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2018 January JAPAN TAPPI JOURNAL

Vol.72, No.1 Abstracts

**Distribution analysis of Paper Chemicals retained inside of Paper Structure**  
**- Mechanistic aspect of paper chemicals and their application for a new development -**

Norihito Higashitani

Department of Research & Development Promoting, Arakawa Chemical Industries,Ltd

We have been providing many kinds of paper chemicals for the necessity of responding customer requests. In recent, more sophisticated development on paper chemicals have been required and, it must be achieved in paper chemical industries. In the development process of paper chemicals, it is very important to know their action mechanism in inducing corresponding effects. Since 2000, we have been studying the adsorption and distribution of paper chemicals to pulp fibers mainly from the view point of microscopic observation technology. In this report, visualization method of (1)sizing agent distribution on paper sheet, and (2)paper strengthen agent polymer flocculation form and its adsorption to cellulosic fiber in pulp surry, have been discussed. In addition, we will also describe about an example of utilization in these technique for products development.

**Main steam pressure stabilization and fuel reduction by boiler combustion control optimization system "ULTY-V"**

Yuji Okamura

NYK TRADING CORPORATION

If the inputs to the boiler change (e.g. coal with a different moisture content is fed to the boiler), a change is required from the control system to compensate for the variance. However, it is difficult for an existing control system to change gain automatically and continuously depending on combustion condition because the ability to measure all the external factors and to reflect these parameters is too hard to carry out, especially in an older traditional control system.

ULTY has been developed to resolve this problem in thermal power plants, by

calculating the most appropriate gain and altering the control systems output correction factor produced by existing systems for plant controls. ULTY can then improve the stabilization of the combustion state and achieve the best controlled performance.

As well as improving the stability of the combustion state, ULTY will also contribute to fuel-saving, preventing heat-exhaustion and improve boiler pressure stability.

### **Resin Roll for Calender - ZE-K series -**

Naoki Kajino  
KINYOSHA CO.,LTD.

We are making researches on resin rolls for super calender. The resin roll has run on soft nip calender and super calender for high-gloss paper. The resin roll has been studied on several commercial super calender, but there are still some unsolved problems.

- (1) Rotary heat
- (2) Hardness reduction in temperature
- (3) High pressure resistance
- (4) Run-in
- (5) Paper edge dent
- (6) Improvement of crack resistance
- (7) Gloss reduction of high-gloss paper

We have developed a resin roll, called “ZE-K series”, that might be a solution to these problems.

### **Cellulose Nanofiber Prepared by Phosphorylation and its Application**

Koh Sakai  
CNF R&D Center, Innovation Promotion Division, Oji Holdings Corporation

Cellulose nanofiber (CNF) is nano-sized cellulose fiber with high aspect ratio, which is produced by fibrillation of pulp. While CNF has a lot of excellent properties as high Young's modulus, low thermal expansion and so on, it needs high energy consumption to fibrillate completely only mechanical treatment. Then, we established phosphorylation

pretreatment method. Wood pulp was modified by impregnating an aqueous solution of urea and ammonium dihydrogen phosphate, followed by drying and curing in hot air for a few minutes. Then phosphate groups were introduced on the surface of cellulose. We could obtain phosphorylated CNF dispersion by mechanical treatment of phosphorylated pulp. This dispersion showed high transmittance. Transmission electron microscopy (TEM) indicated the presence of 3–4-nm-wide nanofibers. Viscosity of phosphorylated CNF dispersion was high compared to conventional thickeners. The phosphorylated CNFs are expected to various applications, for example, highly viscose thickener, and transparent and flexible sheet. The CNF sheet had high transparency and mechanical properties. The sheet was tolerant to chemicals and highly flexible, therefore, can be expected to apply to a wide range of fields by taking advantage of these properties.

### **Efforts for the practical use of cellulose nanofibers**

Masayuki Kawasaki

Nippon Paper Industries Co.,LTD

As a comprehensive biomass industry, Nippon Paper Industries Co., Ltd. tries to develop various new business areas making the most of woody biomass. As one of the new use of cellulose, we focus on production and development of various applications of cellulose nanofibers (CNF). We examine the use of CNF not only for functioned nanocomposite (with resin or rubber etc.) utilizing its high fiber strength and low thermal expansion, also for an optical film utilizing its high transparency and for a catalyst carrier or the absorbent utilizing its high surface area. Among those uses, because the use of CNF as functional additives such as thickener or dispersant is a similar use as existing carboxymethyl cellulose (CMC), early commercialization is expected. In this report, as the example of the effort for commercialization we present the development of CNF as functional additives. And the production method of CNF, the solidification technology for practical use and CNF's various characteristics as additives are reported.

### **Commercialization and application development examples of nanoforest**

Hiromi Hashiba

Development, Chuetsu Pulp & Paper Co.,Ltd

Cellulose is one of the most popular recyclable biomass resource on the earth and

is generated as a main component of plant fiber cell.

Recently cellulose nanofiber(CNF) and cellulose nano crystal, produced by cellulose fiber defibration into nano size, are extensively studied in the world.

CNF is well known as of its excellent physical properties such as strength, elastic modules, and thermal expansion.

Therefore, a lot of attention has been paid for CNF application development and a lot of studies about CNF have been extensively developed in the world.

In Japan, CNF development was positioned as “Japan Revitalization Strategy” and “Nano Cellulose Forum” was established.

Following these trends, several Japanese paper company had made decision to build CNF production plant and some of it had already started operation.

Chuetsu Pulp & Paper Co., Ltd had started R & D of CNF since 2010 and had started operation of CNF commercial production plant at Sendai mill, Kagoshima on June 2017.

This report will introduce our CNF technical development and application development.

## **Preparation of high performance air filter media from cellulose nanofiber**

Junji Nemoto

Novel Materials Development Office, Hokuetsu-kishu Paper Co., Ltd.

Air filter media containing cellulose nanofibrils (CNFs) were prepared by freeze-drying of CNF dispersions. The CNF content in the filters was controlled by adjusting the CNF dispersion impregnated to the base glass filter. The CNF-containing filter media showed superior filtration properties. When the CNF content was 0.08% in the base glass filter, the filter quality factor showed the highest value. This is because nanoscale and spider-web-like networks of the CNFs with large specific surface areas were formed within the base filter. At the CNF content higher than 0.08%, densely packed CNF networks rather formed and prevented the efficient capture of oil-aerosols used as model particles. After exposing the CNF-containing filter media to high humidity conditions, the pressure drop decreased, and the particle penetration ratio increased. However, the original porous networks mostly remained, and the high quality factors were maintained even after exposing the filter media under humid conditions. The unique properties of CNFs such as the extremely small fiber diameters are advantageous in preparing

new air filters with high performance.

### **Prioritizing pest control measures based on scientific evidence and evaluating effectiveness**

Tomohiro Ohba

Earth Environmental Service Co., Ltd

With growing demand for prevention of product contamination caused by insects and rat, it is necessary to show that their pest management program is effective and a preventive system that problems hardly occur in the future. Currently, in order to promote preventive management more strongly, the concept of risk management is beginning to be introduced. In risk management, it is possible to allocate costs effectively by implementing measures by prioritizing according to the magnitude of risk analyzed and evaluated on objective standards.

However, in factories engaged in risk management, they are in trouble with the method of prioritizing risks and the method of evaluating the effectiveness of the measures implemented. In order to solve this, it is important to scientifically create contamination scenarios using monitoring data and survey results. We provide various investigations, analytical methods and educational support concerning analysis / evaluation of risk based on this contamination scenario. ESCOEVO, our new service, is a powerful support tool for aggregating and analyzing data, operating and reviewing improvement activities, and communication with factor.

### **Development of failure prediction system for chemical spraying equipment to improve productivity of paper machine**

Hitomaru Sakata

System Development Team

MAINTTECH CO.,LTD Fuji Technology Development Center

As one of the challenges currently addressed by Japan, there is a population problem and the age population of production (population of 15 to 64 years old) turns to decrease after peaking in 1995 and is estimated to continue decreasing in the future. In recent years, technology fields such as IoT (Internet of Things), BD (Big Data), and AI (Artificial Intelligence) are attracting attention as leading to

these countermeasures. By utilizing these technologies, it is expected analysis and prediction based on data collected by sensors on production facilities would solve this kind of labor shortage.

In our company as well, we consider these technologies to be essential technologies future business developments, we will utilize IoT for the chemical spraying devices "Mist Runner" and "Shower Runner" As a first step, failure prediction system. In this report we will introduce its purpose and system details.

### **The Effect to Physical Properties of Bamboo Paper with Different Cooking Agent**

Chia-Jung Chung and Masamitsu Inaba

Graduate School of Fine Arts, Tokyo University of the Arts

Gang Chen

Department of Cultural Heritage and Museology, Fudan University, Shanghai, China

Hand-made bamboo paper was frequently used for printing and drawing since the Tang dynasty (618-907AD) in China because of its features of strength and flatness. Regarding rare books, the share of using bamboo as the raw material for making paper is said to be around seventy percent. Also Japan has been using bamboo paper in for either the collection of rare books or diversified purposes such as painting by importing them from China too. For conservation of these cultural objects on bamboo paper, we are expecting and required use better quality bamboo paper, but cannot get the equivalent quality of paper as in the past. The traditional way of making bamboo paper is to get the raw bamboo shoots to be fermented in slaked lime first. Afterward the cold digestion method and hot digestion method will go through the process without alkali cooking and with alkali cooking respectively. The air dried fermented raw bamboo fiber (*Mosochiku: Phyllostachys pubescens*) which was collected in Jiangxi province, China were cooked with caustic soda (NaOH), soda ash (Na<sub>2</sub>CO<sub>3</sub>) and lime (Ca(OH)<sub>2</sub>), to the result of a cooking rate which was lower in that order. The physical strength of ISO folding number was decreased greatly for lime cooked paper which yields at 84% (L84) because of long cooking hours. The purpose of this research is to study the effect of cooking agent on durability of 5 kinds of handmade bamboo papers. The bamboo papers have been coated with acidic *Dosa* sizing solution (traditional surface size including animal glue and alum for Japanese painting) with normal and higher concentrations. Then the moist heat ageing test was done under the conditions of 80°C+65%rh, from 1

week to 8 weeks. The changes in color, pH, physical strengths (Folding Endurance and Tear Index) were measured. We found that the initial pH of all original papers remained in the range of 8.7 to 9.2 without the acidic *Dosa* sizing. Even the pH stayed above 7.9 when a high concentration acid sizing solution was coated in advance. The changes in physical strength resulting from moist heat ageing were quite small due to the alkalinity of the bamboo paper. The discoloration rate during ageing for lime cooked papers (i.e. L94, L84) were smaller than the other papers at the same pH value. In conclusion, the durability of bamboo paper cooked with caustic soda and soda ash is better than with slaked lime.

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### **Operating Experience of Boiler Combustion Control Optimization System "ULTY"**

Kyohei Fukuchi

Saga Mill,Oji Materia Co.,Ltd

In Saga mill, the energy consumption rate for paper production in 2016 is 94.1% compared with in 2011,

and energy saving has progressed steadily. However, energy saving items with cost-effectiveness, such as change of manufacturing process, control of motor rotation number, downsizing of equipment, were almost done, so the number of items tend to decrease year by year. Therefore, countermeasures from new point of view are required to continue activities for energy saving. Under such circumstances, we were introduced from NYK TRADING CORPORATION about boiler combustion control optimization system "ULTY", which can be expected boiler fuel-saving. We introduced the system to NO1 boiler in Saga mill, and we could obtain effect more than we had expected. We report operating experience of the system in this paper.

### **Proposal of a Spray Type Agent for Interlaminar Strength Improvement**

Yasuhiro Yamahira

Research & Development H.Q., Paper Chemicals , Arakawa Chemical Industries, Ltd.

In recent years, due to increasing electrical conductivity and the amount of anionic trash in paper making system, internal paper strengthen agent cannot show desirable performance. Therefore, spray type paper strengthen agent is required in which the agent will be applied just after wet sheet is formed. In multilayer papers, spray type paper strengthen agents are commonly used to obtain interlaminar strength. It is very common that non-gelatinized starch or chemically modified starch is sprayed in a slurry state between sheet layers. However, due to

suction after papering and water squeezing in the pressing part, the spray-added starch moves from the interlayer to the inside of the layer together with water, and a part of the starch flows out of the paper. It is therefore, not possible to obtain good enough interlaminar strength, and starch flows into wastewater, which leads to deterioration of waste water load(COD, BOD).

As a solution to these problems, it is conceivable to (1) switch traditional starch to PAM type paper strength agent for spraying, and (2) improve sprayed starch retention in between layers. In this report, these two process has been described.

### **Functional recovery by Coating and Winder survey**

Kanato Mizukoshi

Coating and Finishing Eng., Dept. Voith IHI Paper Technology Co., Ltd.

Due to the expansion of digital media, market structure of paper and board have been changed dramatically. To meet market demand, high level of productivity, stable quality and minimized raw material and energy are required. By the other hand, customer have to distribute their resources into various field to correspond to market needs and suffering lack of man power for the maintenance at the paper production mill site. In such a market situation, Voith IHI Paper Technology is recently focusing on P&S (Products & Services) business. Means enforcing the business to realize energy saving, high efficiency, stable operation. Especially for the services, Voith IHI is providing not only the services which asked to correct specific failure by customer but also proposal type of facility audit.

Here we introduce functional recovery by audit focusing on winder which we learning a lot from Japanese customer and their requirement of roll quality.

### **Recent scale tendency of the kraft pulp process and its solution**

Hitoshi Tsuchida

Sales engineering DEPT, Hakuto Co.,Ltd.

The paper industry is in the process of transformation , not only manufacturing pulp and paper, but also manufacturing value-added products like power generation projects, environmentally friendly closed system operation , use of wood chips containing scales.

The kraft pulp manufacturing process was originally a process that was prone to

scale problems in the cooking process and bleaching process, but with the transition of the use of wood chips containing scale and tendency toward closed system, a large change also appears in the tendency to scale problem.

In this report, focusing on calcium phosphate and calcium oxalate which can be noted as a scale tendency of the kraft pulp process, We will introduce newly developed scale controlling agents for cooking process 「DEPONAX P-78」 and scale controlling agents for bleaching process 「DEPONAX P-99」「DEPONAX P-96」 series as solution.

## **Energy Saving in the Activated Sludge Treatment Process**

Kenji Hayashi

Mushugen Industries Co.,Ltd.

In the pulp and paper wastewater treatment, the energy saving of the activated sludge treatment process by the update of a blower and the aeration equipment and cost-saving may be planned, but there are few cases which energy saving is considered for with an operative aspect positively because it tends to be designed with high load in comparison with other types of industry.

However, in late years a load condition of the drainage processing becomes loose, and room planning energy saving occurs because of a decrease in production and integration and abolition of the product line.

In this paper, we describe some points when we plan the energy saving of the activated sludge treatment process based on the energy saving results with other types of industry.

## **INTRODUCTION OF ARIOSTEA SPIRAL WELDING SILO, HOW THIS NEW TECHNOLOGY REALIZES REDUCTIONS OF BUILDING TIME, COST AND SPACE**

Yosuke Suzuki

Itochu Machine-Technos Corporation

Building a new silo remains big issues for any paper companies no matter what the purposes are, especially for those who are intending to implement by sea side area, in limited space, with too much cost to build. ARIOSTEA is a leading spiral silo designing, engineering, manufacturing company who has established its history

and reputation for over 60 years.

This article describes features of ARIOSTEA silo how it realizes the benefits by showing some of the ARIOSTEA's past references.

### **-The European Largest in Paper & Pulp Industry - StoraEnso's Lubricant Control, Challenge and Solution**

Eiji Suzuki

JSD Ltd.

Harunori Takeda as Europafilter Asia Representative

The process of pulp and paper production involves the use of various kinds of hydraulically-operated machines and a large amount of lubricating oil. Much of the process has a high degree of automation, but this means that a single malfunction somewhere in the machinery affects the whole process and can result in severe loss. It is known that 85% of malfunctions in hydraulically-operated machinery involve issues with the oil, causing pulp and paper factories to take extra caution in managing their machinery equipment as well as their oil.

I was given the privilege of speaking at the 60th Annual Meeting of Japan TAPPI (Japan Technical Association of the Pulp and Paper Industry) so I decided to visit the Hylte Mill of StoraEnso, the leading European company in pulp and paper manufacturing, and report on the oil management (hydraulic oil and lubricating oil) at that company.

In addition, I will also report on the functions and operations of the "Europafilter" used at Hylte Mill to manage the oil. This filter has a special feature that absorbs the water and any contaminating particles larger than 100 nanos (0.1 micron). It connects a bypass to the oil tank, filtering the oil at low flow and removing the water and the contaminating substances before returning to the oil tank what has now turned into super oil. This keeps also the whole machinery equipment and parts clean.

This filter product is an indispensable part of the equipment for the operation at Hylte Mill. One of the installed oil tanks has a function that constantly monitors the temperature and purity of the oil at key positions. The analysis of the oil every 6 months has yielded such great results that oil change has been unnecessary for unexpectedly long period of time.

## **Non-destructive qualitative and quantitative measurement of the filler content of paper and board**

Daniel ohndorf

Marketing & Sales Area Manager Japan      emtec Electronic GmbH

Hiroyuki Miyaoka

Scientific Instruments Dept.   Nihon Rufuto Co.,Ltd.

Fillers play an increasingly important role in the paper production which is also due to the increased usage of waste paper.

The waste paper leads to an automatic but unknown supply of minerals to the production process.

Typical fillers in the paper industry are for example Clay, Calcium carbonate ( $\text{CaCO}_3$ ), Titanium dioxide ( $\text{TiO}_2$ ) and Talcum.

In paper production, minerals can have a positive influence on the degree of whiteness, opacity or flatness/printability of paper and enable to reduce the costs of the raw material.

Traditionally in the paper industry, the ash content (or the combustion residue) is determined by the combustion method according to ISO 1762 and 2144, DIN 54370, TAPPI T413 or T211.

However, the traditional combustion method has some disadvantages. The ACA Ash Content Analyzer and its new and innovative measuring principle without combustion of the paper samples, meaning without destruction, enable to determine both within seconds, the total filler content as well as the percentage content of typical fillers in the paper industry. This means that the respective percentage content of calcium carbonate, kaolin / talcum, and titanium dioxide as well as further used mineral fillers in the paper industry can be detected.

**“ For sound or noise in industrial world Part IX ”**

**-It thinks about the noise as part of T.F.O from SKF -**

Yasuhiko.Yamasaki

RSS RS SKF Japan.

“Confirmation of listening by a person has a lot of tasks and challenge . The topic is how to visualize noise of lubrication condition and propose countermeasures.

This time is a consideration about that "condition of lubrication" and its "countermeasure plan".

### **Development of new chemical additives applications for wire and press part**

Tomohiko Nagatsuka

MAINTech CO.,LTD

Fuji Technology Development Center

Application Development Section

As the recycle pulp in the furnish is increased, the amount and adhesive deposit is also increased in the system. particularly, the adhesive deposits lead to serious problems in paper-making machine which cause sheet breaks or defects in a finished paper.

This report introduces the detail of New applications which is combined with chemical and equipment and knowhow, and examples applied in the paper machines are also presented.

### **Preparation of Nanofibrillated Cellulose in Powder Form**

Takeshi Nakatani and Sinji Sato

Nippon Paper Industries Co., Ltd.

Cellulose nanofibers (CNFs) are generally produced in the form of aqueous dispersion at low concentrations, and it would lead to issues including the high cost of transportation and the high risk of decomposition by bacterial contamination. Therefore, manufacturing dried CNFs is essential for expanding the market of CNFs. In the process of drying, CNFs strongly aggregate and the formed hydrogen bonding inhibits re-dispersion of CNFs in water. Consequently, reduced are resulting characteristics of CNFs, such as high transparency and high viscosity. The prevention of the aggregation in a drying process is the key to the preparation of dried CNFs.

In this paper, we report a preparation of dried CNFs that can be easily re-dispersed in water. The key to the preparation of dried CNFs was the selection of chemically modified CNFs and water-soluble polymers for CNF suspensions. The dried CNFs were easily dispersed in water and their transparency and viscosities

were not deteriorated even through the drying process. These CNF materials will be provided in powder form with good handling.

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### **The drones are attracted, the visual vision that completes 3 dimensions**

Akira Tsuda

Japan Drone Association

Drone performances and functions, holding various training sessions to correctly understand aviation law, establishing a skill certification system to fly safely, technical guidance, etc. based on a unified standard, drone users can do basic without anxiety We will develop an environment where opportunities to master skills and knowledge can be obtained.

In addition, we will support drone spreading activities in collaboration with the development of new technology using drone, social contribution project including entrepreneurial support and education, environment for drone safe operation, administrative and related organizations.

I would like to focus on the development of the drone industry in Japan, with everyone who has the same intention regardless of individuals or companies.

### **Development of Valmet Industrial Internet**

Hisanori Bando

Valmet K.K.

Jari Almi, and Johanna Newcomb

Valmet Automation Inc.

The Industrial Internet has enabled the unlocking of the value of vast data resources in a modern pulp and paper complex. The unlocking of this value is today being done by experts in pulping, papermaking and energy processes who analyze this secure data in supplier performance centers. Their analyses, discoveries and recommendations are now being used to optimize the performance of mill sub-processes and the whole mill, and to improve reliability. Supplier and pulp and paper producers collaboratively implement and sustain performance

improvement and reliability improvement programs based on various optimization and analytics methods. Specific case studies are presented where productivity has been increased, raw material and energy costs lowered, quality optimized and process uptime improved.

### **Fuji Electric's IoT solutions to create new value**

Yasuo Inamura  
fujielectric.com

Fuji Electric has been providing the state-of-the-art control technologies for use in various areas, including social infrastructure such as electric power and transportation, equipment for industrial use such as iron and steel, chemicals, automobiles and electric and electronic devices and consumer products such as buildings, retail stores, vending machines and in-vehicle devices.

And recently, the Internet of Things (IoT) has been attracting a great deal of attention and the control technologies in the industrial world are entering a phase of major change.

This paper describes Fuji Electric's approach to the IoT with the following examples.

- 1) The energy center for improving energy management operational efficiency
- 2) Boiler combustion solution for reducing boiler fuel cost
- 3) Vibration diagnosis system of rotating machine with wireless sensor

### **Industrial Internet for the Power Industry**

Yasutaka Muta  
Solution Architect, Power Digital, GE Power

The power industry faces lots of challenges like power-market deregulation, the rise of renewables, unstable fuel price, and changing consumer behavior. Power companies need to understand the impacts of these challenges and by embracing digitalization, companies can apply unprecedented insights, new capabilities and innovative business models to these challenges.

To change challenges to enormous opportunities, GE provides industrial internet platform, PREDIX, and industry-centric digital solutions, Asset Performance Management (APM), Operations Optimization (OO), and Business Optimization

(BO). APM is a solution to capture, integrate, and visualize data from physical assets in power plants and run analytics to improve reliability and availability of these assets. Predictive analytics is the key feature of APM that enables operator to anticipate or identify failure of an asset with longer lead time by modeling the asset's expected versus observed states. OO is designed to help power companies to tackle operational issues, meet business demand, and reach "true" plant capacity while still reducing cost. OO has two key components, cloud-based visualization and recommendation solution and closed-loop edge control solution that enables real-time operational optimization. BO is a cloud-based solution designed to help power companies to take full advantage of predictive analytics to make improved decisions around power trading, fuel purchases and portfolio management. These solutions are powered by PREDIX, the industrial internet platform. Advanced analytics technologies including Digital Twin is a key advantage of PREDIX. Data security is also built into the PREDIX environment that enables power companies to fully embrace this platform.

### **Predicting equipment failure using IoT and AI**

Shuji Kuromizu, Shuji Senda and Hidekazu Miyagawa

Business Promotion Dept. Marketing Division

YASKAWA INFORMATION SYSTEMS CORPORATION

Kazuya Hirabayashi

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The internet of things (IoT) has been finally in spread period. Moving objects, such as smartphones or automobiles have been leading the market, and the rapid growth of IIoT (Industrial IoT), IoT for industrial area, has been highly expected. However, there have been difficulties in spreading IoT, because the utilization of IoT and its effects are not perfectly understood and shared. Even after introducing IoT-driven remote false detection, largely accumulated data from sensors are not perfectly utilized in the most cases.

We have provided the IoT platform service by in-house development since 2006, when the word, IoT or M2M, was not existed, with utilizing the mobile telephone network. Also, we have started the false predicting service in 2016 as bigdata utilization of accumulated sensor data by IoT platform service, after some actual proofs of failure detection for facilities by AI (machine learning).

Machine learning has a high affinity with IoT dealing with lots of sensors. A minimum required number of sensors used to be installed, considering the equipment mechanism, and failure prediction is judged by the specialized algorithm.

Recently, the lower price sensors have enable us to install lots of sensors at the same cost, however, a large quantity data have made us more difficult to get analyzed. To response to dealing with such a large quantity data, sensor data is learned by machine learning, which makes us to detect its tendency of failure quickly.

This study shows the sensing big data collected by IoT and AI utilization with our real use cases.

### **Strengthen factory network security applying SDN/OpenFlow technology**

Kazuyoshi Uchiyama

Production technology Div, Oji Paper Co.,Ltd.

With the evolution of Industrial IoT (IIoT) and Big Data, various types of factory systems are going to be connected to each other over and all form factors of devices will communicate with each other across the network. In the concept of IIoT, not only devices but mills, companies or any type of organizations would be connected and communicate each other in multi-dimensional ways.

As mill systems become more complicated, "Network traffic expansion, cybersecurity or securing human-resources with IT expertise" etc..., have been less considered for conventional mill network and there are newly emerging challenges that need to be addressed. Especially it is essential to establish method and plan to reinforce network security in a rapid and flexible manner without affecting running production activities.

To solve these problems we employed SDN (Software-Defined Networking) technology. The network integration by using SDN technology enabled monitoring of mill network security and integrity, and the network virtualization also enables potential network enhancement for the future without being constrained by physical restrictions.

### **Introduction of IoT device “e-Musen Junkai”**

Kaito Ikuta

Hokkaido Shiraoi Mill, Nippon Paper Industries Co., LTD.

Pulp and Paper Company is typical process industry and stable operation is enormously important to reach high efficiency production. In recent years, IoT (Internet of Things) and M2M (Machine to Machine) have been used manufacturing equipment etc. We have developed “e-Musen Junkai” which consists of wireless sensor network system and sensors. These sensors can measure acceleration and temperature of equipment with online. This system contribute to decrease the time of spent in watching equipment and make easier and faster to find breakdown.

This report presents the outline of developing process which we introduced into Hokkaido Shiraoi mill.

### **Replacement Project of PM2 QCS**

Masato Adachi

Niigata Mill, HOKUETSU KISHU PAPER CO., LTD.

PM2 of Hokuetsu Kishu Paper Niigata Mill produces wood-free and wood-contain printing and writing paper. Quality Control System (QCS) installed in this paper machine was B/M7000XL, which was manufactured by Yokogawa Electric Corp., and had been operating for 18years since 1998.

Due to increasing of malfunction occorence and termination of a maintenance support, Hokuetsu Kishu Paper decided to replace with new QCS called as B/M9000VP in 2016.

With the renewal of this QCS, we planned not only a system update, but also an improvement of paper quality and a reduction of energy usages by incorporating requests from production department..

This paper introduces a background of QCS renewal and an improvement of performance of paper manufacturing process.

### **New Approach of Process Optimization by Analysis of Plant Big Data -Cooperative Optimization Control of Stock Preparation and Paper Making-**

Takashi Sasaki

IA-PS PBC P&W Solutions Dept., Yokogawa Electric Corporation

In recent years, as for manufacturing industry of Japan, especially in the process

manufacturing industries of the energy-intensive industry, energy consumption rate are increasing and upward trend due to trend shifts from mass production to small varieties and variant variable production etc.,. Therefore, the need for a smart factory energy management system (FEMS) that guarantees productivity is increasing.

Although optimization of individual facilities and individual processes are being carried out through our company's improvement activities at factory production sites, it has been found that optimization by the cooperation between the adjacent production processes and optimization by the cooperation between the production process and the power process have not been satisfactorily done yet.

We conducted a detailed survey through trial test at the target factory to determine the extent of energy saving potential through cooperative control between a production processes. In planning and realizing these remedial measures, it is necessary to efficiently collect and analyze so-called plant big data in production processes. At the same time, it is required to perform appropriate optimum control and pre-simulation. From these points of view, we confirmed the effectiveness of "the Cooperative optimization tool between processes".

Moreover, as an example of cooperative optimization between adjacent processes, we applied a new concept of feed forward control to color and ash control between stock preparation process and paper making process and confirmed the possibility of energy saving by 50% compared with conventional manual operations.

## **Papermaking. NextLevel**

**～ How Voith is making paper manufacturing better and more efficient through digitization～**

Ryozo Shimizu

Control System Engineering Department, Voith IHI Paper Technology Co., Ltd.

Digitization has long since become a fundamental component of machine and plant engineering. And Voith is leading by example. Whether for existing or new paper machines, 'our digital platform concept stabilizes and optimizes processes, reduces costs and improves quality,' says Dr. Christian Naydowski, Vice President Integrated Solutions at Voith Digital Solutions.

Everyone is talking about "Industrie 4.0" or the Internet of Things. The machine and work environments are going digital. Fast and highly available internet

connections are the prerequisite for systematically integrating digital process tools into the supply chain. With its digital strategy, Voith is already a considerable step ahead. In recent years the machine and plant engineering company has consistently focused on developing a product system range for its core areas of business. This expertise is now being pooled across sectors in the new Corporate Division Voith Digital Solutions.

Papermaking. Next Level – The revolution in the paper industry

One of these core areas is paper manufacturing. Voith has been building paper machines for around 150 years and through numerous developments has revolutionized the manufacturing process for graphic papers, newsprint, packaging paper or specialty papers like banknotes or label holders. Naydowski calls Voith's next revolution for the paper industry " Papermaking. Next Level". 'We want nothing less than to integrate modern, dynamically developing information technologies with existing automation to create solutions for the paper industry.' The availability of fast internet and high, inexpensive processing power are helping the new automation tools from Voith to make the decisive breakthrough. 'Sensors, actuators and networked, data-based controls in Clouds are the basis of the new technology. What is essentially new is that we can make intelligent use of the cyber world with the physical world of plant construction and its machine components to obtain paper-specific indicators for managing the production process. In this context, speed and access to fast data processing play the decisive role.'

## **ANDRITZ Optimization of Process Performance (OPP)**

Kazunori Ohmori

Andritz K.K. Capital Systems Sales

The internet has fundamentally changed the way humans communicate. It has transformed knowledge sharing, interaction and the overall economy. Today we are facing the next revolution, the Industrial Internet of Things (IIoT). With the ability to see, hear, smell, taste and feel, countless machines and components can now communicate with each other and command and optimize themselves. With IIOT, the production of goods takes on an entirely new dimension. On the other hand, ANDRITZ is bundling its years of experience in the production of components and machinery as well as its in-depth process know-how, and expanding them with smart digital solutions in Pulp & Paper industry. In past years, ANDRITZ has also

amassed extensive know-how in the optimization of processes and successfully implemented it in numerous projects in its customers' key industries, primarily in the area of Pulp & Paper. This applies for new as well as for existing machines and equipment. Now, all in-house technology, knowledge and services are united with IIOT products under ANDRITZ's new technology brand, OPP.

## **IIoT Evolution to Direct Sensing of Solenoid Valve**

Yukinobu Kawabe

ASCO Japan Co., Ltd.

In order to support the safety operation of factory, the idea of IIoT system is starting to attract attention as well as the construction and improvement of safety instrumented systems. By detecting the opening and closing of the solenoid valve operation directly, it will be possible to predict deterioration of parts and prevent failure. This paper introduces the system in detail.

## **Extrusion molding of cellulosic fibers using cellulose derivative**

Kaito Kawamura

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Takatsugu Abera

THE PACK CORPORATION

Hiroshi Nonaka

Graduate School of Bioresources, Mie University, Japan

According to the Paris Agreement, it is getting important to develop 100% plant-based materials which could substitute oil-based plastics. Cellulosic fibers are abundant in the earth and have both durability and biodegradability. However, products from cellulosic fibers are typically limited to sheeted materials. In this study, we aimed at developing all-cellulose material which could be applicable to various forming methods like injection and especially extrusion. In order to extrude cellulosic fibers without using any oil-based plastics, hydroxypropylmethyl cellulose (HPMC), one of cellulose derivatives were blended to the fibers and kneaded with water to give clay-like material with plasticity. Effect of water on the extrudability

and shape retention was large. The best water content was chosen as 50% for paper powder used in this study. The material was successfully formed using hand-operated clay-extruder, dried at 60°C to give molded pieces. Addition of HPMC to paper powder increased extrudability of the material and the strength of the molded piece. The best blending ratio of paper powder and HPMC was estimated to be 7:3. The molded piece was disintegrated in stirred water and most of HPMC was recovered from the water as HPMC solution. We demonstrated an idea to realize 3D forming of cellulosic fibers with sufficient extrudability, strength and recyclability.

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**Thermomechanical Pulp Innovation for Energy Saving and High Brightness Paper Development**

**Part 2 Pilot Test**

Takanori Miyanishi

JAPAN TAPPI

It is reported that Douglas-fir is not suitable for mechanical pulping. Extractives such as dehydroquercetin and quercetin contained in the heartwood of Douglas-fir are known to be deleterious by consuming costly bleaching chemicals with the result that the end product may be a pulp with lower brightness. The objective of this study was to improve bleachability of thermo-mechanical pulp (TMP) of Douglas-fir. The TMP interstage bleaching was selected as a model process, where hydrogen peroxide bleaching took place between the primary and the secondary refining. Two sets of experiments were carried out to evaluate pulp washing and chip pretreatment in various conditions. The first experiments showed that pulp washing with water after the primary refining prior to the interstage bleaching was effective in improving bleachability. The second experiments found that chip pretreatment with diethylenetriaminepentaacetic acid (DTPA) or sodium hydroxide (NaOH) prior to the primary refining improved bleachability and saved 35-40% hydrogen peroxide in the interstage bleaching. Precautions were taken to optimize the chip pretreatment conditions. The pretreatment efficiency depended on the initial pH of the chemical liquor and the optimal pH range was found to be around 11.5. DTPA or NaOH, which were added for the chip pretreatment, showed the same effect. The experimental results were successfully applied to the energy efficiency and high brightness paper development project in one of the largest paper mills in North America.

## **Development of new BM Sensor System without Radiation**

Shinichi Nagata, Hidetada Sawamoto, Toshie Sakamaki and Takako Morikawa  
Innovation Promotion Division, Oji Holdings Corporation.

Typical BM sensor systems have been using the infrared for the moisture ratio and the radiation for the basis weight for about 40 years. But it is said that the radiation has bad influence on human body. On the other hand, we had developed an on-line fiber orientation sensor system and an on-line moisture sensor system using microwaves. The former is based on the anisotropy of dielectric constant and the latter is based on the dielectric loss of the sample. After developing above two sensor systems, we started to examine the possibility of BM measurement by using the sensor head of the fiber orientation sensor. As a result, we found the unique method for BM measurement by combining the fiber orientation sensor technology and the moisture sensor technology. As we examined the capability of the new method for BM measurement by using the prototype on an actual machine with comparing the typical BM sensor system, we would like to report the results and the measurement principle.

## **Characteristic and the Latest Trend of Forming Fabric**

Atsushi Koiwa  
Technical Dept. PMC·EF In-House Company Nippon Filcon Co., Ltd.

Forming A Forming Fabrics is a necessary and integral for modern papermaking machines, performing three main functions: 1) draining pulp slurry; 2) forming the sheet; and 3) transporting the sheet to the press section. Adequate sheet formation is one of the greatest concerns of paper makers, because it affects most of the sheet qualities. Recently, high quality and high productivity have both become top requirements of papermakers. Paper machines have evolved, increasing in size and speed. To meet the current demands of papermakers and the latest machines, forming fabrics have been evolving as well.

The first generation of triple-layer forming fabrics had the hope of being an ideal design, yet they were not able to expand into the market rapidly due to a structural design flaw which resulted in internal wear issues. Second and third generation triple-layer fabrics exhibited design improvements, and have become a current

mainstream design used on today's paper machines.

Aiming to improve quality and productivity, Nippon Filcon has developed "N-FAST", a revolutionary high-tech improvement on triple-layer design. N-FAST has a single-warp and triple-weft structure, which virtually eliminates internal wear (the weakness of triple-layer fabrics). Another advantage N-FAST design has over conventional triple-layer fabrics is greater MD flexibility, which enhances pulsation and improves sheet formation. Finally, our N-FAST provides optimum CMD sheet profile throughout the fabric's life.

In this session, we introduce the history of forming fabrics structure, from single-layer to triple-layer, and their evolution alongside the advancement of paper machines. Finally, we present Nippon Filcon's latest triple-weft design, the cutting-edge "N-FAST" series.

### **Next-generation Surface Sizing Agent**

Kazuhiro Kumeda

PAPER CHEMICAL BUSINESS DIVISION, SEIKO PMC CORPORATION

Some enzymes have been used for papermaking. Enzymatic technologies had been examined to using for various papermaking applications. If enzymes can act efficiently to their target (for example, pulp fibers and trash), it is expected that higher effects of enzymes to their target are obtained.

We introduce the application using enzymes in pitch control, deinking. We have developed the combination of the different enzymes that showed good effects for the reduction of tackiness, improvement of whiteness and dart count in the waste paper. We hope that enzymes become available more effectively by the combination of enzymes.

In addition, we introduce our enzyme products for the improvement of paper quality and runnability.

### **Operating Experience of New Softwood Bleaching Plant**

Yasuhiro Hayashi

Takaoka Mill, Chuetsu Pulp & Paper Co., Ltd.

The production of bleached softwood pulp had been reduced at Chuetsu Pulp & Paper, Takaoka mill because of the reduction of the bleached softwood usage in the paper machines. Due to this reason, the old existing bleach plant became too big for

the required production, and the operating and the energy efficiency became lower. There was high maintenance cost with the old bleach plant, and the old bleach plant building (built in 51 years ago) did not have enough strength for big earthquake. In order to solve these issues, Chuetsu pulp & paper decided to build the new softwood bleaching plant at Takaoka mill. The operation of new plant was started in December, 2015.

The reasons for Chuetsu to select the equipment supplier to Andritz were ; DD washer which has multiple stage washing and minimum required space, higher chemical and energy efficiency, and less working load on operators with start-up and shut-down.

There were various issues since the start of production. But the present operation has been stable with modifications and operation tuning.

For our future challenges, we are trying to improve the chemicals and energy consumption, and maximize the benefit with automatic brightness control.

### **Flying insects, especially chironomid midges, invading paper mills from outdoors**

Goro Kimura, Yuji Uchida and Junichi Enokida  
Technical Research Laboratory, IKARI Corporation  
Product Development Division, IKARI Corporation  
Second Sales Division, IKARI Corporation

The preventive effect of nets against invasion by flying insects, especially chironomid midges, was examined. Except the net of 40 mesh (opening: 480 $\mu$ m), all the nets prevented chironomid midges from invasion. On the other hand, thysanopteran insects passed through even the net of 50 mesh (opening: 330 $\mu$ m). In addition, the present study reviewed lighting management and light trapping method as physical and mechanical control of chironomid midges.

### **Latest Technology Trend of Headbox Sheet and Rod / Bed**

Ryohei Watanabe  
Spectris. Co., Ltd.

BTG-IPI (currently BTG USA Mill) was originally an OEM provider of Headbox

Sheet and Metering Rod / Bed for BELOIT and joined BTG group in 2006. BTG-IPI has been recognized as one of the valuable suppliers in the world who can propose the optimization for these products.

Headbox Sheet has been applied for the latest paper machines although the technologies have been for long years in paper industry and it has been known that the Headbox Sheet gives a huge impact on the sheet formation and fiber orientation that are the most important quality for the paper. BTG-IPI can provide not only the replacement but also the optimized design with the simulation of the expansion energy.

Optimization of the diameter and groove shape of the Metering Rod that is used at sizer and rod coater can bring a large cost-saving.

Headbox Sheet and Metering Rod / Bed are ones of the consumable goods and very small parts in the gigantic paper machine. But the optimization of the designs of these products can save a huge production cost and improve the paper quality without a large investment.

In this paper, I introduce the one of the samples for the optimization of these products BTG-IPI has done.

## **Report on the Results of the Fiscal 2017 Follow-up Survey on “JPA's Action Plan for Low-Carbon Society” 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 2012, JPA newly started “the Action Plans towards a Low Carbon Society” and has been actively addressing global warming prevention in order to achieve the following targets set in the plan:

- Compared to BAU scenario(based on specific CO<sub>2</sub> emission rate of 2005), reduce fossil energy-derived CO<sub>2</sub> emissions by 1.39 million tons by fiscal 2020 .

- In view of securing forest resources and increasing forest carbon sink, expand forest plantation areas owned or managed by the paper industry at home and abroad to 700 thousand hectares by fiscal 2020.

According to the results of the fiscal 2017 follow-up survey (actual results for fiscal 2016), fossil-energy derived CO<sub>2</sub> emissions in fiscal 2016 was 17.96 million tons, a 28.0% reduction compared to the fiscal 2005 (24.94 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, outline of the next phase of JPA's Action Plan for Low-Carbon Society spanning the ten-year period from fiscal 2021 through 2030 and the latest information of countermeasures against global warming.

## **Introduction of the Researches Presented at 19th International Symposium on Wood, Fibre and Pulping Chemistry (ISWFPC)**

Hiroshi Ohi

Graduate School of Life and Environmental Sciences, University of Tsukuba

Ayumu Tagami

Research Laboratory, Nippon Paper Industries Co., LTD.

KTH Royal Institute of Technology, Fibre and Polymer

Technology / Wood Chemistry and Pulp Technology

Keiichi Koda, Yasumitsu Uraki and Takahiro Furukawa

Graduate School of Agriculture, Hokkaido University

Yuji Matsumoto

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

The 19th International Symposium on Wood, Fibre and Pulping Chemistry was held in Porto Seguro, Bahia, Brazil on August 30–September 01, 2017. Totally about 140 researches were presented (oral 80, poster 60). Presented researches covered wide range of chemistry and were divided into sessions: pulp chemistry versus bleachability and quality, pulping, biorefinery, chromophore formation and brightness stability, bleaching of dissolving pulps, Bleaching for biorefinery purposes, lignin, lignin biosynthesis, nanomaterials, dissolving pulp, hemicelluloses, analytical, lignin preparation, lignin product, and lignin based resins. In this report,

some of presentations will be briefly introduced.

## **Theory and Practice of Ozone Bleaching**

Takanori Miyanishi

JAPAN TAPPI

Ozone bleaching began on an industrial scale in 1992 in connection with increasing environmental pressure and customers' demand for production of Elemental Chlorine Free (ECF) and Total Chlorine Free (TCF) bleached pulps. Ozone bleaching did not immediately reach its optimal efficiency from a technical viewpoint, and had to face several issues during its early years. By improving mixing technology, better understanding ozone chemistry on pulp components and tuning the whole process, ozone bleaching sequences made it possible to produce a pulp with the quality similar to or better than that prepared by conventional ECF. They mark a clear milestone in the development of environmentally sound bleaching methods. Today the choice of ozone may still be motivated by ecological requirements but it is mostly justified by the economical savings resulting from chemical cost reduction. They allow combining high brightness and strength with cost efficiency. Ozone bleaching is conducted either at medium or high pulp consistency, depending on ozone bleaching process suppliers. The choice of one of these processes over the other depends on a number of factors – including investment costs, carry-over load, bleaching filtrates recirculation and bleach plant temperature profile and others.

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### **Operating Experience of Down Flow Lo-Solids Cooking at Ishinomaki Mill**

Shohei Maya

Ishinomaki Mill, Nippon Paper Industries Co., Ltd.

It is Lo-Solids cooking system with a continuous digester was used since 2001 in 1KP process at Ishinomaki Mill, Nippon Paper Industries Co., Ltd. These days, it was difficult to operate stably in the final cooking zone because the ratio of domestic wood chips which basic density was lower than that of wood chips from oversea was increased. The unstable operation made Kappa number of pulp blew from the digester variable. As a countermeasure, high cooking temperature and high White Liquor dosing ratio were required.

In October 2015, new cooking system, Down Flow Lo-Solids cooking, was started in order to improve the operation. A new bottom scraper which had long arms and a big corn to make chip flow smoothly was installed and we changed liquid flow from up-flow to down-flow between C7 and C8 extraction zones. At the same time, liquid extraction from C8 screen was started. The opening area of C8 screen strainer was expanded in order to maintain liquid passing flow rate low and prevent chips clogging between strainer bars.

As a result, the operation was improved with the new cooking system and the standard deviation of the Kappa number was reduced. We were able to make our target of Kappa number 2 points higher than with Lo-Solids cooking system and increase the pulp yield. On the other hand, Kappa number after oxygen delignification process was not changed and reduction of bleaching chemicals was achieved unexpectedly. We thought that washing efficiency with Diffuser was improved because pulp consistency blew from the digester was increased due to the stable operation in the final cooking zone. In addition, temperature set points at the top of the digester and the output from a cooking heater were decreased because chip compaction was increased and actual cooking time was extended in the digester. The reduction of steam consumption was achieved. North America.

## **Operating Experience of Vapor Recompression Evaporator**

Yosuke Nonaka

Niigata Mill, HOKUETSU KISHU PAPER CO., LTD.

New vacuum evaporator the name of H train systems has been operating in Niigata mill since June 2015. The old evaporator, the name of C train started in 1976 and D train started in 1978 could not handle the pulp maximum production by reason of poor vacuum running caused of the long term deterioration. For the purpose of old facilities update, environmental load reduction, and the stable operation of the black liquor concentration process, we introduced the new vacuum evaporator.

H train has been running over 2 years while overcoming several problems, contributed to the mill's maximum pulp production. 7 body 7 effect equipment and

Vapor-Re-Compression-System (abbreviate it to VRC as follows) compress the steam by the re-compression fan strengthen the black liquor concentration ability.

In this paper, we briefly describe the outline of the equipment and operating experience of H train.

## **Realization of Quality Improvement by Optimizing Plate Design for Thermomechanical Pulping**

Satoshi Ishikawa

Kushiro Mill, Nippon Paper Industries Co., Ltd.

In The specific refining energy reduction in TMP plant is the task to be developed continuously from the view of cost down and energy savings. Especially pulp quality improvement with energy savings identified with refiner plate character has been studied as the most important task.

We, Nippon Paper Kushiro Mill, have tried to install a variety of low energy plates for many years. Now, our TMP process achieved 20% specific refining energy reduction caused by installation of non-conventional plates designed by ANDRITZ. In addition, the operating condition with great performance of new plates was established with three times pulp strength improvement and 75% shive reduction. This report explains our significant efforts.

## **Operating Experience of Intensa Maxx**

Yoshihiro Uotani

Kanazu Mill, Rengo Co., Ltd.

Rengo Kanazu Mill, located in Awara city in the northern part of Fukui prefecture, owns one paper machine for corrugating medium and its average production volume is 650t/D. The waste paper plant has two pulpers of 7.6m in diameter for OCC and one another of 5.3m used for core board.

Stable operation in the stock preparation is essential for paper board production to keep high productivity and quality.

This report describes general information and operating experiences of Intensa Maxx which was installed in March 2017 to improve pulping process and stabilization in fine screening process.

## **Outline of the Tokai Mill Hydropower Station**

Akihiro Tanaka

Tokai Mill, Oji F-Text Co., Ltd.

Oji F-Text Tokai Mill, comprised of three manufacturing sites producing specialty paper in Fuji and Fujinomiya City, Shizuoka Prefecture, also has eight hydropower stations in Fujinomiya. They started operation in 1919 to 1964 and have been working for a stable electricity supply, but they also have been aging over the 53 to 98 years operation.

Oji F-Text has been replacing these old stations in order to ensure thorough maintenance of hydroelectric facilities and pursue a long-term stable supply of hydroelectricity as a clean energy resource.

An overview of the replacement project of Urui river No.2 power station as well as the outline of each hydro station is described. The hydropower design is optimized by examining the flow regime, the water head, and the water wheel type, resulting in annual increase of 4,054 MWh power generation after replacement.

## **New program with FiberWhite® for DIP process optimization**

Koji Sogo

Industrial Technical Consultant, Pulp and Paper Business, KATAYAMA NALCO INC

pH in DIP process is important control point that can be influence operation and quality of DIP. Therefore constant rate of chemical is dosed to maintain proper pH.

However circulation water recovery and reuse is common and DIP system is a good environment for bacteria growth. In fact, bacteria count at a DIP system was very high. Also, bacteria growth is confirmed in a process like a tower that requires long detention time, and pH is lowered due to generated organic acid. In such a condition, we confirmed that caustic soda is consumed and hydrogen peroxide is resolved unintentionally.

We have been introduced various slime control technology for paper making process. By applying monochloramine, one of those technologies, we considered DIP process optimization program and achieved not only pH improvement but also other problem solving and optimization at DIP process, and as a result, we managed total operational cost reduction and quality improvement. We would like to introduce one of those cases.

## **Novel Polyvinylamine Product“RZ series”for Pitch Control in Paperboard Making**

Kenji Sakai and Naho Murata

Shonan Research Center, HYMO Corporation

Pitch troubles such as sticky deposit on equipment, dirt, breaks and holes of paper are one of the main issues in paperboard making. After studying the solution to address these issues, we succeeded in synthesizing new Polyvinylamine (pVAM) Emulsion Products “RZ series” as pitch control agents for paperboard making process.

The charge density of RZ series can be designed in wide range. Furthermore, the molecular weight of these products becomes much higher than that of existing pVAM products by applying our emulsion polymerization technology. Therefore, RZ series can make a beneficial effect on the fixation of pitch in paperboard materials.

The evaluation of the fixation performance was carried out by “Micro pitch-image analysis system”, and the evaluation for reduction of sticky substances was carried out by “Heat press-image analysis system”. As the results, RZ series showed superior performance to other widely used organic cationic coagulants.

We assumed the reason why the RZ series showed a superior fixation effect, and the verification test of following three items was conducted.

- 1) High performance on the fixation of micro-pitch to pulp with keeping small size of pitch.
- 2) High performance on the fixation of micro-pitch to pulp with strong interaction.
- 3) High performance on reducing the adhesiveness of pitch.

**Purification of papermaking process water using coagulant with multiple kinds of reactive site and continuous monitoring of unfixed micro particulate matter by a new sensor**

Takashi Saigusa

Kurita water industries LTD.

Along with the recent increase in paper recycling rate and closed systematization of the paper making process, various substances accumulate in the water of the paper making process, and cause the deterioration of paper quality and runnability of paper making machine. Fixation of the accumulated substance is important and the need of the coagulant increases.

We developed the new coagulant with multiple kinds of reactive site which increased reactivity by reaction of non-cationic site. Fixation and retention performance of the new coagulant was higher than conventional cationic coagulant. In addition, we were able to add the characteristic performance by regulating the balance of the reactive site, such as the fixation of pitch, the reaction in the cationic substances surplus, and the prevention from foaming by the poor fixation.

In addition, we developed the new sensor which measured unfixed micro particulate matter level consecutively. By using the new coagulant, the unfixed micro particulate matter of white water was reduced to half level, and the number of the spots decreased. The new coagulant contributed to cleaning of papermaking process water and improvement of paper quality and runnability of paper machine.

**New Approach to Effluent Load Reduction by“AXISZ System”**

Koichi Tadaki, Yohei Miyoshi, Yoko Fujiwara, and Kaori Sugasaki

Technical Div. Technical Dept., SOMAR Corporation

Somar has developed wet-end improvement system named “AXISZ System” which enables various types of wet-end chemicals to demonstrate the original and intrinsic performances to the maximum. “REALIZER A Series” is high-performance coagulant which is effective for sticky pitch and defect paper surface and is also, special cationic polymer which is good to be applied to stuff box. High-performance retention aid, “REALIZER R Series, FX Series” is multifunctional polymer with special structure and can achieve higher retention even with small dosage. Optimum Wet-end system can be obtained by combination of those chemicals. Also, it's should be noted it is unique that each chemical alone can demonstrate its own capability.

The match which reduces the displacement because the amount of consumption is quite watery by paper industry becomes important. The tendency which rises every year can see white water load by which it's for COD and the electric conductivity. I focus on effluent load reduction in paper mill by writing and introduce several new way to approach to which white water load of a papermaking machine is reduced. During these research and development, we found that the application of wet-end improver “AXISZ System” could reduce wet-end chemical dosage, reduce effluent load, and reduce other environmental load. Development of wet-end chemicals focused on less environmental load is the main feature of Somar and its performance is verified through number of machine trials. This report describes effect of our latest paper chemicals.

## **Development of SE Rotor Vane type II**

Yujiro Deguchi

Rotor Industry Co., Ltd.

SE Rotor Vane developed by our company is a high efficient rotor vane, which boasts a sales result of more than 30 units including large and small ones since its release. It is a great honor for us that this Rotor Vane was awarded the 43th Sasaki Award and the 17th Chugoku New Business Awards. We named a new product that improved the usability of the SE Rotor Vane SE Rotor Vane II.

The SE Rotor Vane II is the one which realized the improvement of the SE Rotor Vane's usability and durability with the shape of the SE Rotor Vane unchanged. The shape and appearance of Rotor Vane that contributes to improving the production efficiency and material quality of pulper is the same as before.

There are several changes in the SE Rotor Vane II. The part that we thoroughly thought is how to change a spare blade. In past years, the most popular approach is to attach the spare blade with three bolts prior to releasing the SE Rotor Vane. However, in the SE Rotor Vane, the number of mounting bolts of the spare blade significantly increases in exchange of easy replacement of the spare blade. Through a long development period, the number of mounting bolts of SE Rotor Vane II becomes three (3) bolts, the same as before.

We are diligently developing products other than the Rotor Vane, including projects that we already have been moving forward to acquire rights. We have a plan to occasionally announce them at the phase of completion of acquisition of the rights after completing actual proof thereof in future.

### **BW Papersystems Finishing Equipment Technical Improvement Program (TIP)**

Hayato Tanioka

K.K.IRISU (C.ILLIES & CO.,LTD.)

BW Papersystems has a long history of drive and motor designs, going back 31 years. In this paper, we discuss how we got to the unique advantages of the liquid cooled drive and motor system.

### **The History of Technological Developments of the Paper Industry in Japan after World War II**

#### **Part 6 Overseas Developments**

Kiyoaki Iida

Until around 1970, overseas projects were proceeded to secure raw materials necessary for increasing domestic paper demand. They were some of followings: importing woods and chips, bringing back home pulp produced overseas and carrying back finished paper products. In the 1970s, oil price hiked, pollutions caused by the industry were censured and environmental conservation was concerned. The paper industry tried to use more amount of recycled pulp, and understood an economic advantage of and invested in having large costal integrated mills using imported chips. It could not afford to proceed overseas ventures in those

years.

In the 1990s, the paper industry, having recovered a relatively stable economic condition, started to work on overseas ventures. The its first concern, this time again, was securing wood chips and afforestation was carried out in many countries overseas. The other was how to deal with Asia. Some companies began to operate box plants in Asia to supply corrugated containers to their customers who moved their plants to Asia. As a whole, however, some was eager and others were not. The paper industry scored the lowest figure in the ratio of overseas sales to its total among manufacturing industries in Japan in 2002. It was so even in 2015, though the industry would like to do.

### **Characterization of TEMPO-Oxidized and Refined Pulps**

Yukinori Kobayashi

Pulp and Paper Innovation Center, Oji Holdings Corporation

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

Yasutomo Noishiki, Manabu Yamamoto

Pulp and Paper Innovation Center, Oji Holdings Corporation

Tsuguyuki Saito and Akira Isogai

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

Catalytic oxidation using 2,2,6,6-tetramethylpiperidine-1-oxyl (TEMPO) can be used to selectively convert primary hydroxyl groups in accessible regions of cellulose and hemicellulose molecules in pulp fibers into aldehyde and carboxy groups. Clear improvement of the wet tensile strength of handsheets prepared from a TEMPO-oxidized pulp (TOP) was previously demonstrated without the use of any wet strengthening agent. Moreover, the paper chemical contents added at the wet end and retained in the handsheets increased. However, the practical use of TOPs as raw materials in papermaking has not yet been sufficiently studied. In this study, the effects of refining TOPs on the resultant fiber morphologies and properties were investigated. TOPs with carboxy group contents of 0.42 and 0.86 mmol/g were prepared and refined to various levels using a PFI mill. The average fiber lengths of the TOPs decreased and their fines contents increased with increasing number of PFI revolutions; these results were similar to those for the original pulp. However, the freeness remarkably decreased and the water retention value significantly increased with increasing number of PFI revolutions compared with those of the

refined original pulp. Moreover, the fibrillation behavior of the TOPs with refinement clearly differed from that of the original pulp in terms of the changes in pulp morphology and the amount of functional groups.

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### **Solutions based on new technology for effective energy utilization**

Masaki Yagita

System Application Dept. Engineering & Technology Div.

Yaskawa Siemens Automation & Drives Corp.

Yaskawa Siemens Automation & Drives Corporation (hereafter referred to as YSAD), a joint venture between Yaskawa Electric Corporation Japan (hereafter referred to as YEC) and Siemens AG Germany (hereafter referred to as Siemens), was founded in 1999. YSAD offers industrial electrical systems for all industries (with the exception of steel and public work projects), electric products sales and after-sales service for YEC products and SAG drives. In this article we introduce novel solutions for effective energy utilization based on new technology utilizing YEC and Siemens products.

Examples of recent trends for energy saving strategies using new technologies can be found in both EVs (Electric Vehicles) and FCVs (Fuel Cell Vehicles), which are actively driving the transportation sector. Even in the business sector large-scale buildings are required to comply with Energy Conservation Law, which is expected to accelerate the energy saving with the introduction of fuel cells and heat pumps. In the industrial sector, inverters have been employed for many years and the Top Runner Program for electric motors and transformers has also been put in force. According to the Energy White Paper published by Ministry of Economy, Trade and Industry, in the time period from 1973 to 2014 energy consumption in the industrial sector has been reduced by 80% while the GDP growth rate itself was 240%. However, as industrial sectors account for about half of all domestic energy consumption, energy conservation promotion is still required.

In order to address these demands it is essential to introduce new energy saving technology, examples of which are introduced here.

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

Shingo Shimoyama

Sendai 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.

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

Nobuhiro Date

Akita Mill, Nippon Paper Industries Co., Ltd.

On the Activities for Energy Saving in Akita Mill, we did not achieve the expected target enough in 2015. For breaking this situation, we started the new energy saving activities named “Neigah Activities” in 2016. They were carried out four times a month by the special members selected several sections and also supported by the outside consultancy (Japan Business Innovation Consulting Co., Ltd.). As the new target of energy savings, we set 3% of the energy consumption in the previous year.

On the first half of term, we confirmed the flow and the material valance for each equipment or process, and investigated the quantity of electric power, water, steam, and air. We recognized the energy consumptions of each item from them. On the latter half, we analyzed the each condition and whether the energy was used effectively, and looked for the difference between actual and specification of each equipment. We picked up and listed the themes for energy saving once we imagined, and prioritized based on benefits and costs.

The members gained some matters and knowledge from each other by discussing with illustrations and pictures. Through these activities, we achieved 3.23%, and exceeded the target.

## **Niigata Mill Energy Saving Case**

Masahito Washidu

Niigata Mill, Hokuetsu kishu Paper Co.,Ltd.

In recent years, countries have been required to take measures against global environmental problems such as global warming, and Japan aimed to reduce CO2 emissions in FY 2030 by 26% from FY 2013 by draft of COP 21 promise.(1 Hokuetsu Kishu Paper also has been trying to conserve energy by launching an energy conservation project in order to contribute to the draft of the promise of COP 21. In this paper, we introduce examples of energy conservation by 'Steam trap diagnosis in Niigata factory' and 'First screen high efficiency improvement of Niigata No. 8' conducted at the Hokuetsu Kishu Paper Niigata Plant.

## **Effective utilization of energy by chemicals for boiler water treatment**

Koji Aoki

Kurita Water Industries Ltd.

Chemicals for boiler water treatment are evolved out of a long process for requirement of energy saving. In this paper, 3 topics which we concerned in the energy saving activities of each factory with boiler water treatment chemicals are briefly described.

Low pressure boilers in which feed water are mainly softened water have a problem with mineral scales deposited on the internal heating surface. The scales adversely affect energy efficiency of those boilers. A scale remover has been required in addition to conventional chemicals, but if remover is added excessively, the boiler tubes made of carbon steel may be damaged.

Kurita Water Industries has invented a multi-purpose chemical for preventing scaling and corrosion in boilers and removing deposited scales. It contributes to the energy saving of each factory through the stable and efficient boiler operation.

## **Energy Saving Bag Filter**

Hiroyasu Hattori

HATTORI ENGINEERING Ltd.

In this paper three topics which I was concerned to the development were briefly described.

We understand the importance of particulate filtration and emissions monitoring delivering environmentally friendly and economically viable solutions to your business.

Increasing economic and environmental pressures on the paper industry places significant importance on maximizing manufacturing performance and process efficiencies throughout the entire plant operation.

Pentair Environmental Systems (PES), through its globally recognized brands Goyen and Mecair, continue to deliver industry leading filter cleaning systems and emissions monitoring solutions to industry, supported by over 100 years of combined market intelligence and application experience.

We offer a dedicated Research and Development team pioneering industry leading products and customizing solutions. World class manufacturing in two locations, global offices and local technical experts who will ensure all aspects of particulate filtration and emissions monitoring are optimized, supporting your business in delivering quality product, competitively.

### **Energy and Cost saving by Doctoring optimization**

Toshifumi Wakabayashi

Valmet K.K.

Our experience says that 99% of all doctoring positions can be somehow improved. Very often, the money spent on doctor blades is considered as doctoring costs. However, doctoring affects costs far beyond the cost of blades and holders, and therefore there is often a large improvement potential. The improvement can come from a variety of sources like increased runnability, improved blade durability, more efficient logistic solutions, reduced energy consumption and more. Sometimes unit price of a blade can be important for a mill, but most often the focus should be on other ways of improving the doctoring economics. This paper introduces energy and cost saving by doctoring optimization.

## **Introduction of energy-saving examples that can be realized at low cost**

Takehiro Uwafuji

Miura Co., Ltd.

MIURA has recently strengthened the proposal of "total solutions" to solve customers' problems, under the slogan "Let's deliver the cheapest, best heat, water and environmental products in the world to customers around the world".

Energy conservation by large-scale capital investment is also continuingly high demand, but energy conservation examples that can be realized at low cost are increasing year by year, from this point of view, from the viewpoint like this, from the viewpoint of heat related, compressor related, water related, factory waste hot water I will introduce relevant energy saving case examples.

In any case, "visualization" of energy is important, and we hope that our technology will contribute to your energy conservation plan even a little.

## **Introduction of Fajar Paper PM8 Engineering**

Ryosuke Taki

Paper Machinery Engineering Dept., Kobayashi Engineering Works, Ltd.

We, Kobayashi Engineering Works, Ltd. received an order in 2014 of renovation & relocation project of PM8 from Fajar Paper who is biggest paperboard supplier in Indonesia. The purpose of this PM8 project is a secondhand machine imported from Europe was producing the information paper and remodeling to produce the corrugating boxboard.

## **Chlorine and Potassium Removal System using Evapo-Crystallization method CRP System; Chlorine Removal Process**

Kenichi Fukushima

EPC Department, VEOLIA JENETS K.K.

In the craft pulp recovery cycle, chloride and potassium coming from wood chip as raw material are accumulated in the process, and what is concentrated in effluent

gas dust drained from a recovery boiler is well known. A melting point of the dust decreases by concentrated chloride and potassium, and there might be concern about clogging of the boiler, corrosion, and drop of the boiler ability. Conventionally, the method to decrease the chloride and potassium concentration that rose was to discard the dust at electric dust collector. Therefore this conventional method causes loss of the soda and expenses to supply soda increase. In the effort that craft pulp industry continues working hard to raise the integrity for the recovery cycle, this problem is becoming a serious problem. To improve this problem, the system removal chloride and potassium included in the dust is necessary. The CRP™ system which is evapo-crystallization method has been developed in such a background. The CRP™ system which piled up the experiences at all over the world is introduced.

#### **ACA Permi Online Air Permeability Analyzer and RoQ Roll Hardness Profiler**

Yohei Suzuki

SHIN-NIHON CORPORATION

Generally, Porosity measurement used to be considered that it can not be measured on-line as it takes time. Therefore, it has been measured by sampling at off-line.

Permi Online Porosity Analyzer of ACA Systems (Finland) is a system that can measure porosity on-line in real time. Permi can calculate the porosity by any method such as Gurley, Bendtsen, Coresta at high speed. The measurement data will be saved in SQL format on the server PC. Online porosity measurement will bring many merits such as system control and quality control.

Measurement of roll hardness has been common with hammering method or Schmidt hammer. However, these methods have problems such as measurement error and time consuming. RoQ Roll Hardness Profiler of ACA Systems is a next-generation device that solves these problems. It is possible to measure the roll hardness with high accuracy. Furthermore, measurement data can be taken out in Excel format.

## **Biorefinery of Oil Palm Empty Fruit Bunch by Nitric Acid Prehydrolysis Soda Cooking. Production of Furfural and Dissolving Pulp**

Agusta Samodra Putra, Akiko Nakagawa-izumi, Mikio Kajiyama, and Hiroshi Ohi  
Graduate School of Life and Environmental Sciences, University of Tsukuba

Abundant waste agricultural residues such as oil palm empty fruit bunch (EFB) can provide alternative sources of biomass for producing furfural. The aims of this study were to propose a method of preparing furfural and dissolving pulp (DP) from EFB using prehydrolysis with nitric acid, and to examine how the prehydrolysate, which contains xylan, can be used for furfural production. The furfural yield in the nitric acid prehydrolysate was increased to 6.2% of the EFB material weight by dehydration with an acid catalyst. Nitric acid prehydrolysis followed by soda cooking under atmospheric pressure was also applied to the preparation of DP. The obtained pulp was then bleached by using peroxymonosulfuric acid (Psa), chlorine dioxide (D0, D1), and hydrogen peroxide (Ep) in the elementary chlorine-free Psa-D0-Ep-D1 sequence. The pulp demonstrated a brightness of 90.4% ISO and a viscosity of 6.5 cP, which met the National Standard of Indonesia, although the xylan content was a little high and the  $\alpha$ -cellulose content was 83.0%.

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### **Saving energy by modifying waste paper treatment process**

Shoichiro Yamada

Kanto Mill, Nippon Paper Industries Co.,Ltd.

The Kanto mill Soka, Nippon Paper Industries Co., Ltd., has three paper machines and nine wastepaper processes and produces industrial paper board including cardboard.

This time, we had reviewed three wastepaper processes for PM2 and conducted two countermeasures in order to save energy. The first one is the primary coarse screen was stopped by reducing the pore diameter of pulper extraction plate. The second one is process modification which two secondary fine screens were installed in series. Energy saving case we implemented is reported below.

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

Takuya Kato

Oji F-Tex Co., Ltd.

Amid rising interests over renewable energy, Oji group has been positively progressing the utilization of biomass and hydroelectric power generation. Since paper manufacturing is an energy-intensive industry, the amount of purchasing energy such as LNG is still large. And the energy cost has a great influence on the profit, extraction and implementation of energy saving projects that produce the effect quickly are required. Since setting up an aim of reducing 1.5% of energy consumption from the previous year and progressing energy - saving activities in every Oji FTEx mills, and I wrestle for energy saving activity, but have a hard time for the excavation of the energy saving item newly.

Meanwhile, because I received the introduction of the energy saving apparatus which enabled the consumption electricity reduction of the induction motor called "SHIGA SAVER" in the Tokai mill and there were the introduction results a lot and got

an effect, I installed “SHIGA SAVER” in the facilities in the factory and inspected an electric power saving effect.

This paper presents “the energy saving with the SHIGA SAVER” as an example of the energy saving item.

## **Energy saving study process and examples using the Heat recovery solution**

### **『Water heat utilization system』**

Yasuhide Takuma, Syo Tamura

ORGANO CORPORATION

The heat of water contained in wastewater and cooling water is discharged at many factories. Water heat utilization system is a water heat recovery system that uses our total engineering and original review process. And it has high energy saving performance and high investment effect. We introduce the system outline and examples.

## **Activities for Energy Saving in PM8**

Yusuke Nishimukai

Amagasaki Mill, Rengo Co.,Ltd

Rengo Co., Ltd has set a target, which is called Eco Challenge 020, of a 32% reduction in CO2 emissions from the 1990 level by 2020. Amagasaki mill has formed a special team “ecocha!” to achieve this goal since 2014 and already met some success in it.

This report shows 3 examples of the reduction of steam consumption at the dryer part. Firstly, the prevention of paper temperature reduction at size press part by installing hood panel. Secondly, the improvement of sheet moisture profile and reduction of water consumption at moisture profiler by adjusting tabulator bar position in dryer cylinders. Finally, the effective utilization of the flash steam from the final drain tank at steam heaters.

## **Recent CO2 reduction technology by high biomass co-firing in coal-burning boilers**

Hitoshi Fukushima, Masato Tamura, Hidekazu Kasai, Shunichiro Ueno and

Yasuo Matsunagakihi

IHI Corporation

There is a CO<sub>2</sub> emission reduction method of burning woody biomass and coal, as a technical method to reduce the CO<sub>2</sub> emission of the coal fired power plant. So we have performed studies and examinations for providing the useful technical knowledge. Based on the result, we performed the verification test of 25cal% in a quality of woody pellet with coal fired power plant of 149MW of Kamaishi Works in Nippon Steel & Sumitomo Metal Corporation. The boiler had been performing the stable operation during that test. The text introduces the studies, examinations and verification test for high co-firing ratio of woody biomass.

### **Fundamental properties of surface modified pulp sheet**

#### **—TEMPO-oxidized pulp/aliphatic amine salts—**

Yukinori Kobayashi, Yasutomo Noishiki, manabu Yamamoto

Pulp and Paper Innovation Center, Innovation Promotion Division, Oji Holdings Corporation

Two TEMPO-oxidized pulps which have different carboxy group content (0.42 and 0.86 mmol/pulp-g, respectively) were prepared from HBKP by TEMPO/NaBr/NaClO system. Then, primary, secondary and tertiary aliphatic amines with different carbon number of alkyl chain length (n-butyl, n-octyl, n-dodecyl, n-hexadecyl, n-octadecyl, di-n-octyl, di-n-dodecyl, tri-n-octyl, tri-n-dodecyl-amines) were introduced into carboxy groups present on TEMPO-oxidized pulps by neutralization. FT-IR analysis showed that almost all of the carboxy groups on the surface of TEMPO-oxidized pulp changed from acidic form to the carboxy/amine salt form in the case of primary amines, whereas formation of amine salt by secondary and tertiary amines were harder than primary amines, and the amount of amine salts was decreased in the order of secondary amines and tertiary amines. The introduction of abundant long-alkyl chains on TEMPO-oxidized pulp resulted in the lower density and tensile strength of TEMPO-oxidized pulp sheet, but such density was higher than original pulp and such tensile strength was equivalent to original pulp. Contact angle of sheet was dramatically increased because aliphatic amines made the surface of TEMPO-oxidized pulps hydrophobic. The higher contact angle and tensile strength sheet compared with original pulp was prepared from n-octyl amine salt of TEMPO-oxidized pulp with 0.86 mmol/pulp-g carboxy groups.

Eiji Iwata, Kenichiro Suyama, Nobuaki Urata, Katuhiko Nakahama, Tomotaka Shinya,  
Kazuya Nanto and Akiyoshi Kawaoka  
Research Laboratory, Nippon Paper Industries Co., Ltd.  
Sakae Shibusawa, Masakazu Kodaira  
University of Agriculture and Technology  
Ko Kato, Hiroyuki Obanawa  
Chiba University

In this study, we developed a biomass increase production technology and measurement technology to dramatically increase the amount of cellulose per unit area of afforested trees at the eucalyptus afforestation site owned by the Nippon Paper Group in the northern part of Brazil. Specifically, the following three items were implemented to realize this. (1) Development of large-area soil evaluation system using a soil sensing technology. (2) Development of DNA marker breeding technology. (3) Development of biomass estimation system using terrestrial laser scanner and UAV.

This achievement will be used for wood biomass production at overseas plantations, with an aim to develop and strengthen a wide range of manufacturing industries that use wood biomass as major materials, as well as forestry.

#### **Industrial Internet as Valmet Service**

Jari Almi, Johanna Newcomb  
Valmet Automation Inc. Finland  
Masahiro Kanee  
Valmet K.K.

Our background lies in 1960's when our first automation solutions came to the market. In 1980's we launched first distributed controls and monitoring systems, and in 1990's we already were able to embed intelligence and advanced information into the production processes.

In early 2000, we started to provide our customers with 24/7 remote services for troubleshooting assistance and for preventive maintenance. Already since 2010 our customers have been able to utilize our information services and remote analysis to increase their productivity, end product quality and raw material efficiency.

Today, our customers can enjoy solutions that enable them to improve their performance by utilizing benchmark data and best practices regarding.

## **Introduction of on-line TOC Analyzer for waste water**

**—On-line TOC Analyzer especially suitable for sample with lots of salts or suspensions—**

Shuichi Akasaka

Mitsubishi Chemical Analytech Co.,Ltd

Online Total Organic Carbon (TOC) analyzers have become commonly used to monitor abnormal values of industry sewage in recent years. The combustion-type TOC analyzers are used in most cases, where we face many troubles by frequent maintenance and part replacements due to samples with higher salt concentration and suspended solids. One of the advantages is the two step destruction with ozone as the oxidant, which gives oxidation efficiency equivalent to the combustion-type analyzers. Another advantage is a wide sampling tube,  $\phi 2$  i.d. or larger, which prevents the tube being clogged with samples.

Further, the instrument is suitable for measuring industry sewage because the wet-type oxidation with ozone will not be affected by coexisting salts.

## **Big Data Management in Paper Manufacturing**

**-A Vision of the Future of Data-Driven Paper Making-**

Mark Korby, Ian Padley, Masashi Hasegawa, Yuji Nishino  
Spectris. Co., Ltd.

The rise of big data, meaning the collection, analysis, and visualization of exponentially greater quantities of information, is having a disruptive impact on papermaking. Dramatically better methods for generating, storing, analyzing and understanding data are giving progressive paper manufacturers fresh opportunities to gain advantages. This can result in smoother operation with fewer process upsets, lower raw material consumption, improved efficiency, and better bottom-line profitability.

In this article, we will review the ways in which data has been used in paper making in the past, and what the current practices are today at many companies. We will then look at other advanced data management methods that are not as widely used today, but can offer competitive advantages. Finally, we will speculate on where big data management might be going in the future.

**Pulsar/Kawanoe Latest Converting Line Technology for Household Paper**  
**—New Trends in The Configuration and Management of Converting Line—**

Massimo Franzaroli

Pulsar Srl

Masaya Onishi

Kawanoe Zoki Co., Ltd.

Kawanoe Zoki has built partnership with Pulsar, Italy since July, 2017 and we are now pleased to introduce and offer the products and the latest technology of Pulsar for the domestic customers. Among a number of innovative products, we would say the following products are the most effective and attractive for the domestic markets. These are – 1. Product quality inspection equipment, 2. Conveyancing system for household products line, 3. Performance assessment analysis software for household products line.

Since there has not been any superior Product quality inspection equipment (for toilet roll as well as packing products) so far in the world market, major European tissue makers commencing with Italy has started to recognize Pulsar's prominent optics technology and adopt its products. In domestic market, one tissue maker has installed Product quality inspection equipment last year and inspection work has been shifted from manual labor to unattended.

In cooperation with Pulsar in combination with our household tissue converting machines, we believe that we would be able to offer more flexible and effective solutions to the customer than ever.

**How the paper industry in Japan has technologically responded to the paradigm shifts of the Japanese society**

**Part 1 The paper industry as one of industrial sectors of the Japanese economy**

Kiyoaki Iida

When you plot the annual consumption of paper and paperboard against the year, the axis of the consumption being a logarithmic scale, the gradient at a certain year represents the rate of change at that year. The paper and paperboard consumption in

Japan was plotted in that way since 1950, and two sharp drops in the rate of change per year were found, one around 1970-1975 from 13.2% to 3.8% and the other around 1995-2000 from 3.8% down to minus 0.9%. The Japanese DGP (nominal) behaved in the same way and its rate of change per year decreased from 14.5% to 8.6% in the first period and further went down to 0.0% in the second period. The fact suggests that the Japanese society experienced the paradigm shift at those two periods and the paper and paperboard production was also affected.

The Japanese paper industry maintained the share of about 3% in the total industrial output (based on money), though in a downward trend, since the World War II. It is quite unique, as other industries experienced large ups and downs. It is because the Japanese paper industry supplied the most of domestic demand, against pressures from foreign suppliers. In fact, its import and export volumes have been less than 10% of the total production.

The Japanese paper industry has technologically responded to those paradigm shifts, and has been substantial in the Japanese economy. Its technological efforts will be followed in the next issues.

### **Development of Alkaline Newsprint Grade with High Brightness and High Opacity for Color Printing**

Takanori Miyanishi

JAPAN TAPPI

Several mill trials on a twin wire gap former suggested that neutral PCC (Precipitated Calcium Carbonate) filled newsprint has high brightness and opacity, and is technically feasible. Sheet formation was good, physical properties were acceptable, and print quality such as ink transfer and print through was excellent. However, more linting propensity was observed. To solve this problem, Prüfbau printing tests and EPMA (Electron Probe Micro Analysis) were employed for the evaluation of linting tendency and paper sheet structure. PCC fillers retained by mechanical filtration were observed near the paper surface as agglomerates. Laboratory studies found that using a retention aid improved two-sidedness of paper and distribution of PCC fillers by colloidal forces, and reduced linting propensity. Based upon these results, the next mill trial was performed. For effective use of retention aid, zeta potential of the paper machine headbox was monitored

continuously by an on-line instrument and was controlled into the proper range. Stock inlet pH was stable at 7.5-8 due to the buffering effect of PCC, and no darkening of mechanical pulp was observed. No paper breaks or foaming troubles occurred. The first pass retention was increased and two-sidedness and linting of the newsprint were decreased to satisfactory levels. The neutral papermaking technology of newsprint was successfully applied to develop value added high brightness and high opacity wood containing printing grade and generated ample profit to paper mills.

### **Development of the dry paper recycling technology which realizes a new office papermaking system**

Masahide Nakamura

PL Business Management Department, Printing Solutions Operations Division, Seiko Epson Corporation

We have developed a new “dry paper recycling technology” and commercialized a “dry office papermaking system” that creates new paper from used paper at offices under the users’ care. Although direct dissolving processing has become widespread as a means of recycling confidential documents generated from offices, confidential leakage due to accidents during transportation is a risk as cardboard boxes containing confidential documents are transported to a paper company during the processing. As a solution, the office papermaking machine made it possible to realize both confidential deletion and recycling at users’ site without bringing confidential documents to the outside.

The developed technologies consist three technologies; "defibration technology" for decomposing used paper into each one pulp fiber, "sheet forming technology" for forming fibers again into a uniform sheet, "pressing and binding technology" for increasing fiber density and bonding pulp fibers each other to create new papers. By doing these in dry processes, we realized a small sized and low power consumption papermaking machine to be able to create on-demand paper recycling system. This recycled paper can be used to print as a PPC (plain paper copier) paper. In addition, to further increase the utility value as a papermaking system, we incorporate technology to create cardboard various thickness and colored paper according to the user's setting freely.

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## **Supply and Demand of Wood Chips for Paper Producing and Its Worldwide Trends**

Kiyoshi kamikawa

Managing Director, Japan Paper Association

Paper and paperboard is indispensable for human life and its main raw material is wood chips. Pulp and recovered paper are also used as raw materials for paper and paperboard producing but their raw materials are also derived from wood chips. So, it can be surely said that paper and paperboard is almost 100% produced from wood chips. The demand for paper and paperboard has been decreasing after Lehman shock mainly due to the development of IT technology. So, the production of paper and paperboard has been also decreasing thereafter. About 70% of woodchips is imported and the imports of wood chips by China have been increasing very rapidly because China has recently been No.1 paper and paperboard producing country in the world.

As for domestic wood chips, the demand of wood chips for biomass has been soaring due to the expansion of wood biomass energy generation by FIT. Therefore, the demand and supply situation of wood chips has been getting very harsh and competitive. On the other hand, Clean Wood Act has been enacted in 2017 to tackle illegal logging ensuing the degradation of forests on the earth and the traceability of wood chips is strongly required by users and consumers. Besides, the increase of certified wood chips by FSC, PEFC or SGECC is the urgent agenda to secure the sustainability of global environments.

## **Chip Mill Operation and Woodchip Quality Control**

Kenji Yoshinaga and Hiroshi Tachikawa

Forestry Dept., Raw Materials & Purchasing Div., Nippon Paper Industries Co., Ltd.

Chipmill managers are not only adjusting their chipping operation in order to fulfill various requirements from customers, but also improving it day by day toward cost-down. There are two famous procedures for woodchip size analysis; one is

“TAPPI-UM21 Sieve Analysis of Pulpwood Chips”, and the other is “SCAN-CM 40:01 Size Distribution”. Since it takes normally only seven minutes (TAPPI) or ten minutes (SCAN) per sample, these are commonly utilized for on-site quality control at chipmill.

Chipsizes are determined by three dimensions of the woodchip; length, thickness, and width. Especially for the chip length, we have to fully understand each of the components of the chipper along with their roles, and also properly have to adjust and to maintain them through precise check-out. Although there are several types of chipper, in this paper we mainly described about the characteristics and structure of Carthage chipper, Sumner chipper, and Norman disc chipper.

Referred to chipper components, we explained the function of spout, feed plate, wear plate, knife holder, chipper knife, counter knife, vertical anvil, and horizontal anvil. Also we described the procedure to adjust them using knife adjusting frame, chipper knife gauge, and thickness gauge. Although we listed up woodchip specification failures during operation and their trouble-shootings, some of the solutions are fully based on the fair condition of the chipper disk and stability of its shaft. Therefore it is very important to establish good maintenance team with sophisticated procedures, otherwise there is a possibility that they cannot even notice of the fundamental fault and repeat useless patching-up measures toward each trouble.

At the last part of this paper, we introduced one example of static chipper mill and one from infield chipper. The former is Fulghum Industries 96” – 10 knife disk chipper operated by AMCEL – Amapá Florestal e Celulose S.A. in Northern Brazil, and they process debarked *Eucalyptus urograndis* logs, cut to length by seven meters for each. The latter is Peterson Pacific DDC-5000G (later 5000H) mobile chipper operated by Croxley Pty Ltd in Western Australia, and they do infield-chipping operation for *Eucalyptus globulus* whole trees, producing woodchip with spec for pulp & paper.

## **Current situation and issue of recovered paper in Japan**

Kouichi Nakada

Paper Recycling Promotion Center

The recovery rate of paper and paperboard in Japan has reached to 80.9%. The recovery papers has satisfied 64.1% of the fiber demand for paper making in 2017 (utilization rate) and the balance are exported for overseas demand.

64.1% is a highest utilization rate in the world and we are aiming to lift it to 65.0% by the year of 2020.

To promote the utilization of recovered papers, it is essential to keep and improve the quality, well-sorted and clean. The scheme for sophisticated sorting, inspections and selection has been built through all stage in recovering with the cooperative working among the consumers, recyclers, local governments, and paper makers under the initiative of Ministry of Economy, Trade and Industry. This philosophy of paper recycling enables us to keep higher recovery and utilization rate and to support the export.

We are experiencing the drastic modification of quality demands from overseas recently. It looks impacting the supply and demand of all over the world including Japan. With knowing the changes in the world, it is recognized the significantly important to maintain and improve the quality of recovered papers in Japan, which leads to the sustainable recovery system.

We would like to report the current situation and issues for recovered paper in Japan.

### **DIP Technologies to Apply for Today's Low Grade Waste Paper**

#### **-Especially for tissue paper making-**

Kazumi Fujita

AIKAWA Iron Works Co.,Ltd.

Today's DIP raw material waste paper for tissue paper is quantitatively limited by reduction of production of writing-printing paper. Since the Mixed Waste Paper (MIX) import prohibition by Chinese government at the end of 2017, the price hike and quantitative tightening situation of waste paper in Japan have been slightly mitigated, but the low quality tendency of available waste paper is not improved.

From the viewpoint of life cycle assessment, the raw materials of tissue paper should have the optimum balance of waste paper and virgin pulp, and we believe that effective use of waste paper by the newest DIP technologies contributing to energy saving and global warming prevention should be sustainable, based on the fundamental signification of waste paper recycling, such as securing raw material for paper making, effective use of resources and formation of a recycling society by waste reduction.

Our target would be "to achieve 65% recycled paper rate in 2020" set by Japan Paper Association. The inbound effect by the Tokyo Olympic Games 2020 also might be expected. We would then like to introduce in this paper the AIKAWA DIP technologies, especially for the tissue making stock preparation process, i.e. Pulping and pulper continuous de-trashing, Coarse screen rejecting with no fiber loss, Washing & floatation, UV-ink dispersion, First pass retention improvement by POM compact wet end system, White water treatment by DAF, and Cleaners for tissue paper machine fabrics.

## **Application of stabilized halogen in deinked pulp manufacturing, and its benefits**

Shintaro Sato

Katayama Nalco Inc.

This paper is written regarding efficiency of hydrogen peroxide bleaching in deinked pulp plants. First, the paper explains technical background of interference with peroxide bleaching by bacteria, and stabilized halogen technology in pulp and paper industry. Then, the experiment is reported that deinked pulp treated by monochloramine which is well utilized stabilized halogen gave more efficient bleaching than no treatment. Lastly, the paper introduces mill experiences from few deinked pulp plants that bleaching efficiency improvement was achieved by applying monochloramine. Some other benefits at the viewpoint of plant operation were also reported as additional return from the application.

## **Factors affecting pulp yield and improvement measures**

Hitoshi Tsuchida and Jungo Nishimuki

Technical Sales Dept., Hakuto Co., Ltd

The external environmental change that the pulp industry should pay attention to include the reduction of paper demand, the expansion of wood demand, and the utilization of wood resources as the information transmission and recording means change.

As wood resources depend on imports, the Kraft pulp manufacturing method is the mainstream, and most of the manufacturing variable costs are raw wood costs. As the domestic paper pulp industry, it is important to know how to produce high quality pulp. The merit of obtaining is very large.

As factors influencing the pulp yield, it is necessary to appropriately adjust the operating conditions such as optimum chemical composition, pH, temperature, time, pressure, etc. through cooking and bleaching processes, and to assist in the cooking and bleaching process. The use of agents can be mentioned.

As a proposal for measures to improve pulp yield, we will report on the prevention of elution of components that can become pulp and investigation of the optimum operation pH region, focusing on re-adsorption, and our newly developed products with the same concept.

## **Fundamentals of KP Brownstock Washing and Technical Trend of Washing in Japan**

Makoto Iwasaki

MIP Consultant Office

The purpose of brownstock washing is to separate spent cooking chemicals and dissolved organic wood solids from unbleached fiber with using as little washing liquor as possible. The brownstock washing is defined that a separation process located between the cooking stage and the bleaching stage or paper machine depending on the type of stock being produced, however, this article describes about basic knowledge of pulp washing included with Hi-heat washing in a continuous digester, blow line washing, washing before and after O<sub>2</sub> delignification stage as well as washing in bleaching stage. At the same time, the changes of equipment for KP washing in Japan are introduced briefly.

## **Importance of Brownstock Washing Process and Andritz Brownstock Washing Technology**

Kanji Hagiwara and Ryo Yoshida

Andritz K.K.

Brown-stock Washing Process is one of the key processes in Kraft Pulp Mill. Purposes of Brown-stock Washing Process are (1) remove dissolve organic material and in-organic material from pulp which are generated in cooking process and oxygen delignification process, and send filtrate to recovery process. Efficiency of Brown-stock washing is very important for Kraft pulp recovery process. This paper explains basic and important points of brown-stock washing technology.

## **Development of wash machine and the technologies for improving washing efficiency**

Yan Ju

Valmet K. K. Services business line

With development of washing machine, it is common understanding that wash press (especially TwinRoll™ Press Evolution, TRPE) is mainly adopted for washing pulp recently. By installation of the wash press it is possible to recover the chemicals and the dissolved wood components efficiently, and reduce COD carry over to the bleaching

plant. On the other hand, by installation of the wash press in the beaching plant (especially in D0 stage) it is also possible to minimize COD carry over to the next bleaching stage, and adjust the beaching conditions easily (pH, temperature etc.), reduce the bleaching chemical consumption, and minimize the discharge of effluent. With DiConn™ system it is possible to increase the washing efficiency both in washing zone of the digester and in the pressure diffuser, produce more flash steam, and increase dry solid content in weak black liquor which is related to reduce the steam consumption in the evaporation plant.

### **Characteristics of Pulp Mill Effluents and Activated Sludge Process**

Masayuki Watanabe

Research Laboratory. Nippon Paper Industries Co., Ltd

In pulp and paper mills, flocculent settling process, a kind of physicochemical process, and activated sludge (AS) process, a kind of biological process, have been used for wastewater treatment. The former is to remove SS by flocculation with chemicals, and the latter is to decompose dissolved organic matter by aerobic bacteria.

Wastewater in the pulp and paper mill is classified to wastewater from KP plant, wastewater from DIP plant and wastewater from paper machine, each of which contains various organic matters. The former two, pulp mill effluents, are treated with AS process in most cases.

In order to evaluate characteristics of pulp mill effluents, dissolved organic matter in wastewater from each pulp plant was fractionated into five components : hydrophobic acid (HoA), hydrophobic neutral, base, hydrophilic acid, hydrophilic neutral. Based on measurements of the degradation rates of the fractionated components, it was confirmed that the most refractory matter was fractionated into HoA. The main source of HoA was KP bleaching process drainage, and a major composition of HoA seemed to be lignin.

Degradability of wastewater was affected by not only characteristics of wastewater but also performance of AS. Biodegradation test with combination of wastewater and AS indicated that AS samples of some mills had different ability for degradation. And, Genetic analysis suggested that high performance AS had much bacteria preferring aromatic compounds which were hardly degradable.

## **The wastewater treatment systems in the pulp and paper mill**

Toshihiko Abe

Sumitomo Heavy Industries Environment Co., Ltd.

The wastewater from pulp and paper mill is classified into the following 4(four) kinds. a. pulp wastewater b. KP evaporator drain wastewater c. paper machine wastewater d. DIP wastewater. The wastewater treatment systems are decided about by the factory scale, locational condition and production item, etc...

Typical wastewater treatment systems are Primary coagulation sedimentation, Activated sludge and Post coagulation sedimentation, wastewater is processed below the processing water quality standard and drained in a public area.

Oji Paper Co., Ltd. Tomioka factory introduced EGSB system (methane fermentation system) of energy and space saving. The biogas is used as supplement fuel of a kiln, and the energy recovery.

## **Principles of Kraft Cooking and Computer Simulation of Continuous Digester**

Takanori Miyanishi

JAPAN TAPPI

The computer model was developed to simulate two-vessel Kamyr continuous digester. The model was a static model that simulated steady state processes for process optimization and retrofit feasibility studies. A new equation that described cellulose degradation by dissolved lignin was incorporated in our model, which made it possible to evaluate the effects of multiple points of black liquor extraction. One of the kraft digesters of Nippon Paper Industries was designed by MCCTM (Modified Chemical Cooking). Prior to the startup, simulation was performed to predict pulp yield and strength properties of hardwood pulp. Simulation shows that higher pulp viscosity and yield were obtained at a given kappa number by several modified cooking methods. The dissolution of the hemicelluloses was best understood by separately considering the two major types: glucomannan and xylan. The content of xylan in MCC cooked pulp was higher than that of the conventional pulp because xylan remained relatively stable to alkali. As hardwood chips contain more xylan than softwood chips, it was predicted that the pulp yield increase in MCCTM and EMCCTM (Extended

Modified Chemical Cooking) would be more pronounced in hardwood kraft pulp than in softwood kraft pulp.

### **New stock preparation Portfolio - Voith BlueLine Product**

Junichi miura

Voith IHI Paper Technology Co., Ltd.

Modern stock preparation has to provide maximum performance with the highest system efficiency. Efficiency means not only using less energy, fiber and water, but also sustainability in terms of quality and reliability. Machines in stock preparation have been developed what are demanded by the period and improved day by day in long history continuing providing the machines. Also surroundings and the needs are changed a lot in different countries.

In this change, Voith presents its new product portfolio BlueLine for stock preparation from several thousand references and experiences in a variety of product ranges.

### **Energy Saving and Demonstration of Operation Experience by New Integrated Lime Kiln**

Hiroto Tsuchida

Hokkaido Mill, Nippon Paper Industries Co.,Ltd

Nippon Paper Industries Co.,Ltd Hokkaido Mill-Asahikawa has two lime kilns in recausticizing process of kraft pulp plant. Lime kiln, which is part of the process for making alkaline solution used in kraft pulping, is lime reburning process to convert calcium carbonate to calcium oxide.

We implemented major upgrade on one of kilns with the aim of shutting down remaining kiln to reduce heavy oil consumption.

In this paper, we will report on the details of the upgrade work, energy saving and demonstration of operation experience by new integrated lime kiln.

## **How the paper industry in Japan has technologically responded to the paradigm shifts of the Japanese society**

### **Part 2 : The Paper Industry in the 1970s (1)**

Kiyoaki Iida

The period from 1970 to 1975 was one of paradigm shifts of Japanese society, as oil price hiked, the Rome Club warned that resources are limited, and the environment deteriorated severely due to the rapid economic expansion ahead of it. The paper industry, suffering imminent free trade of paper, steep rise of wood price and complaints on its pollution from public, had a sense of crisis for its business

To cope with the problems, it invested more than 800 billion yen to control pollution acceptable, mostly on effluent treatment, in the five years. As for wood supply, hardwood could be one of main wood supplies, wood chips were imported systematically, and old newsprint could be processed to newsprint furnish.

What happened in those years were characterized as a technological revolution in Japan. The solid state was a key technology, and every industry in Japan, similarly making the best of it, became prosperous in the world. In the paper industry, many new paper machines were installed. Paper companies worked with unique and close cooperation with domestic suppliers who were licensees of foreign equipment suppliers, and improved their production capability to the top level in the world, and became competitive to imported products.

The next issue will discuss energy saving and international business in those years and sum up the era.

## **Kraft Cooking and Bleaching Ability of Low-density Acacia Wood and Hardwoods with Varying Chemical Characteristics of Lignin**

Keishi Tanifuji , Ken Nozaki and Taro Sugiura

Hokuetsu Corpotation.

Hiroshi Ohi

Graduate School of Life and Environmental Sciences, University of Tsukuba

Low-density acacia (*Acacia hybrid*) wood chips, relatively high-density acacia (*Acacia mearnsii*) wood chips, eucalyptus (*Eucalyptus globulus*) wood chips, and

Japanese mixed hardwood chips were cooked through a kraft cooking process using the continuous conventional mill digester. Chemical composition of these wood chips and properties of the obtained pulps were compared. Low-density acacia wood chips showed the highest lignin content, the lowest combined yield of syringaldehyde and vanillin obtained by alkaline nitrobenzene oxidation analysis of the lignin, and the worst cooking response among the four kinds of woods. When the mixture ratio of low-density acacia wood chips in the feedstock was increased, pulp yield and hemicellulose (xylan) content of the pulp were decreased. The physical properties (breaking length, bursting strength, and folding endurance) of the bleached kraft pulp hand sheets slightly decreased with decreasing xylan content of the pulp. However, changes in the hand sheet strength properties had negligible effects on the quality of the paper products.

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### **Latest technology and history of Calender section**

Yoshiki Kabutoya

Paper Technology, Valmet K.K.

Calendering is one of the fundamental elements in the paper finishing process. Particularly in printing paper, in order to improve its printing suitability, finishing the surface smoothly and giving gloss to paper are important in imparting value added to the paper. On the other hand, technologies capable of executing energy saving and resource saving with better efficiency while seeking the quality of the target are required, and technologies responding to it have been developed. In this paper, we introduce the history and the latest technology of the calendar which have developed technologies unique to each company in order to satisfy requirements of papermaking machine and coating line speeding up, efficiency improvement and product type.

### **History of Winder Technology and Recent Trouble Shooting References**

Yasushi Tachikawa

Voith IHI Paper Technology Co., Ltd.

Looking back at the history of Winder, the machine has been developing with the changing technology. At first, only Two-drum Winders were common until the 1960's. However, the development was advanced. Consequently, Single-drum Winder was developed in the 70's, and in the 1990's, VariPlus equipped with a center drive came out. When entering the 2000's, rubber-covered drum was introduced into the industry. Rubber-cover has two advantages; first, it reduces vibration. Secondly, it enables Winder to accept larger diameter of baby rolls than before. First benefit is vibration alleviation. The flexible surface will follow and compensate the Cross Direction caliper profile. Furthermore, the damping force through the material reduces vibration. Second advantage is that rubber cover gives wider nip width. It allows producing larger diameter of paper rolls with lower nip pressure even with the same nip liner

load.

Even though there are lots of discussions about new equipment or retrofit technology of the product, there are few practical statements about improvements for existing machines. Therefore, here we show some actual improvements for typical troubles based on the author's experiences. Some examples will be introduced such as, for better performance, setting slitter in the right geometry. For reducing vibration and roll kick-out, setting change of rider roll nip pressure for Two-drum Winder. To improve vibration problem, parts replacement such as worn core chucks and radial play of drive shafts for Single-drum Winder. In addition, setting change of friction damper is effective for vibration reduce as well.

Recently, the acceleration and deceleration rate has been increased for capacity improvement. However, due to vibration, many machines have tended to be prevented from operation with the setting rate. Hydro-pneumatic damping system was developed, and has been installed for new Winders. In the near future, the system needs to be applied to not only new machines but the existing ones.

#### **Winder improvement Examples of Winder improvements and labor saving of Finishing – part in the future**

Shoichiro Hayashi

NAGAI TEKKO Co.,LTD

Nagai Tekko started business in 1938 at the corner of RENGO Chibune Mill. In early stage, we grow up our technical skill by parts renewing and repairing at the paper mill. In the 1956, we built a factory at Amagasaki City and grew up from repair business to the manufacturer of paper machines.

In 1980s, we concentrated 2drum-Winder as our core business. Through the OEM-Works, we developed original Winder Automation systems. It fit the customers need of operator reducing.

Recently the needs of Automation systems step forward to the second phase.

We need to develop the new automatic devices or systems that fit the times. Especially we must develop the system that solve the problem of the rapid worker decrease in Japan. For example Connect with the host computer will help reducing the input errors by non expert. Other example Developing the machines without physical strength will help various workers. We will keep advancing technology from now on.

## **About Finish Facilities Labor-Saving**

Ryosuke Yago

Designing Dept. JTEC Machine Manufacture

We are a papermaking machine maker mainly engaged in designing, manufacturing and selling industrial machinery mainly for papermaking finishing equipment. In the paper industry, the finishing department is an important section for determining product quality. The finishing department is difficult to automate, it complicates the process due to diversification of quality as well as quality as well as product form according to the user's requirement, so anyway it takes a labor intensive work It is said that. However, in each industry regardless of the paper industry, labor saving of work accompanying the automation of machines is proceeding and it is a problem that can not be distracted. In the first place, saving labor is to eliminate labor and labor by introducing and streamlining machines, and as we are involved in the paper manufacturing industry as a papermaking machine manufacturer, we must pursue it. In such circumstances, we propose new facility investment for automatic machines of "flat packaging machine", "skid packaging machine", "winding packaging machine" which are finishing process packaging machines, and at the same time, We have worked on labor-saving activities of users by investigating and remodeling and improving machine problems and needs. In this thesis I will introduce and introduce the latter activities.

## **The Method of Prevention Against Insect Entry to Production Factory Applying Ventilation Unit with Automatic Cleaning Filter**

**-The method of prevention against foreign objects with pressure control inside the building-**

Kenichi Mitunaga and Futoshi Okamura

NIPPON PURETEC CO.,LTD

(Air Filter Insect Protective) To keep the air pressure of production room positive greatly contributes to protect insects from coming into the room. However, introduction of great deal outdoor air needs higher costs for air filter installation as well as for operational and / or maintenance.

This system is the solution of above problem, by possibly being applied to the domestic consuming paper plants, with the use of automatic insects evacuation style rotary disc filter together with outdoor air intake fans, aiming at the insect protection by the pressurized room air in economical way.

## **The comprehensive chemical approach for realization of stable operation by the optimum foam control**

Kazuaki Tsuchida

Nissin Kagaku Kenkyusho Co., Ltd.

In the papermaking process, various troubles may be caused by foaming everywhere. Troubles due to foam not only hinders operability and productivity but also often adversely affects the quality of products, and foam control is extremely important in solving the above problem.

Since we began supplying papermaking chemicals to the paper manufacturing companies nationwide in 1943, we have worked on improving foaming problems with our customers, we have a large selection of customized products for each customer process, and as a chemical assistant for foaming troubleshooting today There.

In this paper, we describe our recent efforts on foam control method in each process.

## **Polyacrylamide-based Pitch Control Agent for Pulp and Papermaking Process**

Takuji Sodeyama

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

Deposits of organic contaminants can cause serious problems on runnability or quality. Contaminants can come from wood (pitch) or from manmade sources through recycled fiber (stickies). They can impact the paper making process from the pulp mill to the paper machine. Traditional methods to control pitch and stickies including addition of talc or dispersants can hardly solve these problems in closed system of water.

We developed a novel pitch control agent based on amphoteric polyacrylamide for pulp and papermaking process. First, this agent can be adsorbed onto the surface of organic contaminants, stabilize them in colloidal state, and reduce their surface stickiness to prevent further agglomeration. Second, this allows the particles to be retained in the pulp sheet and removed from wet-end system without creating deposits. Furthermore, this agent has excellent abilities of heat and alkaline resistance so that it performs effectively in various pulp and papermaking conditions as well. We call this agent the “AS series” concept for organic contaminant control.

In this paper, we introduce feature of “AS series” and trial results of improving pulp

quality and operation by applying it for pulp machine having pitch trouble.

## **How the paper industry in Japan has technologically responded to the paradigm shifts of the Japanese society**

### **Part 2 : The Paper Industry in the 1970s (2)**

Kiyoaki Iida

Following the previous issue, the technological approaches of the paper industry in the 1970s were reviewed.

The sharp rise of oil price was devastating to the industry, which, as a whole, started to save energy in any measures. As results, unit consumption of the total energy went down from 133 in 1981 to 92 in 1999, expressed in index with that in 1990 as 100. The ratio of yearly purchased energy value to that of yearly paper and paperboard production was reduced from 19.5% in 1981 to 6.8% in 1993..

The menace of imported products was countered by improving cost performance of products.

Synthetic pulp and paper, which were attractive in the late 1960s and expected to take a 20% share in the 1970s, failed due to oil price hike.

As a result, the paper industry, having technologically dealt with problems like environmental pollution, scarce wood supply, high energy price and menace of imported products, recovered profit more than the average of other industries. It was, moreover, understood in public that the industry was ecologically friendly and sustainable.

The technological development of process industries, one of which was the paper industry, was stagnating in the 1990s and the revolution was beginning.

### **All-cellulose materials adhered with cellulose nanofibrils**

Junji Nemoto, Shota Fukushima

Novel Materials Development Office, Hokuetsu Kishu Paper Co. Ltd.,

Atsushi Kobayashi, Minami Tagawa

Technical Department, Hokuetsu Toyo Fibre Co. Ltd.,

Tsuguyuki Saito and Akira Isogai

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

All-cellulosic materials called vulcanized fibers, in which cellulose fibers are gelatinized and adhered to each other by zinc chloride, have been known for more than 150 years. However, the swelling and adhesion mechanisms have not yet been clarified. In this study, X-ray diffraction, scanning electron microscopy (SEM), and specific surface area (SSA) analyses of cellulose sheets treated with different concentrations of aqueous zinc chloride solutions were performed to elucidate the behavior and mechanism of cellulose fibers adhering to one another during  $\text{ZnCl}_2$  treatment. The X-ray diffraction analysis revealed that the  $\text{ZnCl}_2$  treatment caused swelling of intercrystalline regions but did not significantly change the original crystal structure of cellulose I. The SEM observation of the freeze-dried sheets revealed less aggregated structures of the fine fibers and the existence of three-dimensionally entangled cellulose nanofibrils (CNFs) between the cellulose microfibrils. The increased SSA values of the freeze-dried sheets supported the formation of CNFs during the  $\text{ZnCl}_2$  treatment. These results indicate that in these all-cellulosic materials, CNFs are entangled and form dense networks that are not completely detached in water. In addition, the presence of moisture leads to more viscoelastic behavior as a result of slip between the CNFs during tensile testing.

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### **The Latest Trend of Folio size sheeter and Wrapping technology**

Haruyuki Uchiyama

Maruishi Co., Ltd

Maruishi has been working for paper industry for a long time providing various total system for paper manufacturing process from the dewatering section to finishing equipment. Today, the finishing line is the one of the main products and especially, Maruishi has been sold more than 190 unites of ream warping machines not only to domestic customer but also all over the world. The ream wrapping machine as the first place, Maruishi is capable to provide from the single unit of the various finishing equipment to the whole turnkey project.

Today, the technological innovation is getting tough, considering high demand for the long-term reliability with maintainability for introducing new equipment. Based on experience of manufacturing and service of paper manufacturing machines for over 70 years, we introduce Folio size sheeter, high speed Ream Wrapping Machine, and Kraft roll packaging machine with advanced technology.

### **AI Auto Depalletizing System**

**-AI robot making distribution operation unmanned and labor-saving-**

Ryuta Koshiishi

IHI Logistics & Machinery Corporation     Logistics Plant Sales Dept. Sales Div.

In recent years, our country is suffering from a serious labor shortage due to the decreasing birthrate and aging population.

Especially the distribution industry faces with this labor shortage. Among the logistics tasks, the unloading (depalletizing) work of cardboards stacked on pallets is a heavy work leading to occupational accidents such as back pain. Therefore, it is difficult to secure labor force and even if they can be hired, workers' retention rate is low. So now it is urgent to make the distribution operation unmanned and labor-saving

by robots.

In this paper, we introduce the features of the depalletizing system with AI as an approach to unmanned and labor-saving.

## **Transition of Web Inspection System and State-of-the-art Technology**

Kiyotaka Ueda

Automated Web Inspection Department, OMRON Corporation

Web inspection system is determining a fault by lighting on the sheet of paper or the like, to measure the received light amount between the defect and the base such as black spots and holes in the camera is for determining a defect with the difference. This is advanced total system designed by a combination of optical, electronics, mechanical, control computer, software and variety of technologies. In this paper we describe the evolution of WIS.

## **Development of Quality Inspection Sensor for the Paper Mill Finishing Line**

Takayuki Ikeda

Technology Development Center, JFE Plant Engineering Co., Ltd.

JFE Plant Engineering Co., Ltd is a comprehensive engineering company of machinery, electricity and control, which was established by JFE Mechanical and JFE Electrical & Control Systems in April 2016. In the previous JFE Electrical & Control Systems, we have been working on sensor solution business related to quality control from 2004. For the paper making industry, we have developed many sensors in the finishing line for communication paper, printing paper and household paper. We are developing the inspection system that substitutes for visual inspection by acquiring information on the inspection object mainly by using a laser or a camera and performing advanced mathematical processing on it. It has been acknowledged as one of the suppliers of quality sensors for the paper making industry by proposing and developing unique methods aiming for high accuracy inspection. Through these developments, we have delivered more than 30 quality sensors for the Paper mill finishing line. In this paper, we introduce a part of the technology that we have cultivated through experience.

## **Andritz Fiber Flow Drum Pulping Technology for OCC Application**

Toshio Okunishi

Andritz K.K. Capital Systems Sales

" Paper is made At Stock Preparation System. " This is a word of Papermaking Engineering. In other words, " KP is made at a Continuous Cooking Digester.", " Mechanical Pulp is made At a Refiner". " Recycled Fiber pulp is made At a Pulper". A Fiber-flow Drum pulper ( FFD ) is able to produce the recycled pulp of excellent quality for both DIP and OCC from low quality and inexpensive raw materials that include lots of foreign materials and contaminants. That will be able to contribute a lot in the reduction of production costs. In this paper, is described the application of FFD to the OCC area that has increased rapidly for the last 10 years by introducing the reference results, flow sheets, application examples. In addition, it is stressed that FFD can be utilized effectively for OCC as well as for ONP ( Old News Papers ). The writer will start from the basic descriptions about FFD and then go into the application to OCC.

## **How The Paper Industry in Japan has technologically responded to The Paradigm shifts of the Japanese society**

### **Part 3 : Groping in 1990s**

Kiyoaki Iida

The paper industry in Japan, which had got over a crisis of existence, started to restructure the industry itself, rationalize its traditional distribution system and work on international deployment, as the Japanese economy was drastically slowing down. The restructuring proceeded to some extent. The international expansion, however, was not successful and the overseas sales ratio of the industry in 2002 was the least among industries.

Though paper demand was stagnating, which rather removed the stress of wood supply for its favor, an alternative to paper was not in sight and the industry was regarded sustainable, having a kind of recycling system within, and could afforded to have some relief for its future.

The technological development, successfully carried out with using solid state technology since the 1960s as seen in scale-upping equipment like paper machine,

staleminated and a next key-technology was not found yet. The industry was losing its advantage over foreign followers.

Exactly in this period, the new technological revolution, which would lead to information oriented society and would challenge the essence of paper and become a key- tech in the future, had begun.

### **Preparation of Dissolving Pulp by Totally Chlorine-free Bleaching: Roles of Hardwood Syringyl and Guaiacyl Lignins**

Ayyoub Salaghi, Augusta Samodra Putra, Roni Maryana, Mikio Kajiyama, and Hiroshi Ohi  
Graduate School of Life and Environmental Sciences, University of Tsukuba

Dissolving pulp was produced from four different hardwoods by prehydrolysis-kraft cooking and totally chlorine-free (TCF) bleaching using oxygen (O), peroxymonosulfuric acid (Psa), and alkali extraction with hydrogen peroxide (Ep) in an O-Psa-Ep-Psa-Ep sequence. The hardwood lignin structures were characterized by the nitrobenzene oxidation method, which provided syringaldehyde (Sa) to vanillin (Va) molar ratios (S/V ratios) of the lignin. Eucalyptus globulus wood had the highest S/V ratio of 5.81 and a combined yield of Sa and Va of 3.04 mmol/g-lignin, while the Acacia hybrid wood exhibited the lowest S/V ratio and the combined yield. The E. globulus wood provided a final pulp with an acceptable level of viscosity 7.0 mPa·s, a weight-average molecular weight (Mw)  $3.04 \times 10^5$  g/mol, a number-average molecular weight (Mn)  $5.56 \times 10^4$  g/mol, polydispersity (Mw/Mn) 5.47, a high brightness of 90.1% ISO, and an  $\alpha$ -cellulose content of 94.2%. It is attributed to the high S/V ratio and the high combined Sa and Va yield, which is suggestive of a less-condensed lignin structure compared to the other hardwoods tested. No significant differences in the cellulose crystallinities of the bleached pulp produced from the four hardwoods were observed.

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### **Thirty Years of Southeast Asian Forests: Dynamics of Deforestation and Restoration**

Mamoru Kanzaki

Graduate School of Agriculture, Kyoto University

This article demonstrates the dynamics of deforestation and restoration of forests in Southeast Asian countries. In the most of the Southeast Asian countries, timber resource in natural forests was the easy-access resource for foreign currency earning which might be indispensable as the first step of economic development in these countries. The conversion of forests into crop land caused the massive deforestation in 1960 to 1990 in the countries. Global scale anti-logging campaign and forest conservation movement resulted in Forest Principles Declaration (1992) in the Earth Summit and forest carbon credit in Re-afforestation Clean Development Mechanism in Kyoto Protocol (1997). The timber logging in tropical counties also changed. Now many of counties force forest management units to apply reduced impact logging and also to get the international forest certification. People's thinking about forest was also changing in Southeast Asia, because of repeated disasters like flooding and debris flow. Smallholders, like local farmers and community, are becoming important players in timber production now. In Japan, the condition of forest has been dramatically improved in last 70 years. The forest condition in Southeast Asian counties is expected to be dramatically improved in the next 30 years.

### **Nanocellulose-based Functional Materials Oriented to Life Science**

Yoshikuni Teramoto

Faculty of Applied Biological Sciences/G-CHAIN, Gifu University

While basic concepts of paper-based microfluidic analytical devices ( $\mu$ PADs) have appeared considerably, elemental technology development is worth working from different specialized points of view. Herein, we reasonably utilize 2,2,6,6-tetramethylpiperidine-1-oxyl radical (TEMPO)-oxidized cellulose nanofiber (TOCN) as a module of  $\mu$ PADs. First, we demonstrate that TOCN stably stores

unstable substances when dried and acts as a biochemical reaction field when wet. The thixotropic nature of TOCN aqueous dispersion gives inkjet printability and will facilitate the  $\mu$ PADs production. The exchange of substances in the wet TOCN network takes more time than in solution, but this can be read as control of reaction kinetics. Finally, we construct semi-quantitative  $\mu$ PADs for an organic phosphorus pesticide. We illustrate that by mounting TOCN, various functions can be incorporated on one sheet of paper to lead to the extension of design flexibility and universal use for  $\mu$ PADs.

### **Introduction of the nonwoven fabric products of Mitsubishi Paper Mills Limited.**

Hideaki Saegusa

Mitsubishi Paper Mills Limited.

Our nonwoven business started with the production of glass paper for building materials and filter media for electric discharge machining. New products such as water treatment membrane supports and battery separators have been added by the nonwoven fabric manufacturing facility newly established at Takasago mill in 2012. In this paper I would like to introduce these nonwoven fabric products: glass paper for building materials, filter media for electric discharge machining, water treatment membrane supports, and battery separators.

### **Introducing *NipcoFlex-T*, Installing at the Press Part for Tissue Machines**

Kazuhiro Magome

P&S Sales Dept. Voith IHI Paper Technology Co.,Ltd.

Easy operable machine which satisfies both the following objectives under tissue production: not only producing soft and high-bulk tissues, but also producing them with less energy and pulp consumption? If machines that meet these difficult requirements are not available, an answer of that would be NipcoFlex-T. Voith has accumulated enough knowledge and experience of shoe presses since 1984, when Voith introduced the world first hermetic shoe press to the market. That shoe press technology has spread over a wide area of productions, and Voith eventually has given birth to a shoe press for tissue production. In this article, I would like to introduce a history of shoe presses and the latest shoe press technology, NipcoFlex-T, for tissue production.

## **Proposal of a Flow scheme for the Chemical-form-based Quantitative analysis of Chlorine compounds in Pulp for Sanitary products and Safety assessment**

Shigeo Imai, Mitsuhiro Wada

Unicharm Corporation

Takeharu Wada, Kei Iwasaki, Ritsuko Katagiri, Yasushi Minobe, Satoko Ishii

Chemicals Evaluation and Research Institute, Japan

Since sanitary products such as sanitary napkins and disposable diapers are used in prolonged contact with the skin; it is important to ascertain if chemical substances contained in these products have adverse effects on the human body. Pulp, the main material used in sanitary products, is bleached to increase its brightness. ECF bleaching, which is based on chlorine dioxide, has become widely used and the generation of chloroform and chlorophenols has been greatly reduced. However a little knowledge concerning the generation and persistence of chlorine compounds in the ECF bleaching process has been accumulated. If chlorine compounds are contained in sanitary products, they could dissolve in body fluids such as sweat and could be absorbed through the skin. As the adverse effects of chlorine compounds vary greatly depending on the chemical species, calculating only the total amount of chlorine is inadequate and rather it is important to identify their chemical forms in the eluate. We have analyzed dioxins in pulp used in sanitary napkins and have assessed the risk of use of sanitary products to the health of consumer even if they are used every day for 40 years. In addition, to determine the amounts and chemical forms of chlorine compounds contained in ECF-bleached pulp for sanitary products, we made a flow scheme of chemical form-based quantitative analysis, which involves quantitative determination of compounds eluted by elution tests assuming dermal exposure and confirmed safety. In this review, we introduce these research results.

## **Valmet Industrial Internet**

Jari Almi, and Johanna Newcomb

Valmet Automation Inc.

Hisanori Bando

Valmet K.K.

The Industrial Internet has enabled the unlocking of the value of vast data resources in a modern pulp and paper complex. The unlocking of this value is today being done by experts in pulping, papermaking and energy processes who analyze this secure data in supplier performance centers. Their analyses, discoveries and recommendations are now being used to optimize the performance of mill sub-processes and the whole mill, and to improve process performance and reliability. This data is shared with pulp and paper producers to collaboratively implement and sustain mill performance improvement and reliability improvement programs based on predictive maintenance analytics.

The future of data analytics will involve common solutions by suppliers in a so-called “digital ecosystem”. Concrete steps in building this ecosystem are being taken by combining the resources and solutions of an automation supplier with a supplier of enterprise resource planning and manufacturing execution systems. The potential benefits of this collaboration are presented.

## **Impact on Management and Operation Issues raised by IoT -Including Work Style Reforms-**

Yoshihiko Tamemoto

Mitsubishi Research Institute, Inc.

In 2017, the use of IoT in Japanese companies has entered the trial and implementation stage from the stage of recognition and understanding. In the manufacturing industry, we think that IoT brings three impacts:

- 1) Real-time visualization on site,
- 2) Revolution in production method, process and plan,
- 3) Business structure reform and business model transformation.

The essence of the impacts of IoT is to break away from the concept of "Mass Production". The manufacturing industry should proceed with a study of customer's experience for success.

## **Optimized Plant Operation utilizing Information Communication Technology and Artificial Intelligence**

### **-Digital Solution Service Named MHPS-TOMONI-**

Masaki Horiguchi

Engineering Strategy & Planning Group, Yokoyama Power Systems Service Dept.,  
Power Systems Service Headquarters, Mitsubishi Hitachi Power Systems, Ltd.

To optimize the operation and maintenance costs for thermal power plants and improve the environmental performance by using the ICT (Information and Communication Technology), it is essential to combine collaboration with an operator who has insights of a manufacturer. From this point of view, we provide MHPS-TOMONI as a digital solution in which our company “works together with customers”. Provision of these digital solutions started when our company developed an advanced boiler combustion control system, first in the industry, in the early 1980s. In 1999, our company set up facilities inside the company that remotely monitor a thermal power plant, leading to provision of services in which our engineers monitor plant operation. Thus, the provision of monitoring services enabled a detailed analysis of operation data and monitoring technologies were developed and sophisticated. In addition, nowadays, our company is expanding the object of analysis to unstructured data other than numerical values, such as natural language, and has improved equipment soundness evaluation and abnormality diagnosis accuracy through monitoring, thus leading to the optimization of plant operation.

## **Updated Quality Control by IoT**

### **-Developed Testing Method at Lab and On-Line Measurement at Production site**

### **- L&W New Testing Method and New On-Line Measurement-**

Mitsuhiro Yamazaki

Pulp & Paper Group, Industrial Automation Division, ABB K.K.

In all types of mature business, constant improvements are required for a company to stay competitive. Today it is more important than ever. Search for cost reductions and improved efficiency is always on the agenda. In the pulp and paper industry, the first goal is to produce a product within given specification at the lowest possible cost - quality testing and monitoring of the process is one way getting there. Furthermore, other process than production and quality control, such as market research, research

& development, procurement, sales and so on, are also essentials. Comprehensive data which integrates all the factors is mandatory for whole business assessment.

In this speech, I would like to share the newly developed testing methods, in standalone-, online- and fully automated testing equipment, and then, the way to integrate quality control process by connecting each equipment, and further to integrate quality control to other process.

By means of IoT (Internet of Things), overall data can be obtained, organically integrating real-time data from laboratories and mills. Headquarters can drive to make their business decision fast and correct based on this real-time- and comprehensive data much more than ever.

### **Erosive-wear resistance of overlay welds at high temperature under simulation of circulating fluidized bed boiler**

Tadashi Kimura , Yoichi Shiraishi

Welding Alloy s Japan LTD.

Kazumichi Shimizu

Muroran Institute of Technology

Circulating-Fluidized-Bed (CFB) Boiler is known as one of the earth-friendly environmental Boilers. However, erosive wear becomes a problem because CFB boiler burns flowing fuel and the medium in a high temperature environment. Also, there is an economic issue of operating ratio and maintenance, on the other hand it reduces environmental impact. Main results obtain through the erosion test are as follows.

It can be safely considered that selecting right materials leads to effective countermeasures against wear.

Therefore, it becomes necessary to perform simulation such as test for chloriation corrosion and sulfidation one to find out superior welding materials in erosive-wear resistance at high temperatures.

### **How the paper industry in Japan has technologically responded to the paradigm shifts of the Japanese society**

#### **Part 4 : The Paper Industry in the 2000s—A Paradigm Shift in Society**

Kiyoaki Iida

The paper and paperboard consumption per capita, which increased at the rate of 3.4% per year since 1970, though not so vigorous as in the 1960s, started to decrease at the rate of -2.2% from around 1995. The production volume also declined at the rate of

-1.1% per year from 1997. Those reductions were the first experience of and not specific to the paper industry of Japan. The world paper and paperboard production volume also stagnated around 2007.

The volume of information that was not dependent on paper, on the other hand, drastically increased, probably at the rate of more than 50% a year since 1995. In 2009, its share in the total information flow volume was more than 99%, and its share in the total consumption volume was 87%, leaving the share of information based on paper to only 13%. From around 2010, a kind of digital data classified as big data became available, and is increasing at the rate of tens of percentage per year, probably more than 70 %. The period between 2000 and 2010 was a turning point at which digital data caused a paradigm shift in society and the new era since then can be called information society..

While the paper consumption for newsprint and writing is decreasing, that for packaging and household is increasing. The paper industry seeks to build a business model of dealing the trend and starting new ventures.

### **Cooking behavior of Mixture wood chips consisting of Different species**

Hiroshi Ougiya

Pulp Sec., Pulp Production Dept., MPM OPERATION Co., Ltd.

Masatoshi Ishifuji

Technical Group, Technical Dept., MPM OPERATION Co., Ltd.

Optimization of chip mixture largely depends on chip quality such as pulp yield and digestibility. Chip of *Eucalyptus globulus* shows high pulp yield and easy digestibility compared with that of *Acacia mangium*. To study cooking behavior of Eucalyptus chip and Acacia chip individually, we separated them respectively with packing each chip into a metal basket and digested together. As a result of analysis of cooking behavior of each chip by experimental digestion, we confirm that behavior of chip mixture during digestion can be explained from average of digestibility of individual chips constituting the mixture. Kappa number and pulp yield of two species of chips were not affected by each other.

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**Promotion of Organizational Energy Saving Projects  
-Search by Everyone Energy Conservation Projects-**

Takeshi Ishizuka

Consulting Department, Japan Innovation Consulting Co.,Ltd

I think that employee who work on energy conservation projects do not have the methodology even if they know that there is also a great outcome and continuity.

We introduce examples of roles of each department according to the procedures of (1) common procedure, (2) validity, (3) program procedures.

**Low-level PCB Waste  
-Advantages and Disadvantages of Various Detoxifying Processes-**

Yo Osada

Japan Industrial Waste Management Foundation

Low-level PCB waste is regulated in Japan in two types such as electrical equipment contaminated with over 0.5 mg/kg PCBs and any kinds of pollutants contained in concentration less than 5,000 mg/kg PCBs. The waste is at present disposed of by incineration or washing at certified or permitted detoxifying facilities. At the facilities various detoxifying processes are applied depending on its properties or sizes; for instance, relatively small or medium size of the equipment is processed by heating and combustion and larger size of transformers are processed by on-site washing. This paper explains each processes applied to existing facilities and evaluates their advantages and disadvantages in view of efficiency and cost.

**The Appropriate management of Industrial waste disposal facility**

Hironao Sakamoto

Re-Tem Co.,Ltd.

I will explain the appropriate management of industrial waste disposal facility by case.

"Accidents and inappropriate cases at industrial waste disposal facilities" relate to maintenance and management of industrial waste treatment facilities, risks of other facility management, and environmental pollution of waste treatment facilities.

"Other inappropriate case of industrial waste disposal contractor" relates to the case where processing is incomplete but the manifest has been returned, and the disposer has resolved without processing the waste.

"Check point of statutory inspection etc. of industrial waste disposal facility" is an example of examination content on structural standards concerning treatment facility, industrial waste incineration facility, final disposal site, installation permission of facility, person responsible for management, processing flow, final disposal. Indicate the checkpoint of the field.

### **An application of high efficiency BOD treatment system (Bio-Attack) to paper industry sewage**

Kiyoshi Arakawa

Nippon Steel & Sumikin Eco-tech Corporation

Paper industry sewage is treated by activated sludge process. However, this process is often operated at relatively high BOD volume load about 1.5 kg/(m<sup>3</sup>·day). Under such condition, it is difficult for conventional biological treatment to respond with BOD load variability of wastewater. As a result, the biological treatment becomes unstable and troubles (such as decrease of transparency in treated water, poor sedimentation by bulking) occur frequently.

We supplied high efficiency BOD treatment system (Bio-Attack: BA) and upstream monitoring system to MARUSAN PAPER Mfg. Co., Ltd. for the purpose of countermeasure of increasing wastewater BOD load, unstable biological treatment, and inhibition of poor sedimentation by bulking.

The installation of this BA brought the following effects, 1) Wastewater BOD about 70 - 90% is treated at BA, the inflow BOD load into aeration tank decreases, and the BOD load becomes stable through the year, 2) Biological treatment becomes stable and transparency get better to 10 - 25 degrees[cm], 3) Filamentous bacteria is reduced, and sludge volume index (SVI) goes down 20 - 30%, 4) Cost of chemical for biological treatment is reduced about 90%. Also, upstream on-line TOC monitoring system controlled the volume of nutrient properly and it helped to improve the performance of BA.

## **Improving the wastewater treatment stability**

### **-Reducing a cause substance of COD in the upstream side-**

Keiji Suruga ,Hiroki Katsura and Yasuhiro Kagawa

Kurita Water Industries Ltd.

Wastewater treatment system is becoming unstable with raw material deterioration, energy conservation of the facilities and manpower saving in some paper mills.

We approach to improve the wastewater treatment stability by reducing a cause substance of COD in an upstream side, here the upstream side means the producing process before wastewater treatment facilities.

First, we link the upstream side and the wastewater treatment process by our newly developed " S.sensing® system". The S.sensing® system monitor water qualities, for example the ORP, SS consistency, etc, at both upstream side and downstream side, then analysis the correlation between the water qualities and the wastewater treatment stability. The water quality was controlled by using Fuzzicide®, aeration, and retention aid.

This paper reports several study cases, which wastewater treatment was improved by reducing a cause substance of COD and SS in the upstream side.

## **Energy - saving centrifugal dehydrator**

### **—Energy - saving effects in the sewage treatment plant—**

Daisuke Handa

Sanki Engineering Co., Ltd.

Centrifugal dehydration technology has long been used for dehydration treatment of sewage sludge, and development for reduction of cake moisture content and low power has been carried out. While centrifugal dehydration technology is capable of large-scale treatment and has the advantage of stability of treatment, there is still strong demand for reduction of electric power consumption by low-power generation. In this paper, not only features of newly introduced energy saving centrifugal dehydrator but also characteristics of the sewage treatment facility and energy saving effect after the introduction are introduced.

## **Low-Frequency Noise Countermeasure in a factory**

### **-Listen and Feel how we can resolve the Noise Problem-**

Masahiko Aoki

Acoustic Solution Division, Nihon Onkyo Engineering Co.,Ltd.

When the noise exceeds the regulation standard at the site boundary, the effect of the noise countermeasure is determined by the composite value of the countermeasured noise source and other noise sources that have not taken measures.

The method of surrounding the noise with the soundproof box is most effective, and the method of installing the silencer and the soundproof hood at the air supply / exhaust port is also relatively effective.

Measures on the propagation path of noise include installation of sound absorbing materials and sound insulating walls, but in many cases, it is not possible to obtain the effect as much as measures on the sound source side.

When there are complaints from neighboring people, noise of frequencies close to low frequency sounds or low frequency sounds tends to be problematic indoors.

The reason is that, in a detached house or the like, in general, the noise in the high frequency range is comparatively attenuated in the room compared to the outdoors, whereas the low frequency sound is difficult to attenuate.

We have developed our own "measuring equipment to visualize noise sources", we confirmed in a short time which noise source influence the position of workers, and the effect of the measure is confirmed by simulation are considering.

## **Predictive Maintenance by Acoustic and Vibration Diagnostics Utilizing IoT**

Masaaki Shida

Hitachi, Ltd.

In recent year predictive maintenance to carry out maintenance depending on condition of individual equipment is focused. Predictive maintenance includes a merit such as reduction of the maintenance cost and the minimization of the downtime. Maintenance includes the case of judgement using sounds from the equipment. However, the performances of those applications often degrade due to noises such as neighboring sounds. One of the technologies to solve the problem is sound source separation technology. A desired sound and noise are separated by using the technology, and a desired sound is used to monitor the condition of equipment continuously.

This paper introduces the concept for predictive maintenance, procedure to install

IoT technology, and sound source separation technology. Finally, it is shown that a sound source separation technology is effective for predictive maintenance.

### **Measures to prevent odors using diffusion simulation**

#### **-Make the odor visible-**

Satoru Moriki  
Karumoa Co.,Ltd.

Unlike other atmospheric pollution, odor is the pollution due to human senses, so evaluation methods and planning countermeasures are difficult.

In order to solve odor problem, it is not preferable that just introduce deodorizing equipment. To consider later cost and labor, it is preferable that conducting a preliminary survey properly, and take measure as necessary.

In this paper, I introduce diffusion simulation to predict surrounding influence of odor and daily management using odor sensor.

### **Causes of gloss ghosting and effect of properties of the paper on the gloss ghosting**

Hideki Takada  
Development Sec., Technical Dept., MPM OPERATION Co., Ltd.  
Yoshihiro Tamura  
Administration Dept., Mitsubishi Paper Engineering Co., Ltd.

Gloss ghosting is an undesirable phenomenon that occurs in the sheet-fed offset printing. An ink gloss differential on the reverse side imagery appears in the form of a ghosted image of the front side printing. As it gives a significant damage to the appearance of the printed product, the value as a commodity deteriorates. It was reported that oxidizing vapors released from the drying ink of the front side printing accelerate the drying of the reverse side ink film between adjacent sheets in the printed load. However, the detailed mechanism of gloss ghosting has many unclear points. We have investigated what is happening on the surface of the printed ink film, and the effect of the paper properties on the gloss ghosting.

In our study, it was confirmed that the condition of contact between the front side printing surface and the reverse side printing surface is important to determine whether the gloss ghosting occurs or not. It was found that the time interval between front side printing and reverse side printing greatly influences the gloss ghosting. We were able to clarify the mechanism of the gloss ghosting by tracking both the oxidizing vapors generation amount from the front side printing and the arithmetic average roughness Ra

of the surface of the printed ink film. Gloss ghost appeared clearly as the difference in Ra value between the printed surface accelerated drying by oxidizing vapors and the surrounding area was larger. In conclusion, there was a tendency that gloss ghosting is less likely to occur in printing papers with smaller variations in Ra value over time on the printed surface.