changing dramatically in recent years. To adapt this situation, almost all companies are required to transform under the keyword "DX". However there is no methodology that guarantees success of the manufacturing DX. Yokogawa Solution Service has analyzed the situation of manufacturing site, and defined the elements of manufacturing DX through collaborations with customers in wide variety of industries, such as chemical, oil, pharmaceutical, etc.

In this paper, we describe four points for success in manufacturing DX, and provide case study from other industries that Yokogawa Solution Service conducted workshop for site staffs to help their transformation.

## **Importance of Data Utilization and Environmental Measures at Manufacturing shop floor**

Tatsuya Terasawa

Sustainable Manufacturing Engaged Div., Uvance Business Group FUJITSU LIMITED

The world now faces the crisis of global scale of environment, society and economy. Climate change poses a "survival crisis" for mankind and many other organisms, and global warming has progressed during the past 10 years, causing the retreat of glaciers, the death of coral reefs, and abnormal weather in various parts of the world. In addition, various social issues such as poverty, human rights violations, and the aging of the population continue to be major challenges. In addition, the components of the value chain, such as the novel coronavirus pandemic, geopolitical crisis, and currency fluctuations, are exposed to unprecedented uncertainty. In this uncertain and unstable age, this paper outlines points requiring attention in the promotion of manufacturing DX, while it mentions the arrangement of problems in the paper and pulp industry, challenge themes for the solution of problems, data utilization in manufacturing shop floor, and the importance of environmental countermeasures. It should be noted that the interpretation and consideration of the regulations in this paper are not absolute, because they are discussed in part based on the judgment of our company based on the interpretation by the government and industry groups.

## **Visualize and Reduce Fiber Losses by OnView.MassBalance**

Nodoka Furubayashi

International sales department, Voith IHI Paper Technology Co., Ltd.

Voith is promoting the digitization of the papermaking process under the name of PM4.0. While increasing the number of digital products delivered to the papermaking process worldwide, we are also developing digital products for the raw material process as a full-line supplier. This article introduces a product called OnView.MassBalance that visualizes fiber loss in the OCC line.

Generally, fiber loss in the raw material process is known only on a monthly or weekly basis, and it is difficult to pinpoint the location of the process in which the loss occurs. By using OnView.MassBalance developed by Voith, the flow rate of feed, accept, and reject of each process is clearly displayed in a chart format called Sankey diagram, and it is possible to identify the place where fiber loss is high in real time.

## **Steps into the future as seen in global digitalized plants**

Taku Shigihara

Digital Industries, Siemens KK

The degree and speed of change in our business environment today is significantly faster than it was a decade ago, making it imperative for any company to increase its competitiveness through industry digitalization. This article explores the concept of digitalization and hints for the Japanese manufacturing industry, with examples of digitalized factories overseas.

## **Toward Data-driven Factory Automation as seen from Recovery Line Optimization**

Hisanori Bando

Automation Systems Business Line, Valmet K.K.

In pulp and paper mills, automation of each process has been introduced worldwide, but further mill automation has been proposed to optimize operations throughout the entire mill.

This optimization of factory-wide operations is called "Operation 4.0," and is the next step in optimization technology that is attracting worldwide attention.

In conventional optimization technologies for each process, optimization control is added to the issues and areas that can be improved in each process to enable more efficient operation of the process. This has resulted in reduced chemicals, reduced energy consumption, increased production output, improved quality, and reduced emissions.

Optimization throughout the mill, with a special focus on the inter-processes, can reduce losses between processes and further improve efficiency.

As a manufacturer capable of providing equipment, machines, automation products, and services for pulp and paper mills, Valmet has developed this mill-wide optimization with the support of its experts. Valmet offers this solution as "Mill Wide Optimization".

## **Effect of introducing the boiler combustion control optimization system**

Kai Matsubara  
Kanto Mill (Katsuta) ,Hokuetsu Corporation

In Hokuetsu Corporation Kanto Mill (Katsuta site), the No.2 biomass boiler (2B) and No.2 steam turbine generator (2T/G) generate steam and electric power for the whole facilities, and the surplus electricity is supplied outside for sale. The 2B mainly uses wood chip derived from construction waste, coal, and paper sludge and waste plastic generated inside the mill. On calorie basis, about 90% of the fuel is wood chip and paper sludge, about 1% is waste plastic, and the rest of around 10% is coal.

Fuel supply is controlled by DCS automatically, under the condition of keeping the amount of power generation constant due to power selling. As a result, the main steam pressure fluctuates greatly, reducing the combustion efficiency of the boiler. Therefore, this time, we introduced the boiler combustion control optimization system (ULTY-V plus), which has a proven track record in coal boilers. By suppressing pressure fluctuations with this system, we worked to improve the combustion efficiency of the boiler and reduce the fuel consumption.

## **Comprehensive Solutions for Utilizing Recycled Paper by KURITA**

Satoshi Wada  
Pross Technology Department, Kurita Water Industries Ltd.

Failures such as defects and paper breakage originating from recovered paper materials can be caused by a variety of factors.

We have developed a highly accurate analysis method that can quantitatively and quickly estimate the causes of these problems by using continuous water quality measurement with the S.sensing® system and DX for data analysis.

This method can also be used to predict future problems that may occur in the future. Because this analysis method can be universally implemented quantitatively by anyone, we believe that it can supplement the transmission of empirical knowledge due to manpower shortages and the retirement of veteran operators, which is expected to be a problem in the future.

By appropriately combining the various countermeasure methods, including our own water treatment chemicals, for the highly influential factors related to water treatment derived from this analysis method, we will be able to implement highly accurate countermeasures against failures.

## **Proposal to control color quality and to reduce the loss in the production line by high precision color sensor**

Hiroyuki Fukuhara  
Sales & Marketing Division, X-Rite

It is very important to manage the color of paper as well as the other factors which need to be under control. It seems not to be discussed enough how to manage the color. This time I will explain about the importance of the color sensor as an input device with some examples.

## **DX Initiatives for In-house Power Generation Facilities**

Nobutaka Maki  
Energy Technical Department, Energy Business Division,  
Nippon Paper industries CO., LTD.

As our company, where the necessary factory energy is provided by in-house power generation facilities, one of our major challenges is to control breakdowns, as boiler breakdowns have a significant impact on production. However, with experienced employees retiring every year, it is difficult to pass on technology through paper-based information exchange alone, and occurrence of similar breakdowns and a decline in on-site capabilities are becoming apparent. Under these circumstances, it is close to the limit to run the stable operation of aging facilities with only the knowledge and experience possessed by a few individuals.

Therefore, in this theme, I would like to introduce some of our efforts to break away from the operation method based on personal knowledge and experience by utilizing digital technology, focusing on the digitalization of operation information and changes in operation monitoring methods.

## **Pulping of Mitsumata by using Twin Screw Extruder**

Naoichi Muto, Takashi Okuda and Takuma Teraoka  
Research Institute, National Printing Bureau, JAPAN

The bast fiber of Mitsumata (*Edgeworthia papyrifera* Sieb. et Zucc.) has traditionally been used as a raw material of paper. Mitsumata belongs to Thymelaeaceae family, and the paper made from its bark is known to have hue of egg yolk color and unique texture. Mitsumata pulp for paper making is manufactured as follows. Mitsumata branches are steamed and barks are taken off, from which its epidermis and cuticle are removed. Then, the residual white bark is cooked with an aqueous alkaline solution in the digester. Compared to the chemical composition of wood, the white bark contains more amount of pectin and less amount of lignin. So, pulping of Mitsumata primarily aims to remove pectin that works as a binder among cells, and pectin in the white bark can be removed by alkaline solution under heated.

In this research, we used twin screw extruder to produce Mitsumata pulp from its white bark. Twin screw extruder consists of two co-rotating screws in a cylinder barrel, and it is widely used in the manufacturing industry for material processing such as shearing, kneading, heating and mixing. The white bark is impregnated with an aqueous solution of sodium hydroxide before defiberizing by twin screw extruder. The process of twin screw extruder is continuous and its processing time is short compared to normal cooking process.

The effect of processing temperature and addition rate of sodium hydroxide on defiberizing of Mitsumata fiber was investigated. We found that Mitsumata fibers could be defiberized by twin screw extruder at lower temperature than cooking process.

Handsheets were made from the pulp produced by twin screw extruder, and their optical and physical properties were studied. The ISO brightness of the handsheet produced by twin screw extruder was high compared to the handsheet produced by normal cooking process. The pulp yield produced by twin screw extruder was also higher than the yield by cooking process. The side chemical reaction is considered to be suppressed during the extrusion process because of the low processing temperature and the short processing time.

## CONTENTS

### Welcomig New Employees

- 2 Contribute to Saving Energy and Maintenance and Low Noise for Aeration Blower and Flotator Blower  
—New Technology Linked by IoT Support Stable Operation of Wastewater Treatment with Cloud Monitoring and Machine Learning—……Daiki Yamaura and Go Kawazu
- 7 Abrasion Mechanism and Characteristics of Cast Material for Refiner Plates  
……Masahiro Matsushima
- 11 Latest Mechanical Seal Face Technology  
—Operational Reliability Improvement by Technical Specialty of Seal Face—  
……Atomu Ono
- 16 Shaft Voltage Measurement to Protect Roller Bearings……Yuta Konishi
- 20 Innovative Roll Handling Module Driven by Compressed Air……Kazuho Imagawa
- 24 The Approaches to Achieve Efficient and Simplified Pest Management  
……Takeo Ishizaki
- 29 Effect of Two Colors of New UV-Absorbing Films on the Adult Chironomids  
……Goro Kimura, Hiroyuki Watanabe, Mitsuteru Hirono and Michio Yamada
- 31 Speedy! Safety! High Repeatability! ABB L&W Reliable Paper Testing Technology  
—L&W New Testing Method Provides New Quality Management Way—  
……Hiromichi Yoda
- 36 Development of the New Formation Tester “FMT-4”……Kazuhiro Nomura
- 41 Report on the Results of the Fiscal 2022 Follow-up Survey on “JPA’s Carbon Neutrality Action Plan” and Related Information on Measures against Global Warming in the Japanese Paper Industry……Yasuharu Sakina

### Introduction of Research Laboratories(150)

- 60 Laboratory of Applied Microbiology and Microbial Metabology, Department of Biochemistry and Molecular Biology, Faculty of Agriculture and Life Science, Hirosaki University

### Research Report(Original Paper)

- 65 Novel Analysis of Recycled Pulp-Containing Paper, Including Fluorescent Whitening Agent:  
Part 1 Confocal Laser Scanning Microscopy Method……Atsushi Narita, Susumu Kawanobe, Satoshi Nakaba, Ryota Kose, Ryo Funada and Takayuki Okayama

### Pulp and Paper Mills in Japan(102)

- 85 Kani Mill, Daio Paper Corporation

- 03 Committee report
- 62 Essay on Intellectual Property
- 63 Coffee break
- 90 Papyrus

- 95 Industry News (Domestic and International)
- 99 List of Patents issued and Laid-open Publication
- 105 Price list of Domestic Logs and Wood Chips by District
- 106 Other Monthly Statistics
- 108 News from the Association



**Contribute to Saving Energy and Maintenance and Low Noise for aeration blower and flotator blower  
New technology linked by IoT  
Support stable operation of wastewater treatment with cloud monitoring and machine learning**

Daiki Yamaura

Fluid Sales Division, ShinMaywa Industries, Ltd.

Go Kawazu

Design Department Ono Plant Fluid Division, ShinMaywa Industries, Ltd.

In this paper I would like to introduce the advantages and technologies of TurboMAX turbo blower. TurboMAX turbo blower consists of superior technologies like air-foil bearing, permanent magnet synchronous motor, high efficiency impeller, high speed control technique and so on. As for the overall structure, blower, motor, inverter, touch panel controller and blow off valve are installed in one enclosure. This is a new style turbo blower called "air foil bearing-variable speed-single stage turbo blower". Compare to the conventional blowers, TurboMAX turbo blower has many advantages in "Saving energy" "Low noise and vibration" "Saving maintenance cost" "Space-saving and lightweight". Especially, compare to the conventional root blowers, TurboMAX turbo blower can reduce power consumption by 20% on average.

As global warming is serious issue around the world now, reducing the power consumption is required to all industries regardless of its type and scale. Especially for paper industry which uses and disposes a large amount of water, reducing the cost for waste water treatment is a big challenge. In the process of waste water treatment, aeration blower's power consumption makes up the large proportion, and aeration blower usually runs for 24 hours every day. So, high efficiency aeration blower can contribute to the cost reduction of waste water treatment significantly.

In the latter half of this paper, I introduce an actual case of replacing 2 root blowers with 1 turbo blower (MAX100) at municipal sewage-treatment plant for the field trial. As the result, we could confirm 25% energy saving, 16dB noise reduction, 25 $\mu$ m vibration reduction, and 6°C blower room's temperature reduction.

ShinMaywa Industries, Ltd. launched TurboMAX turbo blower since 2012 in Japan, and some blowers have been delivered to paper factories. As for paper factory, we have delivered blowers to 8 paper factories so far and 12 blowers are in operation now. Especially, one of these blowers are used for flotator which is used in the deinking process during manufacturing recycled paper from used paper, and we confirmed TurboMAX turbo blower can reduce power consumption in non-aeration use too. I expect TurboMAX turbo blower can reduce the power consumption in many other uses too. I hope TurboMAX turbo blower contributes to the energy saving in many fields and it leads to the reduction of environmental burden of the globe.

**Abrasion Mechanism and characteristics of cast material for refiner plates**

Masahiro Matsushima

Research & Technology, NIDAK Corp.

Investigation of the reason why refiner segment's blade made by abrasion resistant hard material will wear during refining pulp which is much softer. Investigation was performed by observing worn out section of used refiner segment.

Based on customers evaluation of abrasion resistance of refiner segment materials obtained during their actual operation, several laboratory abrasion tests were performed to find which test method leads to results closest to customers actual operation results. Throughout the tests micro structure image analysis, micro area hardness test and multiple regression analysis were also performed to consider influencing factors for the abrasion resistance.

As a result, Suga system abrasion test showed the closest results to the customers actual operation results and largest Influencing factors were as following in influencing order;

①Hardness of Eutectic carbide ②Hardness of other carbides ③Volume of Eutectic carbide ④Bulk hardness ⑤Max. Dia. of Eutectic carbide ⑥Min. Dia. of Eutectic carbide, ⑦Volume of other carbide.

## **Latest Mechanical Seal Face Technology** **—Operational reliability improvement by technical specialty of seal face—**

Atomu Ono  
Sales Dept., John Crane Japan, Inc.

In the pulp and paper industry, many rotating equipment peculiar to this industry are used. In addition, these are often difficult operating conditions for mechanical seals. There are many voices of issues and requests for improvement such as seal performance improvement, complex auxiliary systems, reducing repair frequency and maintenance costs, operational reliability improvement, and reducing water usage.

We have solved many difficult problems by using our own product development and technology as a seal manufacturer. Fully split seal and auxiliary wet seal system which can reduce water usage introduced until last year are part of solutions that represent our company. Also, we picked up latest seal face technology as a theme of this year and introduce following three technologies and its successful cases.

Case-1, problem for unstable pressure resource, heat load and slurry damage on inboard seal, and high load on outboard seal can be resolved by USP seal. Inboard seal surface of the seal has a unique surface groove structure, and the seal water (barrier water) is taken in between seal surfaces. Then, seal water is pressurized and pushed into process fluid side. The seal has same seal performance as a double arrangement seal.

Case-2, seal face damage problems which are caused by slurry, insufficient lubrication, and heat generation of the seal can be resolved by John Crane Diamond™ seal face material. This material of seal face which has higher wear resistance and chemical resistance than general hard face materials, and at the same time, it has a lower coefficient of friction than carbon face material.

Case-3, steam leakage issue on shaft sealing device of steam turbine can be resolved by Type-28ST dry gas seal. The seal has surface groove and can reduce leakage drastically.

These high-value-added technologies are used on wide range of applications. And, these are used not only improve productivity and reduce costs, but also contribute to environmental conservation, such as stable operation of rotating equipment, longer life of shaft seals, and reduction of equipment load.

## **Shaft Voltage Measurement to Protect Roller Bearings**

Yuta Konishi  
Engineering Department Seals Motion Control, Fukuda Corporation

In this paper, we introduce bearing premature failures due to bearing currents, which mostly exist when motors are operated by Variable Frequency Drives (VFD). In the past few decades, a number of pulp and paper mills have experienced bearing failures such as fluting, also known as ridge marks or washboard patterns. However, bearing currents also degrade lubricants in bearings and/or on gearbox gears. To evaluate its risk, we introduce how motor shaft voltages are measured and a remedy of the grease degradation in addition to bearing premature failures.

## **Innovative roll handling module driven by Compressed air**

Kazuho Imagawa  
Matsubo Corporation

Many paper manufacturers install or consider automatic roll handling equipment, but conventional equipment requires large space, foundation work for pit and long non running period for installation. These causes cost increases, decreases in production and inflexibility of roll handling routes. Additionally, manual hand transportation is a big burden to operators, and it also has a risk for an accident. Therefore, The Finnish company called “MoveRoll” developed an innovative roll transfer equipment which can solve those issues. It makes the automatic roll handling simpler, cheaper and safer. MoveRoll various applications of the unique conveying system can help most of paper manufacturers reduce manpower and improve safety in paper mill inter logistics.

## **The Approaches to Achieve Efficient and Simplified Pest Management**

Takeo Ishizaki  
Earth Environmental Service Co., Ltd

We need efficient and simplified pest management abilities suited to the times, because many factories have limited staff and time to spare for pest management due to a decrease in population, the reform of working practices, and COVID-19 pandemic.

In this paper, I examined some points in order to solve these problems. First, we have to build Plan-Do-Check-Action cycle(hereinafter called “PDCA-cycle”). It is important to set on appropriate objectives for pest management in specific to make PDCA-cycle work smoothly and efficiently, and also to match several inspection activities to the needs precisely.

As for the monthly improvement activities, if we apply measurements based on the characteristics of insects or root cause of the problems, it helps to cut extra time. We can also shape the meeting style in order to have simpler related meetings, and our ESCOEVO system is particularly beneficial method to shorten the meeting time, to help factory staff understand what they should do, and to promote preventive pest controls.

At last, I introduce the latest rat-monitoring system called “Pescle”, which we developed in partnership with Ryoden Trading Co.,Ltd.. One of the most differentiated features of it is that it solves the problems for on-line monitoring systems that we have to check the rat-monitoring devices on site due to some misdetections. Using our original AI techniques, we can only get accurate information, so that we can contribute to formulation of sustainable pest-control systems.

## **Effect of two colors of new UV-absorbing films on the adult chironomids**

Goro Kimura  
Technical Research Laboratory, Ikari Shodoku Co.,Ltd.  
Hiroyuki Watanabe, Mitsuteru Hirono  
Business Development Division, Ikari Shodoku Co.,Ltd.  
Michio Yamada  
Taisei Fine Chemical Co.,Ltd.

The use of UV-absorbing films that block near-UV light radiation in factory has been shown to be effective for preventing pests from entering factory. However, our previous study indicate that there was no significant difference between the attracted number of adult chironomids with a white fluorescent lamp (with UV radiation) and a white LED lamp (without UV radiation). In the present study, we attempted to clarify the preventing effect of red and green colors of new UV-absorbing films on the adult chironomids in the field. The collection number of chironomid adults in the UV-absorbing film treatment of each color was significantly lower than the without film (control experiment). The results suggest that UV-absorbing film is one of the useful method of control of nuisance chironomid adults.

## **Speedy! Safety! High repeatability!**

### **ABB L&W reliable paper testing technology**

### **-L&W New Testing Method provides new quality management way-**

Hiromichi Yoda  
Division manager, Process Industry Division, ABB K.K.

Currently, industry got strong pressure from the market because Japan government announced carbon neutral industry by 2050. In Japanese industry, especially material industry, there are several serious potential issues like lack of human resource due to less attractiveness for young people, retirement of baby boomer and the technical transfer. On the other hand, there are bright future in paper industry because paper is excellent material for plastic reduction and new functional material, Cellulose Nano Fiber.

ABB started following four approaches to cooperate with customer to solve facing issues.

- 1) Reliable and high performance online measurement for Refiner, Wet end control
- 2) Cutting-edge fiber analyzer for new material development
- 3) Speedy, Safety and high precise paper testing machine
- 4) High speed, high precise and reliable automated paper testing machine

In the paper, 3) Speedy, Safety and high precise paper testing machine is described. You can understand new method for paper flatness and CMT plateau measurement which allows you to have quick and precise measurement for process optimization.

## **Development of the new formation tester "FMT-4"**

Kazuhiro Nomura  
NOMURA SHOJI CO., LTD.

We have developed the new model of the formation tester "FMT-4" and will start selling it. FMT is the light transmission type formation tester that has sold more than 70 units in total to paper manufacturers and non-woven fabric manufacturers in Japan and overseas since the release of the first generation FMT-100 in 1990. In this development, which is the fourth generation, it is possible to strengthen and adjust the transmitted light by adopting an LED unit for the light source of the transmitted light for the first time. It is now possible to measure thick paper with a basis weight of about 300 g/m<sup>2</sup>, which was not possible with the previous model. The housing has also been revamped, making it possible to install it in a smaller space by realizing a more compact design. We will introduce the basic functions of the formation tester and the points that have been renewed in the "FMT-4".

## **Report on the Results of the Fiscal 2022 Follow-up Survey on" JPA's Carbon Neutrality Action Plan" and Related Information on Measures against Global Warming in the Japanese Paper Industry**

Yasuharu Sakina  
Japan Paper Association

The Japan Paper Association (JPA) established its "Voluntary Action Plan on Environment" in 1997, in response to The Japan Business Federation's call to the Japanese business community to organize "The Voluntary Action Plan on Environment". Since then, JPA has carried out a follow-up survey and published the results every year.

As the Voluntary Action Plan finished in fiscal year (FY)2012, JPA newly started "the Action Plan towards a Low Carbon Society" which is renamed "Carbon Neutrality Action Plan (Phase II)" this year and has been actively addressing global warming prevention in order to achieve the following targets set in the plan:

- Reduce energy derived CO<sub>2</sub> emissions by 38% by FY2030 from the FY2013 level .
- As a source of CO<sub>2</sub> absorption, increase total forest plantation area at home and abroad by 375,000 ha to 650,000 ha by FY2030 from the FY1990 level .

According to the results of FY 2022 follow-up survey (actual results for FY 2021), fossil-energy derived CO<sub>2</sub> emissions in FY 2021 was 15.83 million tons, which is 0.19 million tons higher than those in FY 2020(15.64 million tons) but is 3.0 million tons lower compared to those in FY 2013(18.83 million tons). This is attributed to each manufacturer's active efforts including energy saving and energy conversion from fossil energy to non-fossil energy such as biomass energy.

In addition to the results of the follow-up survey, this report introduces the current energy situation in the Japanese paper industry.

## **Novel analysis of recycled pulp-containing paper, including fluorescent whitening agent: part 1 confocal laser scanning microscopy method**

Atsushi Narita, Susumu Kawanobe,  
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Satoshi Nakaba, Ryota Kose, Ryo Funada and Takayuki Okayama  
Division of Natural Resources and Eco-Materials, Institute of Agriculture,  
Tokyo University of Agriculture and Technology

In recent years, the use of recycled pulp-containing paper has spread widely with the increase in the recovery rate of wastepaper. This increased use is sustained by the concern regarding environmental pollution and the concept of sustainable development. In Japan, the “Law Concerning the Promotion of Procurement of Eco-Friendly Goods and Services by the State and Other Entities” stipulated in 2009 that the percentage of wastepaper pulp should be at least 70% for recycled copy paper and 60% for recycled printing paper as the eco-friendly products<sup>1)</sup>. Recently, a precise method to assess the wastepaper pulp content in recycled paper products has been required with the increasing use of wastepaper pulp.

A new method using a confocal laser scanning microscope (CLSM) to assess wastepaper pulp content in recycled pulp-containing paper was tested in this study. Most printing and writing papers contain fluorescent whitening agents that enhance the whiteness of paper and, partially remain after recycling treatment. This characteristic can be used to distinguish wastepaper pulp from virgin pulp.

A wastepaper pulp sample was prepared using a typical deinking treatment of handsheets made from hardwood bleached kraft pulp and bleached chemi-thermomechanical pulp (BCTMP). A controlled amount of fluorescent whitening agent was added to the pulps. Several recycled handsheets were prepared by changing the ratio of wastepaper pulp to virgin pulp. Images of pulp fibers with the adhered fluorescent whitening agent were observed without breaking the form of the sheet, and the difference between the wastepaper pulp content was confirmed by CLSM. Following image analysis, it was found that the mean intensity of the images of the handsheets correlated well with the actual wastepaper pulp contents.

## CONTENTS

### Plastics substitution

- 1 SEIKOAT® T-EF201, a Novel Non-fluorinated Oil-resistant Coating Agent Capable of Maintaining High Air Permeability of Paper.....Teruyuki Matsushima
- 6 Development of Water-based Coating Agent for Paper Packaging Materials .....Teruaki Sato
- 12 Introduction for VOITH Group Pilot Coater and Development Activity of Barrier Coating Paper using Curtain Coater.....Toshihiro Katano
- 16 Technologies for Reuse of Beverage Paper Packages.....Atsuhiko Terashima
- 20 Development of Biomass Plastics Derived from Wood Pulp.....Yusuke Yataka
- 24 Development of Applications for Non-beverage Paper Container "SPOPS" and Future Plans.....Takaharu Noda
- 28 Development of Paper Packaging for Plastic Reduction .....So Satou, Kazuki Azumagawa and Yusei Kawanami
- 33 Development of Biomass Based Non-Woven Fabric for Thermoforming, "Kinarito" .....Sakura Miyazaki, Hiroyasu Tachibana, Hiroki Yamamoto and Hitoshi Ishizawa
- 37 Market Deployment of Micro Cellulose Beads.....Hirohumi Maeda

### Topics & Information

- 41 Adsorption Thermal Storage System "Mega stock" by Using Waste Heat .....Takamasa Ooyama, Haruyuki Kamata, Yoshiaki Kawakami, Takuji Nakata and Masayuki Tanino
- 48 Initiatives for Low-Carbonization in Kanto Mill (Katsuta).....Kai Matsubara
- 53 Research Projects of Universities and Government Research Institutes .....Wood Science Committee, JAPAN TAPPI

### Pulp and Paper Mills in Japan (103)

- 63 Ebetsu Mill, Oji F-Tex Paper Co., Ltd.

03 Committee report

62 Coffee break

67 Papyrus

71 Industry News (Domestic and International)

75 List of Patents issued and Laid-open Publication

82 Price list of Domestic Logs and Wood Chips by District

83 Other Monthly Statistics

85 News from the Association

## **SEIKOAT<sup>®</sup> T-EF201, a Novel Non-fluorinated Oil-resistant Coating Agent Capable of Maintaining High Air Permeability of Paper**

Teruyuki Matsushima

PAPER CHEMICAL BUSINESS DIVISION, SEIKO PMC CORPORATION

A fluorinated oil-resistant agent was used to impart oil resistance to paper, but there have been cases where an organic fluorine compound must be replaced with an alternative because of concerns about health and the environment. However, it is difficult to obtain the same oil resistance as a fluorinated oil-resistant agent. In addition, when a non-fluorinated oil-resistant agent such as acrylic is used, the air permeability of the paper is reduced and it becomes difficult for steam to escape, which deteriorates the texture of French fries and other fried foods.

This paper introduces "SEIKOAT T-EF201", a new a non-fluorinated oil-resistant agent that can maintain high air permeability of paper while being a non-fluorinated agent.

"SEIKOAT T-EF201 has characteristics below:

- High oil resistance and high air permeability comparable to a fluorinated oil-resistant agent
- The percentage of biomass material in the solid content is more than 95%
- Biodegradation degree (relative value) of more than 750
- Conform to FDA21CFR § 176.170, § 176.180

"SEIKOAT T-EF201" is a more environmentally friendly oil-resistant coating agent that has highly containing biomass and has the characteristics of being biodegradable.

## **Development of water-based coating agent for paper packaging materials**

Teruaki Sato

Research & Development H.Q., Water-Based Polymer Development Dept., Arakawa Chemical Industries, Ltd.

Environmental pollution caused by improperly treated plastic waste is one of the environmental problems that must be dealt with on a global scale. In particular, the amount of plastic waste discharged as packaging material is 69% of the total amount of plastic waste<sup>1)</sup>, therefore it is more important to reduce the amount of plastic used in packaging material to prevent environmental pollution.

"Paper," which is a biomass material that exhibits biodegradability, is attracting attention as a sustainable material that can replace plastic, and new paper packaging materials with excellent plastic functions such as water vapor barrier resistance, oil resistance, water resistance, heat sealability, flexibility, and tear strength are being actively developed. In the field of food wrapping paper, the development of fluorine-free oil-resistant paper is being promoted against the background of stricter restrictions on the use of perfluoroalkyl substances, which may pose a health risk. Therefore, we are developing functional water-based products (AW series) to solve these sustainability issues.

In this paper, we introduce AW-500, AW-102, AW-200 from AW series, which are functional water-based coating agents for paper packaging materials that have been developed focusing on the functions of water vapor barrier, heat sealability, and oil resistance. We will also report on the development status of products compatible with Positive List System for Utensils, Containers and Packaging.

## **Introduction for VOITH Group Pilot Coater and Development Activity of Barrier Coating Paper using Curtain Coater**

Toshihiro Katano

Application Eng. Dept., Voith IHI Paper Technology Co., Ltd.

In recent years, plastic products have been replaced by paper products as part of attempts to reduce environmental impact in order to realize a sustainable society. The VOITH Group has been contributing to this environmentally friendly trend by providing customers with access to its pilot coater and coating technology know-how in Heidenheim, Germany and Motomiya, Fukushima Prefecture.

The VOITH pilot coater in Heidenheim has recently undergone improvements, with a particular focus on its drying capacity and curtain coater. Here, we would like to introduce the Heidenheim pilot coater.

We will also introduce our pilot coater facility in Motomiya City, Fukushima Prefecture, and our development activities related to barrier coatings.

## **Technologies for Reuse of Beverage Paper Packages**

Atsuhiko Terashima

Itochu Machine-Technos Corporation

This time, we will introduce a cavitation pulper made by Repulping Technology, Germany, a separator for multi-layered substrates made by Saperatec, Germany, and a hydrodynamic friction washer made by HydroDyn, Germany, under the theme of reuse of beverage paper packages. The SDGs, adopted at the United Nations Summit in 2015, aim to achieve a sustainable and better world by 2030, and we believe that the equipment and technologies we introduce will overcome challenges that are difficult to be addressed with existing technologies in recycling for the effective use of resources. In order to recycle beverage paper packages, it is necessary to separate paper from laminated polyethylene and aluminum, and furthermore, to clean ink and dirt, which is difficult to do efficiently with existing technologies. Repulping Technology's cavitation pulper separates paper from other impurities; Saperatec's multi-layer material separator separates polyethylene from aluminum; and HydroDyn's hydrodynamic friction cleaning equipment de-inks on film.

We hope that the widespread use of these technologies for recovering paper, aluminum, and polyethylene from beverage paper packages will help realize the reuse of resources.

## **Development of biomass plastics derived from wood pulp**

Yusuke Yataka

Innovation Promotion Division, Oji Holdings Corporation

The functions and low costs of conventional plastics are of essence for our daily and modern life in these days. In the view of sustainability of our globe, we have to care about the emission of the global warming gas and spilling out of the plastics which potentially turned into microplastics. Biomass plastics being good alternatives for them, we still have been confronting some difficulties especially about the material procurement. Therefore, our company have been developing a novel production process for biomass plastics derived from wood pulp for paper making.

We had developed the technology for transforming wood pulp to ethanol which is material for ethylene by biochemical process with yeast. As a beginning of our project, we examined the reproducibility of the technology and manufactured pulp derived ethanol at small and large scale. The ethanol was converted to ethylene by a chemical process which was followed by the polymerization to polyethylene. Purification method that was established to obtain highly purified pulp derived ethanol employed pulp derived polyethylene production.

Manufacturing of pulp derived polylactic acid was also achieved. The raw lactic acid was also obtained by fermentation, whose yeast was replaced by lactic acid bacteria.



## **Development of Applications for Non-beverage Paper Container "SPOPS" and Future Plans.**

Takaharu Noda

Paper-Pak Sales Division, Nippon Paper Industries Co., Ltd

Nippon Paper Industries has developed and commercialized a paper container "SPOPS" for non-beverage applications such as cosmetics and daily necessities. It enables to improve usability at the same time it is eco-friendly. Recently, it has been applied for hand sanitizer containers and for containers for products with new business models such as subscription services for daily necessities. In addition, a high-speed filling machine has been developed that improves productivity and it is expected that SPOPS will be adopted by major brands. In the future, we would like to promote the recycling of used cartons of SPOPS and enter the global market.

## **Development of paper packaging for plastic reduction**

So Satou, Kazuki Azumagawa and Yusei Kawanami

Innovation Promotion Division, Oji Holdings Corporation

Pillow packaging bags made of paper-based materials have been attracting attention from the viewpoint of reducing plastic usage. However, the application of paper materials to the pillow packaging has been limited due to the difficulty in ensuring required quality such as strength, water- and oil-resistance, barrier properties, and printability. In order to have paper pillow packaging used in more fields of applications, we have developed two paper-based packaging materials. One is a highly flexible packaging material that has high puncture strength at the same time. This packaging material is relatively resistant to pinhole formation and is not easily wrinkled during bag manufacturing. The other is a packaging material, in that variable information such as expiration dates, lot numbers, barcode, and QR can be printed with a UV laser. As the information can be printed without direct contact with printheads, printing defects such as faint printouts can be avoided and high quality printing is possible even on paper-based materials where the surface is not smooth. This report introduces the details of these two newly-developed packaging materials.

## **Development of biomass based non-woven fabric for thermoforming, "Kinarito"**

Sakura Miyazaki, Hiroyasu Tachibana, Hiroki Yamamoto, and Hitoshi Ishizawa

R&D Division, Oji Kinocloth Co., Ltd

We have developed a novel airlaid nonwoven fabric that is made from biomass materials, such as pulp and polylactic acid (PLA). This nonwoven fabric, named Kinarito, possesses good biodegradability due to its designed composition. Kinarito can not only be used as is biodegradable nonwoven fabric but also be thermoformed into various packaging shapes. Its features and possible applications are discussed.

## **Market deployment of Micro Cellulose Beads**

Hirohumi Maeda

Rengo Co., Ltd.

Plastic products used in a wide variety of situations, from packaging containers to household products, are essential materials in our daily lives. However, ocean plastics problem has become a global issue. In addition to plastic debris that is not properly processed and flow into the ocean while maintaining its shape, miniscule pieces of plastic which called microplastics, are also a serious problem that affects the ecosystem.

Microplastics include those that are affected by waves and ultraviolet rays during the process of entering the ocean and become small plastic particles, as well as plastics originally found in abrasive compound, face washes, and cosmetics, which are smaller in size. Microplastics are difficult to be removed by wastewater treatment and are said to be discharged into the ocean with little or no recovery, remaining in nature for hundreds of years.

We have been manufacturing and selling biodegradable cellulose beads named "Viscopearl" since 1995, and in April 2022, we started its operation of a new plant for small-diameter cellulose beads, which are expected to be an alternative material to microplastic beads. In this paper, we introduce the features of cellulose beads as well as their future market development.

## **Adsorption thermal storage system "Mega stock" by using waste heat**

Takamasa Ooyama, Haruyuki Kamata, Yoshiaki Kawakami, Takuji Nakata and Masayuki Tanino  
Takasago Thermal Engineering Co., Ltd.

We have developed the open-cycle type adsorbent thermal storage system, so called "Mega Stock". Based on adsorbent of HAS-Clay, the thermal storage system can utilize the low-temperature waste heat. In the offline heat transportation type, the thermal storage tank charged in the co-generation system was transported by the tractor-trailer and used to heat up water and air in a swimming center. The adsorption heat storage system was evaluated through three kinds of seasons: summer, interphase, and winter. By the tests the regenerating efficiency of 90% or more was confirmed. On the other hand, we performed the demonstration test of the offline heat transportation from the charged thermal storage in the co-generation system to the air handling unit (AHU) of painting process by the tractor. The energy consumption of the cold and hot water used in AHU decreased by dehumidifying the air which flowed into AHU with the thermal storage tank. And, the CO<sub>2</sub> reduction effect of 57% was confirmed from the test.

## **Initiatives for low-carbonization in Kanto Mill(Katsuta)**

Kai Matsubara  
Kanto Mill (Katsuta) ,Hokuetsu Corporation

In Hokuetsu Corporation Kanto Mill (Katsuta site), the No.2 biomass boiler (2B) and No.2 steam turbine generator (2T/G) generate steam and electric power for the whole facilities, and the surplus electricity is supplied outside for sale. This boiler mainly uses wood chip derived from construction waste, coal, and paper sludge and waste plastic generated inside the mill. On calorie basis, about 90% of the fuel is wood chip and paper sludge, about 1% is waste plastic, and the rest of around 10% is coal.

Our company set a goal in 2021, that it will achieve virtually zero of carbon dioxide emission by 2050. For this goal, we have already started efforts to reduce coal used for fuel in 2020. In this report we introduce the examples of coal reduction so far and future policies.

## CONTENTS

### Energy Saving I

- 1 Report of the 27<sup>th</sup> Saving Energy Seminar.....Energy Committee, JAPAN TAPPI
- 4 Activities of Kawasaki Heavy Industries for Realization of International Hydrogen Supply Chain.....Terukuni Toge
- 11 Introduction of Carbon Neutral Technology to Improve of Power Generation Facility for Pulp and Paper Mills.....Naoto Hasegawa
- 17 State-of-the-art Integration of Energy Balance by Andritz  
—A Futuristic Pulp Mill with Integration of Fiberline and Recovery Processes—  
.....Tsukasa Katayama, Ryo Yoshida and Masato Tsuchitana
- 22 Start up Experience of a Biomass boiler.....Kazuto Taguchi
- 27 The Activities for Energy Saving in Ohe Mill.....Shoya Ishikawa
- 31 Activities for Energy Saving in Takaoka Mill.....Satoshi Masugi
- 36 Challenges of Energy Saving in Kasugai Mill.....Shota Oi

### Topics & Information

- 42 Andritz Proposal for CO<sub>2</sub> Reduction at Pulp Mill  
—Sootblower ACE for Recovery Boiler—  
.....Shuhei Yamamoto, Takahiro Hanazawa and Kanji Hagiwara
- 47 Valmet Technology for Energy Saving and Reducing CO<sub>2</sub> Emissions in Pulp Mills.....Yoshiro Nishihara
- 53 Revision of the JIS P 8150  
Paper and board -Determination of color by diffuse reflectance- Indoor daylight conditions (C/2°) .....JAPAN TAPPI, Pulp and Paper Testing Standards Committee

### Introduction of Research Laboratories(151)

- 56 Laboratory of Forest Products, Faculty of Agriculture, Yamagata University
- 03 Committee report
- 58 Essay on Intellectual Property
- 59 Industry News (Domestic and International)
- 64 List of Patents issued and Laid-open Publication
- 72 Price list of Domestic Logs and Wood Chips by District
- 73 Other Monthly Statistics
- 75 News from the Association

### **Activities of Kawasaki Heavy Industries for Realization of International Hydrogen Supply Chain**

Terukuni Toge

Project Group, Hydrogen Strategy Division, Kawasaki Heavy Industries, Ltd.

In order to achieve a "Carbon-Free Society" where society as a whole will reduce greenhouse-gas emissions to reach zero net carbon emission by 2050, the use of renewable energy as alternatives to fossil fuels is required. However, renewable energy has issues that it requires a bigger resource input and physical footprint than fossil energy due to its low power density, and that a stable power supply is not likely to be expected due to the meteorological effect. Hence, expectation and interest in hydrogen energy are increasing as the last resort.

Kawasaki Heavy Industries (hereafter KHI) is the only company that owns a series of core technology regarding hydrogen production, transportation, storage, and utilization. KHI has been developing technologies to produce hydrogen from untapped resources overseas and transport it to final destination, Japan. In the field of hydrogen transportation and storage, KHI built not only the largest liquefied hydrogen storage tank in Japan at Kobe LH2 Terminal (Hy touch Kobe) but also the world's first liquefied hydrogen carrier "SUIISO FRONTIER". On February 2022, KHI succeeded in the world's first maritime transport demonstration of liquefied hydrogen from Australia to Japan, which is produced from untapped brown coal in Latrobe Valley of Victoria, Australia. As for hydrogen utilization, KHI installed cogeneration facility with 1 MW gas turbine as the core, which is fueled by hydrogen and natural gas, in Kobe Port Island, and succeeded in the world's first delivery of both energy and heat in an urban area generated using a gas turbine fueled by 100% hydrogen on April 2018.

Based on the findings from those demonstration tests, KHI will develop technologies for large-scale hydrogen production, and plans to conduct commercial demonstration in Late 2020s to realize a full-scale commercialization in 2030.

### **Introduction of Carbon Neutral Technology to Improve of Power Generation Facility for Pulp and Paper Mills**

Naoto Hasegawa

Mitsubishi Heavy Industries, Ltd.

MHI Group has set the target of achieving Carbon Neutrality by 2040 and is aiming to abate discharging of carbon dioxide (CO<sub>2</sub>) emissions from its own operations by 2040. As an interim step and in line with MHI's commitment to addressing climate change, CO<sub>2</sub> emissions from its own business activities will be cut in half by 2030 (compared to 2014).

This paper includes two topics for achieving carbon neutrality. One is the status of development for hydrogen firing technology (for gas turbine and engine) and ammonia firing technology (for gas turbine, diesel engine and boiler). The other is the introduction of Takasago Hydrogen Park. In the Takasago Hydrogen Park, the hydrogen production and storage equipment are under installing work next to existing GTCC demonstration plant at Takasago Machinery Works, Hyogo, Japan. This will enable validation testing of an integrated progress from next-generation hydrogen production technology to power generation utilizing hydrogen fired gas turbines. After validating the system utilizing water electrolyzation, MHI plan to produce turquoise hydrogen by pyrolyzing methane into hydrogen and solid carbon.

In addition, we, MHI, can support to create the roadmap achieving Carbon Neutrality for pulp and paper mills, with making alignment with Clients. Based on the Client's roadmap, we can also contribute to supply the "Sustainable" system.

## **State-of-the-art Integration of Energy Balance by Andritz -A Futuristic Pulp Mill with Integration of Fiberline and Recovery Processes-**

Tsukasa Katayama, Ryo Yoshida and Masato Tsuchitana  
Andritz K.K.

Energy conservation and the use of creative energy sources that do not use fossil fuels are the most important and urgent issues for reducing CO<sub>2</sub> emissions and preventing global warming. In kraft pulp mills, 50% of the biomass supplied is used as green energy, making it an environmentally friendly process. However, there is still much room for improvement. By integrating and optimizing production lines consisting of individual processes, energy conservation and energy creation are possible.

Pulp production line operations require hot water and steam as chemical and thermal energy. These are supplied by the recovery process. The recovery process also has the important function of generating electricity and supplying power to the entire mill system. If the amount of steam used in the system can be reduced, more electricity can be generated, leading to lower costs and higher profitability. ANDRITZ is improving energy efficiency by integrating and optimizing the pulp production line and the recovery process, and is implementing processes that will enable closed systems.

### **Start up Experience of a Biomass boiler**

Kazuto Taguchi  
Tonegawa Division Paper Mills Rengo Co., Ltd.

Because of increasing awareness about environmental issues and soaring fuels price, Tonegawa plant, Rengo, has installed a new biomass boiler that uses three kinds of fuels, such as wood chips, RPF and waste tire. The capacity of new boiler is determined the same level as existing gas boiler and we decided to use existing one for standby.

After we started up the new boiler, we have faced many new problems. For example, ①switching work of high pressure steam line from existing boiler to new boiler, ②accumulating metal sludge in the bed caused by wire of waste tire. However, we were finally able to solve these problems by reviewing operation methods and starting to check quality of fuels frequently. Although we are operating the new boiler stable now, we still have 2 issues, such as outflow problem of sand from the bed and determining a continuous operating period in the future. On the other hand, CO<sub>2</sub> emission has been decreased by increasing utilization rate of the new boiler. Therefore, we predict we will be able to achieve the target, reducing 90,000 tons-CO<sub>2</sub>/year, as original plan.

### **The Activities for Energy Saving in Ohe Mill**

Shoya Ishikawa  
Ohe Mill, Marusumi Paper Co., Ltd

Various climate changes such as global average temperature rise and sea level rise are occurring, and as interest in environmental issues is increasing day by day, the reduction of greenhouse gas emissions has become one of the important global issues.

In order to realize the "2050 carbon neutral" declared by the government in the fall of 2020, the "Shikoku Chuo City Carbon Neutral Council" was established in Shikoku Chuo City, where the Ohe Mill Marusumi Paper Co., Ltd. is located. We are promoting various measures based on the recognition that it is necessary to work on the use of new fuels and the recovery of CO<sub>2</sub>.

In addition, the Energy Conservation Law also requires a reduction in energy consumption per unit by an average of 1% or more per year, and due to the impact of soaring raw material and fuel prices and the appreciation of the yen, energy conservation activities are not only aimed at reducing CO<sub>2</sub> emissions, but also reducing production costs. It is an activity that must be tackled from all aspects.

This paper introduces the energy-saving activities of the Ohe Plant, which replaces the cooling steam of the oil gun for combustion support of the fluidized bed boiler with combustion air.

## **Activities for Energy Saving in Takaoka Mill**

Satoshi Masugi  
Takaoka Mill Chuetsu Pulp & Paper Co.Ltd

The paper industry is an energy-intensive industry, and energy saving activities are an effective means for environmental issues and cost reduction.

Our factory has made efforts for energy saving activities throughout the factory and has achieved goals.

However, with the progress of activities, effective projects are decreasing and in recent years it has been difficult to achieve more energy saving targets.

In order to acquire energy saving benefits at this factory, we are working to raise employee's awareness of energy conservation and find out new projects, mainly by members of energy conservation management committee.

Here, we introduce examples that our factory has implemented.

## **Challenges of Energy Saving in Kasugai Mill**

Shota Oi  
Kasugai Mill,Oji Paper Co.,Ltd

Kasugai mill is working on the environmental objectives for ISO14001, such as promoting energy conservation, reducing waste and use of sustainable resources, recycling of used paper.

In order to enable achievement of that, we set a goal 『Total primary energy reduced by 1.5% year on year』 and challenge together. This report introduces several examples of energy savings regarding lime Kiln in Recausticizing process and also CFB (biomass boiler) plant.

## **Andritz proposal for CO<sub>2</sub> reduction at pulp mill - Sootblower ACE for recovery boiler-**

Shuhei Yamamoto  
Service Sales Group, Andritz K.K.  
Takahiro Hanazawa<sup>\*4</sup>  
Engineering Service Group, Andritz K.K.  
Kanji Hagiwara  
Fellow, Andritz K.K.

As of and after the summer of 2022, Japanese pulp & paper mills are likely to be in a very difficult situation in terms of energy-related matters. Challenges include meeting the CO<sub>2</sub> emission limitation targets set out at COP26, strong demands from customers to reduce coal usage for the mills, rapidly rising fossil fuel costs (coal, crude oil, natural gas), and rapidly soaring raw material costs due to unstable international conditions and the weaker Japanese yen. Japanese P&P mills are required to take strict measures to reduce energy and cost, based on the situation of their factories. We will introduce some of ANDRITZ's technologies that can respond to the customers' situation. In addition, we will introduce the Sootblowing ACE, a technology unique to ANDRITZ, to the sootblower used in recovery boilers as an IT technology.

## **Valmet Technology for Energy Saving and Reducing CO<sub>2</sub> Emissions in Pulp Mills**

Yoshiro Nishihara

Pulp & Energy, Services business Line, Valmet K.K.

In the industrial sector, including the pulp and paper industry, energy saving and reduction of CO<sub>2</sub> emissions, including conversion to renewable fuel from fossil fuels, are the most significant challenges for sustainable development in the future. In the pulp and paper industry in Japan, energy saving of pulp and paper mills is explored to meet the 2030 CO<sub>2</sub> emissions reduction target. Valmet has a comprehensive global sustainability business and is developing technologies to reduce CO<sub>2</sub> emissions in the use phase of Valmet's technologies.

The introduction of the Valmet ImpBin™ - atmospheric pressure impregnation vessel- and the conversion of an existing 1-vessel digester to a Valmet OptiCook™ are typical examples of energy saving in pulp mills.

Both modifications enable to achieve high yield cooking by allowing sufficient chemical impregnation into inside of chips at low temperatures and long impregnation time, and to reduce steam consumption by lowering the cooking temperature.

Another example of energy saving in the washing stage is the introduction of DiConn™ with a pressure diffuser (PD) at digester blow line and Valmet TwinRoll Press Evolution™ press washing machine at brown washing stage. The former results in washing at higher temperatures in the PD, which increases the temperature of the C8 extraction liquor as well as washing efficiency, leading to a increase of steam generation in the flash cyclones. The latter is installed in the final stage of the unbleached washing stage to reduce the amount of washing liquor used while improving or maintaining washing efficiency, and to reduce the amount of black liquor sent to the evaporator, which results in a reduction in steam consumption at evaporation process.

The lignin recovery and the methanol recovery facilities from pulping process provided by Valmet have the potential to produce fuel and generate new revenue sources for the mill.

The lignin recovered in the former is expected to become a new source of revenue for mills through the development of new applications or can be used as biofuel at a lime kiln. In the latter, liquid methanol with low NO<sub>x</sub> and SO<sub>x</sub> content can be refined and is expected to be used for raw material or fuel and marketing purposes.

### **Revision of the JIS P 8150**

#### **Paper and board - Determination of color by diffuse reflectance - Indoor daylight conditions (C/2°)**

JAPAN TAPPI, Pulp and Paper Testing Standards Committee

JIS P 8150 Paper and board — Determination of color by diffuse reflectance — Indoor daylight conditions (C/2°) specify a procedure for measuring the color of paper and board by a reflectometer. This standard has been revised to the second edition for harmonization towards ISO 5631-1 standard. Harmonization with corresponding ISO standards is intended to avoid confusion over test methods and facilitate trade. This second edition cancels and replaces the first edition published in 2004.

The main changes of this edition are as follows:

- 'Indoor daylight conditions' has been added to the title.
- Equipment calibration procedure measuring test pieces containing fluorescent whitening agents have been detailed.
- Weighting functions for obtaining tristimulus values using an abridged spectrophotometer with bandpass correction, have been added.
- The units for reading values have been changed from 0.05unit to 0.01unit, and JIS Z 8401 about rounding of numbers has been deleted.
- Editorial and other changes have been made to first edition.

## CONTENTS

### Energy Saving II

- 1 Case Study of Energy Saving at PM6 after Conversion.....Tomoyuki Fujimoto
- 4 Energy Saving by Updating the Instrument Air Supply System.....Akira Hayashi
- 11 Steam System Optimization and Case Studies in the Paper Industry for Carbon Neutrality.....Suguru Onda
- 16 Company-wide Steam Traps Upgrade for Energy Saving.....Hideharu Yoshimura
- 21 Energy-saving and CO<sub>2</sub> Reduction by Means of Fuel Conversion and Other Measures.....Tatsuya Bandou
- 26 Energy Savings through the Renewal of the Gas Turbine Cogeneration System.....Hironori Nishiura
- 31 Energy Saving and Work Environment Improvement by Heat Shield Material "Top Heat Barrier".....Teruyuki Fukushima
- 33 Development of Ammonia Combustion Technology Development for Coal Fired Power Station.....Shinji Masaki
- 38 Low-carbon and Decarbonization Approaches for Thermal Energy  
—Importance of Decarbonizing Across the Continuum from Low-carbon Measures in the Transition Period—.....Hiroshi Yoshida

### Topics & Information

- 45 Performance Improvement for an ESP, by Replacing T/R sets, Internal Parts and/or by Upgrading to SIR<sup>®</sup> (Switching Integrated Rectifier) .....Toru Wada
- 48 Implementing the Process Optimization Control System (Advanced Model Predictive Control) for the Recovery Boiler.....Mitsuhiko Chiura
- 52 Let's Go Further than Visualization of Product CO<sub>2</sub>  
—Introduction of Efforts to Reduce CO<sub>2</sub> Emissions—.....Tadahiro Yamada
- 56 The Improvement of Work Efficiency in Containerboard Warehouse by Using DX and Automatic Devices.....Masahiro Shishido

- 03 Committee report
- 62 Coffee break
- 63 Papyrus
- 68 Industry News (Domestic and International)
- 72 List of Patents issued and Laid-open Publication
- 80 Price list of Domestic Logs and Wood Chips by District
- 81 Other Monthly Statistics
- 83 News from the Association



### **Case Study of Energy Saving at PM6 after Conversion**

Tomoyuki Fujimoto

No.4 Production Department, Niigata Mill, Hokuetsu Corporation

PM6 of Niigata Mill, started operation in 1986 as the first on-line coater machine in Japan, finished its role and it was shut down in 2019 in order to restructure production capacity of coated printing paper. After conversion, PM6 restarted commercial operation in March 2020 as the first corrugating medium paper machine in Niigata Prefecture.

This conversion is a rebuilt from an on-line coater machine to a corrugating medium paper machine for corrugated board, and since the suitability of the production line different due to a difference in product properties, efficient utilization of equipment is an issue. In particular, there is a lot of room for improvement in terms of energy efficiency, and several improvements have been planned for the purpose of energy saving after conversion. In this article, bypassing of the double disc refiner and drive load reduction at wire section are reported.

### **Energy saving by updating the instrument air supply system**

Akira Hayashi

Kushiro Mill, Oji Materia Co,Ltd

In Kushiro Mill, instrument air was supplied from three compressors via two dehumidifiers.

Production of the main aircraft, the #8 turbo compressor, was discontinued in 2003 and parts supply was discontinued at the end of March 2014, and spare parts arranged before the discontinuation of parts supply were used and depleted due to subsequent repairs, making it difficult to maintain the equipment.

In addition, consumption rate of instrument air in our mill was inferior to other mills in our company, and we started activities to improve it from 2018. After we determined the amount of instrument air supply required for our mill, we updated the instrument air supply system in 2021 in conjunction with the renewal of aging equipment.

## Steam System Optimization and Case Studies in the Paper Industry for Carbon Neutrality

Suguru Onda  
TLV CO., LTD.

Steam System Optimization Program (SSOP®) is a sustainable asset management program that continuously optimizes the performance of the entire steam system through visualization. SSOP® consists of optimizing all condensate discharge locations (Best Practice of Steam Trap Management, BPSTM®) and optimizing all steam applications and the entire steam system (CES® Survey).

CES® Survey identifies the potential from reducing the overall plant energy consumption, analyzes the balance between steam and electricity using Steam System Balance Simulator which is developed by TLV, proposes the potential improvement for each opportunity, and identifies risks in the steam system. Optimization through the CES® Survey progresses in the following four steps. 1st: consultation and on-site survey, 2nd: identifying and tailoring the potential solutions, 3rd: engineering and design, 4th: confirmation of the improvement effect. This survey puts importance on the investment profitability of each opportunity. On average, 69% of the opportunities proposed have a payback period of less than two years.

5 example proposals made for paper industry plants are shown in this paper. The first example is the reduction of vented steam from the deaerator. The vent valve is sometimes not adjusted according to the steam production rate. If the vented steam flow is larger than the appropriate amount, adjusting the valve can reduce energy loss without requiring any investment costs.

The second example is for flash steam recovery from a boiler blow-down. Boilers in the paper industry generate a lot of high pressure steam. This means that there is a huge heat loss if blow-down water is not utilized. In this example, the solution was a flash vessel to recover flash steam from blow-down water as low pressure steam.

The third example is for flash steam recovery from a digester which uses a lot of high pressure steam. The steam condensate is usually recovered to the boiler, however flash steam is not utilized. In this example, flash steam is recovered to heat water using a heat exchanger that is open to the atmosphere. Using this specific heat exchanger, no additional back pressure is exerted on the digester. This is an important point when designing heat recovery systems.

The fourth example optimizes heat recovery in the drainage system of a paper machine. There are significant heat losses in the condenser due to the flash steam amount exceeding the demand. This example proposes using an ejector to recover additional flash steam and reduce heat loss to the cooling water.

The last example is the self-circulating system for a Yankee dryer. A Yankee dryer is one of the steam applications where condensate can be difficult to be discharged. The user had opened the bypass valve of the steam trap to discharge condensate, resulting in steam losses. In this example, the introduction of the self-circulating system has allowed the user to keep the bypass valve closed during production.

### Company-wide steam traps upgrade for energy saving

Hideharu Yoshimura  
Technical & Engineering Div. Nippon Paper Industries Co., Ltd

This report explains that we implement the system that periodically upgrades the failure steam traps to new optimized ones during maintenance as per mill. The system works to maintain discharging condensate under optimal conditions for our mills. Throughout the year, the system also contributes steam saving at a maximum although the energy loss of one steam trap have an insignificant impact because our mills have hundreds of steam traps.

## **Energy-saving and CO<sub>2</sub> reduction by means of fuel conversion and other measures**

Tatsuya Bandou  
Komatsushima Plant, LINTEC Corporation

Measures for addressing the climate change have been attracting increasing attention in a global manner, Japanese government has declared to realize “Carbon Neutrality by 2050”. In addition, a new policy was announced to set a new greenhouse gas reduction target for FY2030, aiming to reduce greenhouse gas emissions by forty six percent from FY2013 levels while continuing strong efforts in its challenge to meet the aggressive goal of cutting its emission by fifty percent. Since our company routinely emits greenhouse gas, it considers it is one of the most significant issues and is implementing countermeasures to fulfill our social responsibility.

This paper describes some facilities for energy-saving and CO<sub>2</sub> reduction by means of fuel conversion and other methods at Komatsushima plant, LINTEC Corporation.

## **Energy savings through the renewal of the gas turbine cogeneration system**

Hironori Nishiura  
Otsu Paperboard Co.,Ltd.

Otsu Paperboard Co., Ltd., located on the shores of Lake Biwa in Otsu City, southern Shiga Prefecture, has placed the highest priority on efforts for environmental protection and has been manufacturing and selling environmentally friendly paperboard (base paper for corrugated cardboard) since commencing operation in 1955. In January 2004, the company switched its fuel from heavy fuel oil C to city gas and started to operate a GTCC system (gas turbine combined cycle, total power output 12,910 kW), where the gas turbine cogeneration was newly incorporated into the existing BTG system (power generation boiler and steam turbine). However, as a result of the significant reduction of electricity and steam consumption on premises due to continuous energy saving activities, overall energy efficiency decreased and the aging GTCC system needed renewal. Against this backdrop, we achieved 4.2% energy savings and 6.0% reduction in CO<sub>2</sub> emissions by upgrading the facilities to the optimal system suited for the current situation. This paper will discuss how we upgraded our facilities and show some examples of energy savings and CO<sub>2</sub> reduction.

## **Energy saving and work environment improvement by heat shield material "Top Heat Barrier"**

Teruyuki Fukushima  
NIHONSHANETSU

Heat shielding materials can be used in all kinds of industries and construction sites (roofs, walls, floors, equipment, cars, pets, tanks, tents, refrigeration, freezers, helmets), which are energy-saving materials with infinite possibilities. Although there are ups and downs depending on the surrounding environment and conditions, energy savings of about 30% can be expected.

## **Development of Ammonia combustion technology development for coal fired power station**

Shinji Masaki  
IHI Corporation

Toward zero carbon dioxide emissions by 2050, IHI aims to realize a decarbonized recycling-oriented society and a comfortable, secure, autonomous and distributed community. On the other hand, for ammonia, we are working to build an ammonia supply chain by participating not only in the ammonia utilization technology introduced this time, but also in the production side business.

## **Low-carbon and Decarbonization Approaches for Thermal energy**

### **-Importance of decarbonizing across the continuum from low-carbon measures in the transition period-**

Hiroshi Yoshida

Sales & Service Sect. Industrial Energy Sales & Service Dept  
TOKYO GAS Co., Ltd.

The wave of carbon neutrality that originated in Europe has been rapidly expanding on a global scale since 2019, and the realization of a carbon neutral society by 2050 is a common challenge for all humankind. In Japan, after the declaration of carbon neutrality in November 2020, companies are rapidly striving to become carbon neutral.

While the use of renewable energy sources is expanding to green electricity, heat demand accounts for 60% of Japan's energy consumption in the consumer and industrial sectors, so decarbonizing heat energy will be a key issue for achieving carbon neutrality in 2050. The key to decarbonizing thermal energy is "green hydrogen. In order to implement and expand the use of green hydrogen in society, it is essential to balance it with economic efficiency, and we believe that the use of "e-methane" is an effective way to achieve this.

The following is the latest status of various activities aimed at realizing the decarbonization of thermal energy through the large-scale social implementation of "e-methane".

### **Performance Improvement for an ESP, by Replacing T/R sets, Internal Parts and/or by Upgrading to SIR® (Switching Integrated Rectifier)**

Toru Wada

Environmental Control Solutions Group, Andritz K.K.

Electrostatic Precipitators (ESPs) for Soda Recovery Boilers often experience difficult process and aged parts conditions from their years of service, resulting in high dust emissions. Depending on the root cause, ESP performance can be improved by upgrading the mechanical and electrical ESP equipment. This paper will discuss various solutions to improve aged ESP performance;

- ESP Internal parts
- T/R set and EPIC controller
- SIR® (Switching Integrated Rectifier)

### **Implementing the process optimization control system (advanced Model Predictive Control) for the recovery boiler**

Mitsuhiko Chiura

MPM OPERATION Co., Ltd.

Power generation facilities at Hachinohe plant of Mitsubishi Paper Mills Limited consist of a coal-fired boiler, a waste boiler, black liquor recovery boilers and steam turbines. These facilities are being operated to supply energy to manufacturing processes both the steam and power demands fully while using many fuel sources such as heavy oil, coal, black liquor and waste efficiently.

Recently, we introduce the implementing the process optimization control system(advanced Model Predictive Control) for the recovery boiler. The system has solved some operating problems and reduced power generation costs.

### **Let's Go Further than Visualization of Product CO<sub>2</sub>.**

#### **-Introduction of Efforts to Reduce CO<sub>2</sub> Emissions-**

Tadahiro Yamada

Solution Business Division Consulting Center Consulting Dept.2, Yokogawa Solution Service Corporation.\* 2

This paper describes the global situation toward achieving carbon neutrality and its impact on Japan, and introduces the importance of working to reduce CO<sub>2</sub> emissions.

YOKOGAWA's efforts, including case studies, will be proposed to address the issue of the lack of utilization of "visualization" systems that have been introduced.

## **The Improvement of work efficiency in containerboard warehouse by using DX and automatic devices**

Masahiro Shishido

Paperboard Engineering Development Group, Rengo Co., Ltd.

The Rengo Yodogawa Logistics Center, which started operation in September 2021, introduced a truck management system and picking application developed in-house, the Japan's first laser-guided automatic clamp lift, and an RFID system.

The truck management system is effective for sharing information and improving work efficiency for logistics personnel, and the picking application is effective for pre-loading at the Yodogawa Distribution Center. The average staying time of trucks at the Yodogawa Distribution Center is less than 30 minutes, which greatly contributes to reducing the waiting time of truck drivers.

The RFID system enables automatic reading at the time of warehousing in the automated warehouse and at the time of shipping from the Logistics Center, and the latter leads to a reduction in the incidental work of the truck drivers and safety measures. RFID initiatives will be used in downstream corrugated cardboard factories in the future, and have already contributed to the reduction of receiving time using one factory as a model, and it is expected that they will be expanded to other factories and the entry of other companies.

## CONTENTS

### Pulp

- 1 Report on 28<sup>th</sup> Pulping Seminar.....Pulp Technical Committee, JAPAN TAPPI
- 4 Life Cycle Assessment (LCA) Basic Method and Recent Trends.....Atsushi Inaba
- 12 Methods for Evaluating the Morphology of Cellulose Fibers at Each Size  
—From Pulp Fiber to Nanofiber.....Ryota Kose
- 17 Pulp Mill without Fossil Fuel  
—Carbon free Lime Kiln.....Keisuke Tanaka
- 21 Basics and Applications Cases of Model Predictive Control in Kraft Pulp Processes  
.....Nozomu Wada
- 26 Kraft Pulp Process Inspection Service by Andritz.....Ryo Yoshida and Kanji Hagiwara
- 31 PulpEye Pulp Analyzer Delivers Mill Cost Savings and Process Performance  
Improvements  
—On-line Fiber Properties and Real Time Data Transformation Enabling Process  
Performance and Product Quality Improvements.....Katsuhiko Yokoyama
- 38 Valmet Cooking Process for Low Bulk Density Chips and Energy Savings in the  
Cooking Process.....Yoshiro Nishihara
- 43 Pitch Control Agent for the Kraft Pulping Process.....Takuji Sodeyama
- 48 Current Situation and Future Prospects of Paper Recycling in Japan.....Shogo Hamano
- 54 The Latest Detrashing Technology with Intensa Series.....Satoshi Orido
- 60 Advanced Technology of Handling Recycle Papers with Wet-strength.....Jiro Urata
- 65 Initiatives for Carbon Neutral Society in the Use of Ammonia.....Kazuhiro Watanabe
- 70 Development and Evaluation of Cooking Accelerators That Contribute to  
Building a Carbon-Neutral Industry  
—Collaboration with the RISE Research Institutes of Sweden AB.....Takashi Tanaka,  
Toshio Yamada, Mayumi Yasumoto, Lars Sundvall, Mats Westin and Robin Westin

### Topics & Information

- 78 The Operating Experience of Kneader.....Yoshihiro Uotani
- 82 Realtime Prediction Model with using Single Point Morphology SPM-5500  
—One of the hottest topics in P&P Industry=Visualization of Fiber Morphology—  
.....Ryohei Watanabe, Hiromasa Matsuno, Nozomu Wada and Kukjin Yoon

### Introduction of Research Laboratories(152)

- 90 School of Agriculture, Utsunomiya University  
Department of Forest Science, Forest Products Laboratory  
Graduate School of Regional Development and Creativity, Division of Engineering  
and Agriculture, Graduate Program in Agricultural Biological Chemistry  
Tokyo University of Agriculture and Technology, United Graduate School of  
Agricultural Science, Department of Symbiotic Science of Environment and  
Natural Resources, Major Chair of Science of Forest Resources and Ecomaterials

- 03 Committee report
- 89 Essay on Intellectual Property
- 92 Coffee break
- 93 Industry News (Domestic and International)
- 98 List of Patents issued and Laid-open Publication
- 105 Price list of Domestic Logs and Wood Chips by District
- 106 Other Monthly Statistics
- 108 News from the Association

## **Life Cycle Assessment (LCA) Basic Method and Recent Trends**

Atsushi Inaba

President, Japan Life Cycle Assessment Facilitation Centre (LCAF)

Recently, the calculation of greenhouse gas (GHG) emissions of products and organizations using life cycle assessment (LCA) has paid attention in the direction to realize "carbon neutrality". The International Standards (ISO) for LCA of products (ISO 14040:2006 and ISO 14044:2006) are the method to assess diverse environmental impacts of products, but it has been refined with the publication of the ISO Carbon Footprint (CFP) (ISO 14067:2018), which assesses only the impacts of GHG emissions. In addition, there are ISOs for LCA and CFP for companies and other organizations. Furthermore, Scope 3 standard published by the GHG Protocol is used by many companies as a calculation method for CFP of organizations. This paper explains the basic method of LCA presented in ISO14040:2006 and ISO14044:2006 and the differences between these ISOs and ISO14067:2007 for CFP and other methods including Scope 3 standards for organizations.

## **Methods for evaluating the morphology of cellulose fibers at each size -From pulp fiber to nanofiber-**

Ryota Kose

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Tokyo University of Agriculture and Technology

The pulp & paper industry can produce fibers of various sizes and morphologies, ranging from pulp fiber to CNF. The effective utilization of all those cellulose fibers is an important issue for the pulp & paper industry, both economically and environmentally. Pulp fibers are hollow fibers with a wall structure. This wall structure is a laminated sheet structure consisting of oriented cellulose microfibrils with a width of about 3 nm. The process of refining pulp fibers to CNFs complicates the fiber morphology and improves the aggregation of the fibers. As a result, while pulp fibers can be recognized as a "single fiber" with both ends clearly observable, it is difficult to recognize fine fibers as a "single fiber". When there are fibers with different widths at a multiscale, not all fibers are captured in the image observed with a microscope at a constant magnification. At low magnification, pulp fibers can be observed, but not CNF. Conversely, at high magnification, CNFs can be observed, but the entire outline of the pulp fiber cannot be observed. To evaluate fiber morphology for such fiber groups, there are approaches to narrow down the evaluation target to only pulp fibers or CNFs, and or extract averaged information on the morphology and size of fiber groups by optical methods, etc.

## **Pulp mill without fossil fuel -Carbon free Lime kiln-**

Keisuke Tanaka

Energy Group

Pulp & Energy Technology, Valmet KK

The pulp and paper industry in Japan have been working to reduce the use of the fossil fuel, however the Lime kiln still uses fuel oil to calcinate the lime mud. The overall kraft pulping process is explained in the beginning of this paper, specially how the lime kiln is involved.

Then two of most commonly used, technology to replace fossil fuel with biomass based heat sources for lime kiln at production level in recent days are introduced.

First technology is the wood power incineration which takes relatively clean wood, dry and grind them to control burning speed and efficacy, and inject to the kiln through burner in the form of powder. The second technology is the CFB gasification technology, which takes biomass, and partially burn them using less than theoretical amount of oxygen in the fluidized bed reactor to create combustible gas and at the same time, remove contamination along with ash.

## **Basics and Applications Cases of Model Predictive Control in Kraft Pulp Processes**

Nozomu Wada

Voith Turbo Co., Ltd. BTG Japan, Process Solutions

Since later of 2010s, we are now going on a rapid growing stream of development of Factory automations as beyond of the last generation's digitalization. In this generation, the automation system can utilize big data with high frequent scanning and calculations which includes tons of information, such like process values, quality check results, production stocks, production plan, PID loop status and so on.

Voith's OnEfficiency solutions (BTG's MACS solutions has been integrated into it and renamed as OnEfficiency.pulp) provides predictive control based on the prediction models which considers much complicated multiple cross-correlations between each unit operations in Kraft Pulp Processes which can provided by the above background technologies.

In this paper, the basics of Model Predictive Control (MPC/APC) and application cases are introduced as which may be useful at pulp mill's pre-considering for implementation.

## **Kraft Pulp Process Inspection Service by Andritz**

Ryo Yoshida

Capital Sales Group, Andritz K.K.

Kanji Hagiwara

Engineering department, Andritz K.K.

The pandemic of COVID-19 and Russian aggression in Ukraine have caused the cost of imported raw materials, energy, and transportation to skyrocket in a short period of time. In addition, as in the past, extreme weather conditions continue to occur every year, and even under these circumstances, there is still a strong demand for CO<sub>2</sub> emission reductions, and measures to reduce CO<sub>2</sub> emissions and actions against increasing energy costs at paper mills have become inevitable.

These factors will require a major change in the way kraft pulp mills have been thinking about operating cost management.

The kraft pulp process is an important one that produces the main energy for the mill, but it is also a process that consumes large amounts of energy, raw materials, and utilities. It is time to review the operation of this process from a different perspective, and to consider and implement measures to reduce costs.

Therefore, Andritz has started a service in Japan to study cost reductions, operational improvements, and CO<sub>2</sub> emission reductions by surveying the problems and cost reduction potential in the mills.

In this presentation, we will introduce overseas investment trends and explain our current kraft pulp process survey service.

## **PulpEye Pulp Analyzer Delivers Mill Cost Savings and Process Performance Improvements**

**-On-line fiber properties and real time data transformation enabling process performance and product quality improvements-**

Katsuhiko Yokoyama

MATSUBO Corporation, Group 2 Industrial Machinery Dept.3

The state of the art for in-line real time fiber properties measurement and analysis is the PulpEye™ which, coupled with Pulp on Target, delivers real time fiber and pulp quality information which can be used to confirm the stability of products or, if deviations are detected, for process troubleshooting. This article will introduce the PulpEye™, the novel modules which deliver unique fiber quality distribution data and how significant process improvements and costs savings can be achieved through the use of multivariate statistical software ExtractEye™.



## **Valmet cooking process for low bulk density chips and Energy savings in the cooking process**

Yoshiro Nishihara

Pulp & Energy, Services business Line, Valmet K.K.

In recent years, the increase of mega-sized pulp mills and changes in chip quality have become increasingly evident. When using conventional cooking processes, it is difficult to maintain stable operation and cooking yield due to insufficient chip pre-treatment and the deteriorating environment in the mill.

Moreover, in the industrial sector, including the pulp and paper industry, energy saving and reduction of CO<sub>2</sub> emissions, including conversion to renewable fuel from fossil fuels, are the most significant challenges for sustainable development in the future. In the pulp and paper industry in Japan, energy saving of pulp and paper mills is explored to meet the 2030 CO<sub>2</sub> emissions reduction target.

The introduction of the Valmet Continuous Cooking™ with Valmet ImpBin™ - atmospheric pressure impregnation vessel- and the conversion of an existing 1-vessel digester to a Valmet OptiCook™ are typical examples of energy saving in pulp mills. The low temperature and adequate retention time of impregnation allows for low reject and high yield in cooking, while the stability of the chip column provides excellent operational stability. In addition, the low reject rate by good impregnation is very suitable for production of pulps with high kappa number.

Both modifications will also contribute to energy savings. Improvements in chip pre-treatment and impregnation are expected to save steam, and improvements in the cooking process are expected to reduce the amount of chemicals used in the following fiber line.

## **Pitch Control Agent for the Kraft Pulping Process**

Takuji Sodeyama

Paper Chemicals Development, R&D Center, R&D Company, Harima Chemicals, Inc.

Pitch reduces the productivity of the Kraft pulping process by lowering pulp quality and shortening equipment lifespan. The pitch in the process exists as colloids that mainly consist of wood-derived resin acids. It becomes unstable and builds up deposits when the concentration of resins in the system increases or the water pH decreases. A conventional and primary strategy to prevent pitch problems is to improve the pulp washing process with equipment and adding talc to deactivate pitch, but these methods are not always sufficient to prevent the problems. In such cases, adding a pitch control agent to the pitch controlling system is an effective solution to eliminate residual pitch.

We have developed a pitch control agent, the "AS series", which disperses pitch as stable fine particles and retains them on the fiber surface without any adverse effects on pulp qualities. The pitch is stabilized by the AS series and discharged from the Kraft pulping process with the pulp.

This paper describes pitch problems in the Kraft pulping process and paper manufacturing process, as well as solutions using pitch control agents, including the AS series.

## **Current Situation and Future Prospects of Paper Recycling in Japan**

Shogo Hamano  
Paper Recycling Promotion Center

Demand for paper and paperboard fell sharply in 2020 because of the temporary closure and remote working as well as a decline in inbound tourists as a result of the spread of Covid-19. It showed a slight recovery in 2021 and 2022 as economic activity picked up.

Amid these demand trends, a look at recovered paper collection by type shows that the volume of old corrugated containers collected decreased slightly in 2022. Nevertheless, since the production and consumption of containerboard are steady, the recovery is expected to be slight increase or flat for some time to come.

The volume of old newspapers collected has been declining year by year due to the digitization of newspapers and a decrease in inserts and so on. Under Covid-19 pandemic the issuance of inserts further decreases, then the amount of old newspapers collection is likely to continue to decline. Paper manufacturers' procurement of old newspapers will become more difficult, and they may need to consider alternative raw materials in the future.

The volume of old magazines collected is decreasing due to the digitization of magazines, but the decline is slower than that of old newspapers because of the progress in the collection of Sorted residential old paper and paperboard. However, if the collection of those papers is promoted, the quality of old magazines will further deteriorate. Therefore, paper mills that use old magazines in the future will need to consider adapting their facilities.

### **The latest detrashing technology with Intensa series**

Satoshi Orido  
Voith IHI Paper Technology Co., Ltd.

For the detrashing system of pulping stage, more effective machine is required because the contaminants ratio of raw material is getting increase recently. The IntensaMaXX and IntensaScreenDrum is the detrashing machine which fulfills the request for better detrashing operation. The IntensaMaxx is rotor and screen plate are located at the top of the tank, and this layout prevents wearing and jamming by heavy contaminants. The rotor axis is located as eccentric against the center axis of the vat. This layout prevents strong centrifugal flow and also growth of long contaminants. The piping layout is also considered for the better reject removal. The IntensaScreenDrum is equipped with powerful cleaning power and rotation speed control by INV. By controlling the INV, it is possible to set the cleaning and dehydration performance as desired. The introduction of the latest detrash enables more efficient and stable operation, and it is possible to aim for optimal power consumption and wear rate.

### **Advanced Technology of Handling Recycle Papers with Wet-strength**

Jiro Urata  
AIKAWA Iron Works Co., Ltd.

The pulp & paper industry has been developing an optimization of all equipment that meets a requirement of an environmental preservation such as decreasing waste and saving energy.

On the other hand, we are now facing a problem that it is getting more and more difficult to procure recycle papers in good quality in the Japanese market, due to the influence on an increasing recycle paper export to China and other Asian countries. It is therefore predicted that we must use low quality recycle papers as a raw material for paper making processes. We then need to optimize the equipment in order to consistently maintain the paper making operations, while keeping the paper quality even the low quality recycle papers are used. This article introduces examples of the cases that focus on pulper & detrash process using the recycle papers with a lot of contaminants.

## **Initiatives for Carbon Neutral Society in the use of Ammonia**

Kazuhiro Watanabe  
IHI Corporation.

Thermal power generation has ability to adjust the fluctuations in the output of solar and wind power, as well as the inertial force that can mitigate frequency fluctuations in the event of a sudden power outage and plays an important role in expanding renewable energy. On the other hand, most of the fuels used in thermal power generation are fossil fuels such as coal, petroleum, and natural gas, and their combustion accompanies CO<sub>2</sub> emissions. Therefore, it is necessary to promote conversion to carbon-free fuels that do not emit CO<sub>2</sub> toward zero CO<sub>2</sub> emissions in thermal power generation. One of the promising ones is ammonia. It is easy to liquefy, has a higher hydrogen density per volume, which are superior characteristics in terms of transport and storage compared to other energy carriers.

This presentation introduces the development trends of ammonia utilization technology in coal fired boilers and gas turbines. In coal fired boilers, we have developed 20% ammonia co-firing burners that can reduce NO<sub>x</sub> emission and unburned carbon to the same level as 100% coal firing. In gas turbines, we have developed combustors focused on stable combustion of liquid ammonia and reducing emissions that can reduce GHG emissions by more than 99%.

## **Development and evaluation of cooking accelerators that contribute to building a carbon-neutral industry - Collaboration with the RISE Research Institutes of Sweden AB. -**

Takashi Tanaka, Toshio Yamada and Mayumi Yasumoto  
Product Development Department  
Institute of Surface Science and Technology, Chemicals Unit  
Nikka Chemical Co.,Ltd

Lars Sundvall, Mats Westin and Robin Westin  
RISE Research Institutes of Sweden AB.

As indicated by the Japanese government's 2050 Carbon Neutral Declaration, efforts to achieve a decarbonized society are becoming an increasingly important issue. Using forest resources is one of the effective means to realize a sustainable carbon-neutral society.

As a method for producing pulp from lignocellulose materials of plants such as wood, digestion using alkali or sulfite is generally used. After the lignin component is mainly decomposed by this cooking treatment, the lignin is removed by filtration and washing to produce pulp.

Although natural resources such as timber are recyclable, excessive deforestation is regulated from the point of view of environment and ecosystem preservation, and the price of timber is increasing. Therefore, in the production of pulp, for example, it is becoming important to increase the amount of pulp produced per unit of raw wood and to produce high-quality pulp products.

As a method to solve these problems, there is a method of using cooking aids (accelerators) for the purpose of increasing the efficiency of cooking and improving the yield of pulp per unit of raw wood. Furthermore, in recent years, there has been a demand for safer digestion accelerators.

This time, we explored various compounds, repeated laboratory evaluations, and developed a new digestion accelerator. However, in order to grasp the cooking capacity more accurately, we thought that an evaluation that reproduced the industrial process was necessary.

Under these circumstances, we contacted the RISE Research Institutes of Sweden AB.

(RISE) and conducted an evaluation of a new digestion accelerator. As a result, it was observed that the pulp yield tended to improve compared to the case where it was not used. Evaluation is ongoing. At the same time, we visited RISE in June 2022, witnessed the laboratory evaluation, and observed the equipment and methods, etc., and found that the RISE cooking evaluation method was more reasonable.

In this presentation, we will explain the theoretical concept of the digestion accelerator developed by our company, and the method and results of the digestion test conducted at RISE.

## **The operating experience of kneader**

Yoshihiro Uotani

Amagasaki Mill production section, Rengo.,co.ltd

After the operation of the kneader facility, many advantages such as increased processing volume of the raw material process, improvement of raw material yield, and stable operation of the paper machine have been obtained. In particular, since the kneader equipment, which is usually used for the purpose of dispersing raw materials, processes the final reject raw material containing a large amount of adhesive foreign matter, there were some unexpected problems immediately after introduction, but now improvements have been made and resolved.

## **Realtime Prediction Model with using Single Point Morphology SPM-5500**

### **- One of the hottest topics in P&P Industry = Visualization of Fiber Morphology -**

Ryohei Watanabe, Hiromasa Matsuno, Nozomu Wada, and Kukjin Yoon

Voith Turbo Co., Ltd. BTG Japan

Paper such as tissue, corrugated board, packaging paper, and graphic paper is an indispensable necessity in the contemporary society, and at the same time, supports our daily lives, industries, and cultures. Graphic paper demand has been shrinking due to the IT development but on the other hand the Pulp & Paper Industry, who successfully circulates forests, energy, carbon emission, and products, has been recently reevaluated as an excellent resource-recycling industry in the world where SDGs is emphasized. The Plastic-Free is one of the major examples.

In Japan, the recovery rate of recycle paper is over 80% and utilization rate of the recycle paper is nearly 70%. This shows that the Japanese Pulp & Paper Industry is one of the top leading countries for the resource-recycling industry in the world.

Alternatively, by the influence of the expansion of the remote work related to the Covid-19, the curtailment of the graphic paper mainly made from the wood pulp has been further proceeded, and this has brought the situation that it become noticeably more difficult to get the high-quality recycle paper. And many paper mills have been trying to use the cheaper chips, that are generally hard to get the good paper strength. These factors have been the bottle neck for achieving the stable quality and operation at site.

The pulp fiber accounts for more than 80% of the paper body and about half of the paper production cost. The pulp fiber varies in the length, width, and fibrillation depending on the chip species, cooking way, and times of recycling.

The fiber Morphology is closely related to the paper quality, for example, softness on tissue, strength on corrugated board & packaging paper, printing quality on graphic paper. The freeness measurement has been applied in the paper manufacturing process as the way of knowing the fiber morphology for years.

The freeness measurement has been one of the good tool to control the important paper quality. But the production side has considered that there is limitation to correctly know the fiber morphology by only the fiber dewatering characteristics.

This article introduces SPM-5550, that is an In-line Fiber Morphology Analyzer, and reference of real-time prediction model for the important paper quality. This is the hottest “Visualization” and “Solution” in Pulp & Paper Industry provided by BTG who has struggled with customer’s critical success factors.

Our slogan is “Knowing Your Fiber. Would you please join us to solve your issue by the solution provided by the leading-edge company in this industry?”

## CONTENTS

### Papermaking Technology I

- 1 Report of the 27<sup>th</sup> Papermaking Technology Seminar  
.....Papermaking Technology Committee, JAPAN TAPPI
- 4 History of Coating Technology and Latest Trends.....Masahiro Nagahara
- 13 Transition and Latest Trend of Tape Turn-Up System  
—RCS/IBS Reel Changing System—.....Atsushi Kudoh
- 17 The Synthetic Rubber Cover for Applicator Roll.....Jun Furuya
- 22 Basic and Latest Technologies for Calender and Reel.....Toshihiro Katano

### Topics & Information

- 29 Operating Experience of Fibre Solve FSV(U) C pulper for Wet Strength Paper  
Machine Broke Handling.....Masafumi Sone
- 34 Foreign Matter Removal Technology in the Papermaking Process Using Low-  
grade Recycled Paper.....Tsuyoshi Yoshino
- 39 The SmartPapyrus Realizes Work Style Reform in Paper Mills (Part 1)  
—SmartPapyrus<sup>®</sup> 1.0 System That Classifies Defects by Origin—.....Takayuki Shimo
- 44 The SmartPapyrus Realizes Work Style Reform in Paper Mills (Part 2)  
—SmartPapyrus<sup>®</sup> 2.0 That Analyzes and Predicts the Occurrence of Defects—  
.....Hitomaru Sakata

### 52 76<sup>th</sup> JAPAN TAPPI General Meeting

- 03 Committee report
- 51 Coffee break
- 69 Papyrus
- 74 Industry News (Domestic and International)
- 78 List of Patents issued and Laid-open Publication
- 86 Price list of Domestic Logs and Wood Chips by District
- 87 Other Monthly Statistics
- 89 News from the Association

## **History of Coating Technology and Latest Trends**

Masahiro Nagahara  
Paper Sales, Valmet K.K.

In this paper, three main topics are described as technology and history of coating and air dryer. The first is the technical development of size press. Pond size, roll metering, application head size press, spray sizer and the latest Hard nip sizer are described. The technical development of some important coater heads is described secondly. Roll application, short dwell application, jet application blade coater and curtain coater are explained. The third is an update of an air nozzle of air dryer. This greatly contributes to improvement of drying capacity and energy saving. The screen and the deaerator which are the important device of sizing and coating supply system are introduced at the end.

## **Transition and Latest Trend of Tape Turn-Up System -RCS / IBS Reel Changing System-**

Atsushi Kudoh  
IBS Japan Ltd.

IBS Paper Performance Group introduced the first Tape Turn-up system (hereinafter – “RCS”) to paper market in 1986 and has delivered over 1,700 units in world-wide. In Japanese market, the first RCS1000 was introduced in 1999, and since then 82 units have been delivered and been operating. From the first-generation RCS1000, the second-generation RCS2000 to the third-generation RCS5000 and RCS3001-T, we supply consistent in-house productions except for some Automation products. We also provide in-house developed and manufactured paper tapes used for Turn-up. In addition, we provide our own regular maintenance service in view point of stable operation. This is because the turn-up system is in an important position to complete the papermaking process and is required to operate stably and accurately 24 hours a day.

## **The Synthetic Rubber Cover for Applicator Roll**

Jun Furuya  
Seibu Polymer Corporation

In recent years, the chemicals used for coating have become more diversified, and the rod metering size press, which supports faster machine speeds and space-saving, has become widespread. The environment in which applicator rolls are used is becoming more severe.

Polyurethane, which has high strength and excellent abrasion resistance, is often used for the coating material of the applicator roll. It is necessary to replace the roll every several tens of days, which is complicated in terms of management.

For the purpose of preventing swelling and peeling due to blistering of the applicator roll, we have developed synthetic rubber materials "Super Tempex SP" and "RPD-164" with excellent water and chemical resistance. In contrast to urethane rubber, which is highly hydrophilic and easily absorbs water, synthetic rubber can be made more water resistant by optimizing the grade of raw rubber and compounding agents.

A temperature difference was applied between the inside and outside of the roll, and an accelerated blister peeling test was carried out. While the urethane rubber peeled off in 4 days, the synthetic rubber could withstand 160 days.

## **Basic and latest technologies for calender and reel**

Toshihiro Katano

Technical Sales Dept., Voith IHI Paper Technology Co., Ltd

In the papermaking process, the surface of the paper after leaving the dryer part is rough and the structure is soft. Calendering applies pressure to the paper to densify the structure and smooth the surface to a specified thickness. Calendered paper is wound onto a roll shape by a reel for processing in the next process. In this process, the paper is required not only to have the required thickness, but also to have the required gloss and smoothness, and must be rolled up delicately so as not to spoil the gloss and smoothness. On the other hand, the demands of the times, such as increased productivity and differentiation from competing products, as well as technological advances, have led to the fusion and further subdivision of processes. As with other paper making process equipment, calenders and reels have also developed unique technologies to meet the specific requirements of each product type. This seminar reports the technological evolution of calenders and reels up to the present day, as well as the latest technologies.

In recent years, we have been focusing on machine inspection. Maintaining good condition maintains quality, which in turn leads to cost reductions. We will also discuss our efforts and actual cases.

## **Operating Experience of Fibre Solve FSV(U)C pulper for wet strength paper machine broke handling**

Masafumi Sone

Fuji Mill,Oji Materia Co.,Ltd.

Fuji Mill has two paper machines, one is N-1 and the other is N-2: N-1 produces all grades of corrugating medium from the general grade to water-resistant corrugating medium and N-2 is one of the largest paper machine in Japan and produces the white paperboard with excellent conversion suitability and printing effects, while the intermediate warehouse located in the back-end process area enables a quick delivery to the customers. The company installed a biomass boiler in 2015 and is working to reduce its environmental impact through the effective use of renewable energy and further use of recycled resources and also made a commitment to resource conservation and environmental protection. This paper introduces a case in which a machine pulper delivered by ANDRITZ was introduced to establish a stable operation of the broke treatment process during the new production of hard-to-pulping paper on the N-2.

## **Foreign matter removal technology in the papermaking process using low-grade recycled paper**

Tsuyoshi Yoshino

Design Department / AIKAWA IRON WORKS CO.,LTD.

In recent years, the used paper utilization rate has been around 64%, and while the SDGs are being called for, the goal of achieving a used paper utilization rate of 65% by 2025 has been set. We believe that the use of used paper will continue to increase. However, while the amount of used paper generated is decreasing due to the COVID-19 pandemic and the quality of used paper is also decreasing, the number of sticky foreign substances such as pitches increases and adheres to fabrics, causing poor water extraction, paper break and reduces productivity. Is increasing. At the same time, improvement of product quality is also required, and the situation where difficult problems must be tackled is increasing. In order to improve productivity and quality even under such circumstances, we will introduce measures to remove foreign substances in the papermaking process while using low-grade recycled paper.

## **The Smart Papyrus realizes work style reform in paper mills. (Part 1)**

### **-SmartPapyrus® 1.0 system that classifies defects by origin-**

Takayuki Shimo

Technology Development Team, MAINTECH CO., LTD Fuji Technology Development Center

Maintech has been providing paper machines with Dryer Section Passivation technology (chemical application combined with chemical product, equipment, and application methods) for over 30 years to prevent defect/sheet break due to dryer section depositions. As of July 2022, the number of applications being operated over the world has topped 800 units. In recent years, the number of problems caused by machine deposits has been increasing due to the worsening of the raw material of pulp situation. In addition, it is becoming increasingly difficult to respond to machine dirt deposits in a timely and appropriate manner due to the decrease in the working population at production sites and the retirement of experienced employees. To address this issue, we are developing "SmartPapyrus®", a system to prevent defects and sheet breaks by visualizing machine dirt deposits using IoT, analyzing it using artificial intelligence, and using machine dirt deposit prevention technology. For this reason, we developed SmartPapyrus® 1.0, a system that uses AI to automatically classify images of defects. SmartPapyrus® 1.0 makes it possible to determine in real-time when and how many defects have occurred.

As a result, the necessity and effectiveness of countermeasures can be quantitatively confirmed. In this report, we will introduce SmartPapyrus® 1.0 and discuss some examples of its use.

## **The SmartPapyrus Realizes Work Style Reform in Paper Mills. (Part 2)**

### **-Smart Papyrus® 2.0 that analyzes and predicts the occurrence of defects-**

Hitomaru Sakata

Technology Development Team

MAINTech CO., LTD Fuji Technology Development Center

In recent years, problems caused by machine deposit have been increasing in Japan due to the deterioration of recycled paper utilization rates and raw material conditions. Furthermore, quality requirements from corrugated board mills have become more stringent and reducing the defect rate has become a major issue.

In addition, with a shrinking workforce and the retirement of skilled workers, it is becoming increasingly difficult to respond to machine soiling in a timely and accurate handling. In response, we are developing "SmartPapyrus®," a system that visualizes machine deposits with IoT, performs predictive analysis of defects and paper breaks using AI, and prevents defects and paper breaks with machine deposit prevention technology. The goal of SmartPapyrus® is to eliminate defects and breaks in the papermaking process. The elimination of defects and breaks will reduce the amount of work required, and by eliminating wasteful work, not only will the machines be more productive, but also the workers will be able to focus on more productive work. Furthermore, by reducing the number of defective products due to defects and paper breaks, energy consumption can be reduced. This will contribute to decarbonization.

Therefore, we have started to develop a defect occurrence prediction analysis as SmartPapyrus® 2.0. SmartPapyrus® 2.0 receives machine condition data from DCS and QCS, in addition to SmartPapyrus® Ver.1 fabric deposit data and SmartPapyrus® 1.0 defect information and analyzes it using AI to detect signs of defects before they occur and to propose countermeasures to reduce defects. The system then analyzes the data to detect signs of defects before they occur and proposes countermeasures to reduce defects. In this report, we introduce an overview of the analysis of signs of defect occurrence and present a preliminary report on the Proof Of Concept (PoC) experiment.



## CONTENTS

### Papermaking Technology II

- 1 The Latest Winder Technology.....Hideki Maeda
- 5 SmoothRun/Active Damping Technology  
—Reduce Vibration During Winding Process—.....Kanato Mizukoshi
- 10 The Transition and Latest Trends of Roll Wrapping Machine.....Shinichiro Kaji
- 16 Sheeter Technology  
—Challenges and Innovation for Paper and Board Market—  
.....Noboru Matsumoto and Lorenzo Alba
- 22 Examples of Improvement in Finishing Process.....Shoichiro Kida
- 26 Web Inspection System Technology Trends.....Shuichi Shoda
- 32 The Key Points for Monitoring System to Achieve Efficient and Effective Pest  
Management.....Takeo Ishizaki

### Topics & Information

- 40 Control of Foam on White Water and Improvement of Operational Efficiency by  
Modeling a Soft Sensor.....Yusaku Okura
- 44 Development of Refining Technology.....Nobuhiko Okumura
- 50 —Foam Control Solutions that Evolve Day by Day—  
A Permanent Chemical Approach to Solving Problems in the Papermaking  
Process.....Yoshitaka Sakuraba
- 55 Optimization of Wet-end Process by Slime Control Agent “CURECIDE” and  
Coagulant “REALIZER”.....Saori Takesue and Koichi Tadaki
- 62 Visualize and Reduce Fiber Losses by OnView.MassBalance  
.....Nodoka Furubayashi
- 66 Paper Chemicals for Environmental Sustainability  
.....Shuhei Akita, Takuji Sodeyama and Syunsuke Hayashi

### Introduction of Research Laboratories(153)

- 72 Department of Mechanical Systems Engineering Graduate School of Engineering,  
Tokyo University of Agriculture and Technology

### Pulp and Paper Mills in Japan(104)

- 75 Mishima Plant, LINTEC Corporation

- 03 Committee report
- 71 Essay on Intellectual Property
- 74 Coffee break
- 81 Papyrus
- 84 Industry News (Domestic and International)
- 90 List of Patents issued and Laid-open Publication
- 97 Price list of Domestic Logs and Wood Chips by District
- 98 Other Monthly Statistics
- 100 News from the Association

### **The Latest Winder Technology**

Hideki Maeda

NAGAI TEKKO Co.,LTD

Nagai Tekko Co., Ltd. has responded to customers' requests by constructing a new factory in September 1993, while responding to the increasing size and precision of its paper machinery, with a focus on winder equipment. In recent years, the company has focused on improving the productivity and quality of Winder, as well as developing labor-saving and automation technologies, as shown below.

1993: Automatic Rollchange system that takes full advantage of the core taping and endroll taping devices with no looseness of rolls.

2004: Web threading device above drumrolls that allows one person to thread web even a wide machine,

2005: NC slitter with simultaneous movement of all slitters and automatic core chuckpositioning" for dutytime reduction

2006: Device for Reduce dutytime of Rollchange process to improve productivity.

2011: "fully automatic coreless winder" for pulpmill that incorporates the world's only technology.

2013~2022: 4 automatic paper core cutting and feeding machines were introduced one after another.

2017: 'Mother Rool Automatic Transfer System', 'Automatic Defect Repair System', 'Winder Monitoring System' for labor-saving .

2021: We developed 2200 mm wide new rewinder with original drive system.

2023: Operation of the winder monitoring support system started.

In August 2022, the fourth "automatic paper core cutting and feeding machines" was put into operation, and as a standard model, I would like to introduce the outline of the equipment and the outline of the winder monitoring support system that started operation in 2023.

### **SmoothRun / Active damping technology -Reduce vibration during winding process-**

Kanato Mizukoshi

Voith IHI Paper Technology Co., Ltd.

Winders are always expected to run full capacity especially the line installed only one winder. Capacity limit of winder directly connected to paper machine capacity. There could be many reasons that winder can not perform full capacity, such as vibration, winding quality, paper quality. Major cause is operation speed reduction or winding quality caused by vibration.

In conventional winders without special damping, vibrations can occur at higher production speeds for certain paper grades, and these vibrations can impair winding quality and production capacity. To minimize the disruptive effect of vibrations during the winding process, the production speed and accelerations rates are reduced below the maximum capability of the winder. Our solution is SmoothRun hydro-pneumatic damping bearings which can be effectively reduced the vibration even at high speeds. This mean winder can operate at high production speed constantly. At the same time, SmoothRun improves the winding results and reduces the overall mechanical stress on the machine.

## **The transition and latest trends of Roll Wrapping Machine.**

Shinichiro Kaji  
KAWANOE ZOKI CO.,LTD.

In the past, one winder and one wrapping machine used to be arranged to process paper produced by one paper machine. In recent years, however, control of production data by computer has made great progress, and now we are in an environment where production data of wound rolls as finished products can be rapidly processed online.

Therefore, we have been able to develop a wrapping machine with a large processing capacity, that can automatically process various types of wound rolls produced by more than one paper machine to save labor, space and energy required by wrapping at a mill.

Our wrapping machine consists of equipment such as bar code reader, printer, wrapping machine, marking device and labelling device. Even a non skilled worker will be able to operate our wrapping machine in a short time because each equipment is reliable and can stand continuous operation for a long time, and also because of features such as complete interlocking and easy input setting, changing and monitoring by touch panel, based on our wide experience and achievements.

Through the use of our wrapping machine, complete wrapping of wound products can be performed.

## **Sheeter Technology**

### **-Challenges and Innovation for paper and board market-**

Noboru Matsumoto  
Horikawa Engineering Works Ltd.

Lorenzo Alba  
Milltex S.p.A.

In this paper we overview market tendency of printing paper outside of Japan through a report of an Italian sheetier supplier, Milltex, who delivered more than 460 sheeters to 20 countries worldwide in the past 30 years. Because of vast expansion of e-commerce demand of digital printing paper is increasing while coated paper is reducing. We are going to introduce challenges of Milltex in energy saving and automation of sheetier lines. Also challenges to convert excessive paper to digital printing paper and on-line sheetier system for duplex board.

## **Examples of Improvement in Finishing Process**

Shoichiro Kida  
Kida Iron Works Co.,Ltd.

Kida Iron Works Co.,Ltd. was founded in Osaka in 1928 and started manufacturing machine parts. At the time when the textile industry was booming, Kida's self-developed humidifier was widely used in spinning mills in Japan, and later entered the recycling industry to meet the needs of the times. Later, the company began designing and developing labor-saving equipment for the printing industry, which continues to this day.

The New Turner series is the fully automatic system that turns sheets over, aligns sheets and removes dusts and powders by air blow. This series has been adopted by large and small printing companies throughout Japan, and currently hold the top share of the domestic market. The company also builds systems to solve users' problems based on its specialized know-how in the printing industry. The company is a typical "monozukuri" (manufacturing) company with its own integrated system from design to manufacturing, installation, and repair. The company's products include the "Turner Series" of paper reversing machines, the "Blanks Checker" of blanks inspection system, the "Mini-Piler Series" of paper alignment high stacking machines, FA, and many other custom-made products. The flexible systems and durability of the machinery built from many years of experience and know-how are well received.

## **Web Inspection System Technology Trends.**

Shuichi Shoda

AMETEK Co., Ltd. SURFACE VISION

In recent years, the technology for image processing has greatly improved. Digital cameras have become higher in resolution and speed, and computers are now capable of faster processing, enabling the development of new features in defect inspection systems. In this article, we will introduce some of the newly functions in SmartView inspection systems. Normally defect inspection systems only stored image data of the detected defects, but the newly developed streaming video can display, save, and replay the entire length and width of the roll. Using this streaming video data, a virtual inspection function has also been added for re-inspection of the roll. One of the new technologies is camera signal multiplexing, which generates multiple camera signals (video data) from one camera and allows separate multiple inspections to be performed in a single camera frame. The adaptive thresholding that follows background fluctuations and adjust the thresholds. SmartLearn classification combines automatic, learning classification. To use both functions SmartView system strongly supports detecting and classifying defects. Integration with external systems has also been enhanced, allowing SmartView systems to incorporate data from other systems and display that data on the SmartView screen, or transfer defect images and feature data acquired by SmartView to external systems.

Ametek intends to continue to support customers in building the most suitable inspection system for their manufacturing sites, leveraging the strengths of the defect inspection system manufacturer.

## **The Key Points for Monitoring System to Achieve Efficient and Effective Pest Management**

Takeo Ishizaki

Earth Environmental Service Co., Ltd

For efficient and effective pest management, the monitoring system (investigation using trapping tools such as light trap, wandering insect trap, and rat trap) plays an important role. Unless we establish the appropriate monitoring system, we can't get accurate information about insects or rats intrusion or inhabitation, leading the customer's complaints or the loss of products related to insects. On the other hand, there is also the possibility that excessive plan might lead to an increase the burden on the site. Therefore it is necessary to understand the importance and the role of the monitoring system in the whole managing system in order to select the right trapping tools or where to place them, based on the risk-based approach.

In this paper, several key points for monitoring systems to achieve efficient and effective pest management were mentioned. First of all, we have to understand the total structure of pest management (Pest management program), including annual plans, organization, the way of communication, inspection/investigation, countermeasures, and training. Monitoring system is a part of pest management program, related to other elements. The meaning of "monitoring" is to analyze the sampling data and to utilize it for the root cause analysis, corrective and preventive actions, and verification, therefore we need to choose the suitable monitoring method based on the possible risks (characteristics of insects/rats and the importance of the zone in the factories).

As for the selection of trapping tools toward flying insects, we have to select light trap model based on the properties of area and to make a decision for places of installation on the hypothesis that we suppose flying insects' pathways of intrusion, considering not only the effectiveness to trap flying insects, but also the risk for attracting insects more than necessary. While, we select types of wandering insect trap and rat trap based on the characteristics of insects/rats or the environment around the place of installation (e.g. the floor which got wet) , and we install them on the places where wandering insects/rats can intrude or inhabit. In this manuscript, several risk-based viewpoints were provided. In addition, I introduce the latest rat-monitoring on-line system called "Pescle", which we developed in partnership with Ryoden Trading Co.,Ltd. We can only get accurate information using our original AI techniques for Pescle in order to formulate a sustainable pest-control systems.)

Finally, several points to remember concerned with monitoring system, such as the interpretation of the monitoring data was provided here.

## **Control of foam on white water and improvement of operational efficiency by modeling a soft sensor**

Yusaku Okura  
Rengo Co., Ltd

Recently, the improvement of digital technology has made it possible to accumulate large amounts of process data that had not been fully utilized.

With advances in technology of data accumulation, it is being especially important to handle big data. By using these data, it is possible to predict the occurrence of machine error or defects in products. Papermaking process is getting to be automated by application of such technology, but it still remains many controls that are set manually by operators. Therefore, it is a significant issue for paper industry to advance further digital transformation.

In this paper, we introduce our efforts focusing on foam on white water during the papermaking at the Kanazu mill, which is our DX model plant.

In our case, we had a problem of occurring defects by foam from white water and these defects had generated paper shorts. We had tried to solve this problem by utilizing big data accumulated in the Plant Information Management System. We had made a soft sensor consisting of extracted features with data analysis by Python programming and had been automated the addition of defoamer with a constructed soft sensor.

This effort enabled us to reduce occurring of defects and improvement of operational efficiency.

## **Development of Refining Technology**

Nobuhiko Okumura  
Engineering Division / Aikawa Iron Works Co., Ltd.

The importance of the refining process in the stock preparation system is well known. The refining process, which greatly affects the properties of the target paper, is also a process that consumes a lot of energy in the stock preparation system, so research has been continued from various points of views. Since the development of the first domestically produced continuous cone-type refiner "Super Refiner" in 1954, we have been challenging for ways to optimize the refining process from the perspective of a stock preparation equipment manufacturer.

In this report, we will look back on the background of the development of each refining equipment and the required functions while tracing the transition of refining equipment up to the present. It also introduces the refining mechanism and the general selection method of refining filling pattern.

## **-Foam control solutions that evolve day by day-**

### **A permanent chemical approach to solving problems in the papermaking process**

Yoshitaka Sakuraba  
Nissin Kagaku Kenkyusho Co., Ltd.

In papermaking processes, foam can cause a variety of problems everywhere. Foam problems not only hinder operation and productivity, but often have a negative impact on product quality, making foam control extremely important in solving problems in the papermaking process.

Since we started supplying papermaking chemicals to paper companies nationwide in 1948, we have been working together with our customers on foam control, and have developed a wide range of customized products for each customer process, and have become a chemical assistant for solving foam problems.

In recent years, the environment surrounding not only paper manufacturers but also chemical manufacturers has changed drastically due to a combination of factors such as a drastic disruption in the supply of raw materials caused by the global spread of the new coronavirus, soaring raw material prices due to inflation, and restrictions on raw material use due to various regulations aimed at environmental friendliness.

In this paper, we report on the latest trends in foam control measures that we have been working on in the midst of this rapid global situation.

## **Optimization of Wet-end Process by Slime Control Agent “CURECIDE” and Coagulant “REALIZER”**

Saori Takesue and Koichi Tadaki  
SOMAR Corporation

In recent years, there has been an increasing trend toward more paper making defects and paper breakage problems in paper machines. Paper making conditions are becoming more severe due to the decline in the quality of pulp and recovered paper raw materials and the accumulation of contaminants caused by the closed paper machines. The focus of this study was on the fact that, based on the results of analysis of paper making defects and paper machine tool deposits, there are many cases in which slime involving microorganisms, adhesive pitch consisting of vinyl acetate, styrene, and acrylates mixed in from recovered paper, and anion trashes form a complex foreign matter. To improve the operation of paper machines, it is essential to reduce paper defects and breaks, and many paper machines have similar problems.

In terms of paper quality, the dosage of additives such as sizing agents and paper strength agents added tends to increase in order to improve and maintain quality, and in some cases, the fixation of these additives is poor. If these unsettled additives circulate and accumulate in the system, they can cause paper making defects and trouble with stains on the paper machine tools. To improve the operation of the paper machine, such as to reduce the number of paper breakages and defects, it is important to optimize the dosage of various additives without degrading the quality of the paper.

We have applied the slime control agent “CURECIDE Series” and the multifunctional coagulant “REALIZER A Series” to various fields such as paper machines, paperboard machines, and household paper machines, and conducted tests to improve the operability and paper quality of paper machines using the optimum addition method and optimum addition amount. The results of the tests will be presented.

## **Visualize and Reduce Fiber Losses by OnView.MassBalance**

Nodoka Furubayashi  
International sales department, Voith IHI Paper Technology Co., Ltd.

Voith is promoting the digitization of the papermaking process under the name of PM4.0. While increasing the number of digital products delivered to the papermaking process worldwide, we are also developing digital products for the raw material process as a full-line supplier. This article introduces a product called OnView.MassBalance that visualizes fiber loss in the OCC line.

Generally, fiber loss in the raw material process is known only on a monthly or weekly basis, and it is difficult to pinpoint the location of the process in which the loss occurs. By using OnView.MassBalance developed by Voith, the flow rate of feed, accept, and reject of each process is clearly displayed in a chart format called Sankey diagram, and it is possible to identify the place where fiber loss is high in real time.

## **Paper chemicals for environmental sustainability**

Shuhei Akita, Takuji Sodeyama and Syunsuke Hayashi  
Sales, Paper Chemicals Company, Harima Chemicals, Inc.\*2

Paper Chemicals Development, R&D Center, R&D Company, Harima Chemicals, Inc.

Global warming and climate change have become primary concerns for all countries and industries. Reducing greenhouse gas emission is critical to address the issues, but the paper industry is known as an “energy-intensive industry”, consuming large amounts of energy in the Kraft pulp and paper making processes.

In Japan, the paper industry has taken various approaches to achieve carbon neutrality by 2050 which is a long-term target for environmental sustainability announced by Japan Paper Association.

Under these circumstances, Harima Chemicals Group has been providing various solutions with its philosophy in mind, "Live a better life with what nature provides". Harima is a pine chemicals company providing products based on pine-derived raw materials, that are natural and renewable resources grown by sunlight and water. Harima produces pine chemicals such as tall oil rosin and tall oil fatty acid by distilling crude tall oil (CTO) extracted from the Kraft pulping process. Harima also generates green power using biomass fuel from by-products of the CTO distillation process.

In this presentation, Harima would like to introduce its sustainable business model, and eco-friendly paper chemicals as solutions for the achievement of sustainability in the paper industry. The paper chemicals include enzymes for better runnability and environmental response, and water-based barrier coating chemicals for plastic replacement and utilization of paper materials.

## CONTENTS

### Pulp and Paper Research Conference

- 1 Report on the 90<sup>th</sup> Pulp and Paper Research Conference  
.....Wood Science Committee, JAPAN TAPPI
- 10 Building a Cellulosic Biomass Fractionation Industry for a Decarbonized Society  
.....Kiyohiko Igarashi
- 13 Improving Retention by Optimizing the Charge of Papermaking Materials with Coagulants.....Koichi Tadaki
- 15 Effect of Rosin-based Plastic Additives to Improve Physical Properties of Polyethylene/Cellulose Fiber Composites.....Tsubasa Ito
- 17 Application of Amphoteric Acrylamide Copolymers as High Performance Papermaking Additives.....Kairi Yamato and Kazuhiro Kumeda
- 20 Reduction of Basic Unit by Digester Additive in the Pulp Cooking Process  
.....Masayuki Kanamura

### Topics & Information

- 23 A Report of the 21st International Symposium on Wood, Fiber, and Pulping Chemistry (ISWFPC) 2023, Venice.....Tomoya Yokoyama, Toshihiro Komatsu, Takao Kishimoto, Tetsuo Kondo, Yasumitsu Uraki, Korawit Chitbanyong, Gaoyuan Hou, Qinyue Gong, Esty Octiana Sari, Ayu Yamaguchi and Hiroshi Ohi
- 34 Utilizing Robotics for "Smart Inspection/DX" of Factories, Plants, etc.  
.....Takayuki Kumada, Kenro Tanaka, Sho Hirabaru and Masatoshi Endo
- 39 DX in the Process Industry as a Reflection of Contemporary Social Demands  
.....Tetsushi Iwasaki
- 45 Consistency and Fiber Morphology  
—Key Process Factor for Pulp Process Control—.....Kiyoyuki Dohi

- 03 Committee report
- 52 Papyrus

- 57 Industry News (Domestic and International)
- 61 List of Patents issued and Laid-open Publication
- 70 Price list of Domestic Logs and Wood Chips by District
- 71 Other Monthly Statistics
- 73 News from the Association



### **Building a Cellulosic Biomass Fractionation Industry for a Decarbonized Society**

Kiyohiko Igarashi<sup>1</sup>

Graduate School of Agricultural and Life Sciences, The University of Tokyo

Currently, most plastic production from biomass is done either by breaking down the extracted oil and sugar components as they are, or by breaking down the constituent sugar components into monosaccharides, converting them into onomers, and polymerizing them to obtain plastic. In the former case, there is often competition for food, and in the latter case, the conversion process is economically and energy inefficient. Therefore, the goal of this research is to develop technologies to enable cascade utilization of biomass according to its tissue structure and molecular weight. In other words, when unutilized biomass is converted by enzymes, etc., we aim to develop technologies to utilize the parts that tend to remain as fiber, the components that are chemically difficult to decompose as polysaccharides or oligosaccharides, and the parts that are easily decomposed as monosaccharides.

### **Improving retention by optimizing the charge of papermaking materials with coagulants**

Koichi Tadaki

Technical Div. Technical Dept., SOMAR Corporation

Various pulp materials used in paper mills vary greatly in fiber length and charge status depending on the type of pulp. Therefore, pretreatment to adjust the charge is necessary in some cases, and in recent years, polymer-based coagulants have been increasingly applied. In this paper, we report on the relationship between the optimization of the charge state and the raw material retention by applying a cationic polymer type coagulant.

Neutral paper making is the current mainstream, and the alum, which was used for charge adjustment in acidic paper making, is less effective in neutral area. This is due to the fact that the trivalent cationic charge of aluminum decreases with increasing pH. Aluminum ions in the neutral region become hydroxide complex ions and their charge valence decreases. If the anionic charge of the pulp material is too high, the excess charge may interfere with the effect of the retention aid added in the wet end process. In such cases, the addition of a coagulant can neutralize the anionic charge and improve the retention of the raw material, so it is very important to know the state of charge of the pulp material and the state of charge at the wet end.

### **Effect of rosin-based plastic additives to improve physical properties of polyethylene/cellulose fiber composites**

Tsubasa Ito

Arakawa Chemical Industries, Ltd.

Plastic composites using cellulose as filler have been actively investigated in recent years to enhance the biomass content of molded products. However, polyolefin-based plastics lack affinity with high-polarity fillers due to their low polarity, and there are often issues in terms of physical properties when used as composites. In this study, we applied rosin derivative containing polar groups, a rosin-based resin, as an additive for polyethylene/cellulose fiber composites.

The results showed that rosin derivative containing polar groups was effective in improving the physical properties of the polyethylene/cellulose fiber composite. Microscopic images suggested that rosin derivative containing polar groups contributed to the improvement of interfacial adhesion between polyethylene and cellulose.

## **Application of amphoteric acrylamide copolymers as high performance papermaking additives**

Kairi Yamato, Kazuhiro Kumeda  
SEIKO PMC CORPORATION

Amphoteric polyacrylamides are utilized as dry strength agents in the papermaking process of the paper industry. The cationic and anionic groups existing in the amphoteric polyacrylamides are known as interaction sites with the pulp that promote the adsorption of amphoteric polyacrylamides onto the pulp fibers. Based on this feature, we investigated the effect of different anionic groups on the properties of amphoteric polyacrylamides and evaluated their performances as papermaking additives. The degree of ionization and the formation of poly-ion complex of the amphoteric polyacrylamides in the aqueous solution were found to change depending on the anionic groups. Furthermore, it was discovered that these paper strength agents with different anionic groups changed their performances in the presence of aluminum sulfate. Notably, the novel amphoteric polyacrylamide in this report is less dependent on the amount of aluminum sulfate used in the papermaking process.

## **Reduction of basic unit by digester additive in the pulp cooking process**

Masayuki Kanamura  
RIKENGREEN Co., Ltd.

Due to the current world situation, various prices are rising, so paper manufacturers are required to reduce the basic unit these days. This paper focused on the cooking process of the kraft pulp method, and described the possibility of reducing the unit consumption of pulp production through efficient cooking. The mechanism of action of the Solenis cooking aid was explained and this product was compared with anthraquinone which is a traditional cooking aid. The effectiveness of Solenis' cooking aid was shown based on two mill trials overseas.

## **A Report of the 21th International Symposium on Wood, Fiber and Pulp Chemistry (ISWFPC) 2023, Venice**

Tomoya Yokoyama and Toshihiro Komatsu  
The University of Tokyo, Wood Chemistry  
Takao Kishimoto  
Toyama Prefectural University, Bioorganic Chemistry  
Tetsuo Kondo  
Enviro-sustainable Materials, Tokyo University of Agriculture and Technology  
Yasumitsu Uraki  
Hokkaido University, Wood Chemistry  
Korawit Chitbanyong and Gaoyuan Hou  
The University of Tokyo, Graduate School, Cellulose Chemistry  
Qinyue Gong  
Nagoya University, Graduate School, Forest Chemistry  
Esty Octiana Sari  
University of Tsukuba, Graduate School, Biomaterial Chemistry  
Ayu Yamaguchi  
Toyama Prefectural University, Graduate School, Bioorganic Chemistry  
Hiroshi Ohi  
University of Tsukuba

The International Symposium on Wood, Fiber and Pulp Chemistry (ISWFPC) has a long history. It has been held every other year since 1981 (Stockholm), and this year marks the 21st time. The 2021 was postponed due to the pandemic, so it past four years since 2019 (Tokyo). It was held in Venice from July 4th to 7th, and is headed by Prof. Claudia Crestine, Ca' Foscari University of Venice. Approximately 200 researchers and students (235 peoples including local staffs) from all over the world, mainly from Europe, participated in 84 oral presentations divided into 3 rooms and in 86 poster presentations into the fields of wood biorefinery, cellulose and lignin (35, 20 and 31, respectively) over 3 days. At the beginning of the first and second days, Dr. John Ralph (USDA, USA) and Prof. Thomas Rosenau (BOKU University, Austria) gave plenary lectures on lignin and cellulose, respectively. The next 22nd symposium in 2025 will be held in Raleigh, headed by Prof. Hasan Jameel of North Carolina State University, USA. This time, it has been decided that Pekanbaru, Indonesia will be the venue for 2027.

### **Utilizing Robotics for “Smart Inspection/DX” of Factories, Plants, etc.**

Takayuki Kumada, Kenro Tanaka, Sho Hirabaru and Masatoshi Endo  
Blue innovation Co., Ltd.

We provide drone inspections using ELIOS, which allows you to fly safely indoors. There are merits such as improvement of worker safety, improvement of work efficiency, cost reduction of inspection cost, and predictive maintenance by digital data conversion. Starting in 2018, it has been used in more than 200 sites. For example, duct inspections could complete a task that used to take a day in just 30 minutes.

### **DX in the Process Industry as a reflection of contemporary social demands**

Tetsushi Iwasaki  
FUJITSU LIMITED

This article clarifies the factors of the delay and proposes a direction to expedite of the speed of DX.

First, the model of DX activity was presented and the points of view were constructed focusing on people as the main body of DX. Then, inhibition was verified based on the dialogue history of 100 people from 61 companies in the process industry.

The true reason for the lack of speed in DX is that the value-creating activity model has not been established yet. There is potential for improvement through a framework approach.

**Consistency and Fiber morphology**  
**— Key process factor for pulp process control—**

Kiyoyuki Dohi  
Sales and technical adviser, Process Industry Division, ABB K.K.

Currently, industry got strong pressure from the market because Japan government announced carbon neutral industry by 2050. In Japanese industry, especially material industry, there are several serious potential issues like lack of human resource due to less attractiveness for young people, retirement of baby boomer and the technical transfer. On the other hand, there are bright future in paper industry because paper is excellent material for plastic reduction and new functional material, Cellulose Nano Fiber.

ABB started following four approaches to cooperate with customer to solve facing issues.

- 1) Reliable and high-performance online measurement for Refiner, Wet end control
- 2) Cutting-edge fiber analyzer for new material development
- 3) Speedy, Safety and high precise paper testing machine
- 4) High speed, high precise and reliable automated paper testing machine

In the paper, 1) Reliable and high-performance online measurement for refiner and wet end control is described. You can understand how ABB L&W online measurement is reliable and how to utilize the measurement data for process optimization.

## CONTENTS

### Environment

- 1 A Report of the 30<sup>th</sup> Environmental Conference  
.....Environmental Technical Committee, JAPAN TAPPI
- 3 Countermeasures Against Factory Odor Using Odor.....Takayuki Ebihara
- 9 By Ultra BM-R System (Ultra Fine Bubble + Recycled Raw Material Modifier)  
Environmental Odor Countermeasures and Energy and Cost Saving Measures  
.....Kazuhisa Hashimoto
- 13 Standards for Synthetic Resin Utensils, Containers and Packaging Under the  
Food Sanitation Act.....Tomoyuki Abe
- 17 Container and Packaging Standards for Milk, etc. and Association Voluntary  
Standards: Past, Present, and Future.....Ryogo Hirano
- 22 30 by 30 for Biodiversity.....Makoto Kobayashi
- 27 The Outline of "M-fine", Submerged Membrane Unit for Wastewater Treatment  
.....Kazuhiko Takayama
- 32 Domestic and International Trends Regarding Climate Change and GX League  
Initiatives.....Keita Takeshita
- 39 Carbon Footprint and Corporate Emissions Accounting.....Wataru Kawamura
- 46 Noise and Odor Countermeasures in Manufacturing Factories.....Shingo Seki

### Topics & Information

- 55 Drainage Load and Odor Reduction Measures Using the AQUAS CLEANJET  
System .....Teppei Tomokuni
- 63 A Report on Revision of the Japanese Standard (JIS) P 8149 Paper and board—  
Determination of opacity (paper backing)—Diffuse reflectance method  
.....JAPAN TAPPI, Pulp and Paper Testing Standards Committee
- 66 A Report on the 63rd National Conference of the Pulp and Paper Industry on  
Safety and Health.....Hidenori Maeda

### Introduction of Research Laboratories(154)

- 72 Co-creation of Communities Research Division, Institute for Future Initiatives,  
the University of Tokyo  
Kikuchi Lab., Department of Chemical System Engineering, the University of Tokyo  
Presidential Endowed Chair for "Platinum Society", the University of Tokyo

### Research Report

- 75 Novel Analysis of Recycled Pulp-Containing Paper, Including Fluorescent  
Whitening Agent:  
Part 2 A Comparison of Quantitative Measures of Wastepaper Pulp Content in Recycled  
Paper Prepared from Softwood Bleached Kraft Pulp.....Tatsuhiko Sakawa, Atsushi Narita,  
Susumu Kawanobe, Ryota Kose, Hailan Jin and Takayuki Okayama

- 03 Committee report
- 71 Essay on Intellectual Property
- 74 Coffee break
- 100 Industry News (Domestic and International)
- 103 List of Patents issued and Laid-open Publication
- 117 Price list of Domestic Logs and Wood Chips by District
- 118 Other Monthly Statistics
- 120 News from the Association

### **Countermeasures against factory odor using odor**

Takayuki Ebihara  
CORE CORPORATION.

IoT systems commonly use sensors to collect data which are then managed in the cloud.

Our company has developed IoT systems by wirelessly connecting commercially available sensors as well as in-house developed sensors. In particular, we are exploring how to quantify and express the five human senses.

One user suggested that if we could visualize 'smell,' it could have various applications across different fields. This led us to initiate the study of visualizing odors. Starting with the numerical values from 'smell' sensors, we discovered that different factories faces various challenges.

As a result, we have been able to commercialize the IoT integration of 'smell.'

### **By Ultra BM-R System (Ultra Fine Bubble + Recycled Raw Material Modifier) Environmental odor countermeasures and energy and cost saving measures**

Kazuhisa Hashimoto  
Mushugen Industries Co.,Ltd.

In recent years, due to soaring raw material and fuel prices, efforts to save energy and cost have become active at paper mills, especially at paperboard mills, but there are also issues in terms of stable quality maintenance and environmental measures.

In this paper, we will discuss the problem of product odor and raw materials associated with cost saving by reusing recovered fibers, using surplus sludge discharged from biological wastewater treatment processes as raw materials, and water saving and energy-saving measures by recycling white water. As a countermeasure against the problem of generating the dangerous gas hydrogen sulfide in the papermaking process and the environmental problem caused by odor generated from the dryer exhaust duct, we will introduce the Ultra BM-R (hereinafter referred to as UBM-R) system, which combines Ultra Fine Bubble (hereinafter referred to as UBF) and the recovery material modifier Mushugen BM-R (hereinafter referred to as BM-R).

: Temporary creation (JAPAN TAPPI)

### **Standards for synthetic resin utensils, containers and packaging under the Food Sanitation Act**

Tomoyuki Abe  
Institute of Food Hygiene, Japan Food Hygiene Association

Due to the revision of the Food Sanitation Law, the Positive List (PL) System for Food Utensils, Containers and Packaging was enforced from June 1, 2020, and now the sanitation of food utensils, containers and packaging is attracting a lot of attention. This paper will explain the standards for utensils, containers, and packaging under the Food Sanitation Law and describe how to set items and conditions for sanitary tests to ensure the safety of food utensils, containers and packaging and how to confirm the requirements before requesting sanitary tests. The author expects that this paper helps improve the hygiene of food utensils, containers and packaging

## **Container and packaging standards for milk, etc. and association voluntary standards: past, present, and future**

Ryogo Hirano

JAPAN ASSOCIATION OF MILK PACKAGING AND MACHINERY

The Japan Milk Containers and Equipment Association has developed along with the legislation of the Ministerial Ordinance on Ingredient Standards for Milk and Milk Products (Ministerial Ordinance No. 52, December 27, 1951) established by the Ministry of Health, Labour, and Welfare (MHLW).

Historically, dairy containers and packaging have been governed under different rules than other food products in the Food Sanitation Law. Standards for synthetic resins used in dairy product containers and packaging were originally developed to address milk cartons. These standards follow a positive list approach and prohibit the use of resins and additives other than those specified in the standards.

For non-dairy products, the negative list system was used for a long time, but in 2020 the Food Sanitation Law was revised and a positive list system was introduced for the containers and packaging of all processed foods including those that are not dairy-based. However, different standards have long been applied to dairy and non-dairy products, and contradiction or inconsistency have been noted in the standards for containers and packaging for both.

To address this issue, the association is currently collaborating with related organizations within the dairy industry to compile specific proposals. In addition, the MHLW is working with the association and related organizations to develop a draft revision of the milk and dairy product container and packaging standards. It is expected that the revision of the standards will enhance the convenience and functionality of containers, thereby contributing to an increase in milk consumption.

## **30 by 30 for Biodiversity**

Makoto Kobayashi

Ministry of the Environment Government of Japan.

A new global goal to be achieved by 2030, the Kunming and Montreal Framework for Biodiversity, was adopted. With regard to resource mobilization, the Global Framework Fund for Biodiversity will be established in the Global Environment Facility (GEF)\* in 2023. With regard to the distribution of benefits related to the use of digital sequence information (DSI) related to genetic resources, it was decided to establish a multilateral mechanism and to establish an open working group to consider measures other than the multilateral mechanism for COP16.

: Temporary creation (JAPAN TAPPI)

## **The Outline of "M-fine", Submerged Membrane Unit for Wastewater Treatment**

Kazuhiko Takayama

AWAPAPER TECHNOLOGICAL COMPANY, Inc.

The membrane bioreactor of M-fine series was developed by AWA PAPER & TECHNOLOGICAL COMPANY, Inc. based on the technology of functional papers and filters, especially support fabric of Reverse Osmosis membrane which is the key product in Desalination plants all over the world. M-fine is a compact designed membrane bioreactor module for fitting into small capacity and footprint and also easy to handle for operation and maintenance.

## **Domestic and international trends regarding climate change and GX League initiatives**

Keita Takeshita

Ministry of Economy, Trade and Industry.

The GX League was officially launched in April 2023. The GX League is conceived in 2022 and has been working for one year as a preparatory period. In the first phase of the three-year period from April 2023, estimates will be made based on the emissions emitted by each participating company, and emissions trading will be introduced on a full-scale basis from fiscal 2026.

: Temporary creation (JAPAN TAPPI)

## **Carbon footprint and corporate emissions accounting**

CDP Worldwide-Japan  
Wataru Kawamura

The term "Carbon Footprint" is often referred to as "CFP" in Japan, which is an abbreviation of "Carbon Footprint of Products," and it means the amount of carbon dioxide emissions over the lifetime (life cycle) of a product or a certain process.

The main purpose of calculating CFP is to quantify the greenhouse gas emissions of products, and it allows companies to understand the impact of their products and identify where and how they can reduce their environmental impact. Moreover, it also helps customers understand their environmental impact associated with products they purchase.

Nowadays, many companies and societies are required to decarbonize, and companies are increasingly expected to calculate their CFP/organizational emissions to provide information necessary to select low emission products and to meet the needs of their customers and stakeholders.

In Japan, a program for CFP calculation and labeling have been in place since 2002, and in 2022, the Ministry of Economy, Trade and Industry (METI) gathered a study group to further expand CFP calculation among Japanese companies. The need for CFP calculation is expected to increase in the future, and rules and mechanisms are being developed around the world.

## **Noise and Odor countermeasures in Manufacturing Factories**

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Manufacturing factories, including the pulp and paper industry, have a large number of production facilities, and there are various noise and odor sources in the factories. The following are expected to be the departments that are actually facing these issues.

- (1) Environmental management department in charge of the environment of the entire plant
- (2) Management department of factory equipment that actually reduces noise and odor (engineering department)

This paper summarizes the technical contents that factory workers in charge of the environment or equipment should know about when considering countermeasures for these problems, focusing on the field of noise. When actually promoting countermeasures, we hope that the contents of this paper will be useful for considering effective and economical measures.

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## **Drainage Load and Odor Reduction Measures Using the AQUAS CLEANJET System**

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Environment Dept. Technical & Engineering Div. Nippon Paper Industries Co., LTD.

Nippon paper Ashikaga Mill, Ashikaga is located at about 70km north from the Tokyo metropolitan area and about 50km south-west from Utsunomiya city, Tochigi prefecture. The mill owns the PM1 that produces core paper, pasting paper board and water-resistant paper board, and the PM3 producing conventional corrugated medium and heavy-duty water-resistant corrugated medium.

In terms of factory location, the site is characterized by the presence of municipal roads and rivers crossing within the premises. Furthermore, residential areas and farmland adjoin the factory site, making it an environment where careful consideration for the surrounding conditions is required.

The comprehensive drainage is discharged into the old Fukurogawa, a tributary of the Watarase River, and the control indicators are pH, BOD, and SS. In March 2021, the drainage standards in Tochigi Prefecture were revised, placing a greater emphasis on water quality improvement. In response, our factory implemented measures to enhance the drainage facilities and reduce the drainage load from our production processes.

In this article, we will introduce a case study focusing on the drainage load reduction measures using the AQUAS CLEANJET System, chosen from among various initiatives.



## **A Report on Revision of the Japanese Standard (JIS) P 8149 Paper and board — Determination of opacity (paper backing) — Diffuse reflectance method**

JAPAN TAPPI

Pulp and Paper Testing Standards Committee

The **JIS P 8149: 2023** is published on 20th October 2023 by the Minister of Economy, Trade and Industry, which has been technically revised. This revised JIS P 8149 standard has been harmonized with **ISO 2471:2008**, which is the international standard. The main changes are as follows.

- 1) A UV adjustment to conform to the CIE illuminant C is required if fluorescent whitening agents are present in the paper or board.
- 2) The table of weighting functions for the instruments that have bandpass correction is added.
- 3) The value is read and recorded to the nearest 0.01% unit instead of 0.05% unit.
- 4) Precision for measurement methods is added since recent international standards emphasis on adding precision.

## **A Report on the 63rd National Conference of the Pulp and Paper Industry on Safety and Health**

Hidenori Maeda

Japan Paper Association

Japan Paper Association (JPA) held the 63rd National Conference of the Pulp and Paper Industry on Safety and Health in person at Yokohama city for the first time since 2019 on September 2023. The conference had 290 participants from member companies and cooperating companies.

The conference took place over two days, and the program of the first day include plenary session, special lecture and social gathering. In the second day, six breakout sessions were held, and each session had three presentations of case studies and group discussion. In the group discussion, each group (consisting of seven or eight participants) discussed preset theme and set action targets. At the end of the group discussion, each group reported on the discussion contents and action targets set in the discussion, in order to share them among the participants in breakout session.

## **Novel Analysis of Recycled Pulp-Containing Paper, Including Fluorescent Whitening Agent:**

### **Part 2 A Comparison of Quantitative Measures of Wastepaper Pulp Content in Recycled Paper Prepared from Softwood Bleached Kraft Pulp**

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To build a society that achieves sustainable development with less environmental impact, the recovery rate of wastepaper has increased by reducing paper waste and protecting forest resources; the utilization rate of wastepaper as a raw material for papermaking has increased accordingly. As the recycled paper is widely used as an environmentally friendly product, estimating and evaluating the wastepaper pulp content in paper and paper products is necessary. However, discriminating between virgin pulp fibers and wastepaper pulp fibers in paper and paper products is challenging because there is a wide range of wastepaper types. Moreover, the pulp fibers are physically or chemically altered during the wastepaper process.

In this paper, we prepared recycled-paper model handsheets from softwood bleached kraft pulp (SBKP) with an internal additive of fluorescent whitening agent (FWA) and compared three test methods for estimating the blending rate of wastepaper pulp. In addition to estimating the blending rate of wastepaper pulp from the image analysis of paper samples using confocal laser scanning microscopy (CLSM), the blending rate of wastepaper pulp from pulp fiber was examined through fluorescence microscopy (FM); evaluation by the visual method and image analysis was also conducted.

The mean luminance (mean fluorescence intensity) of paper samples calculated from the images obtained by the CLSM method showed a high correlation with the wastepaper pulp content regardless of changes in the amount of FWA added or the type of bleached pulp. Another advantage of the CLSM method is that it enables the estimation and evaluation of wastepaper pulp content without the need to defibrate the recycled paper sample.