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Vol.71, No.1 Abstracts

Better Reject Removal Especially for Plastic Contaminants by Combisorter™

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Voith IHI Paper Technology Co., Ltd.

In stock preparation system, “Slot direct system” consisting of pulper and fine slot screen with bypassing coarse hole screen which is used as primary screen has become more common. On the other hand, reject system handling is recently getting more and more important because the quality of raw material is getting worse due to mix rate increase of contaminants such as plastic and sticky. The demand for hole reject screen is growing because it is efficient for removing the plastic contaminants and reducing fiber loss. It is not realistic to add new machine for handling the increasing plastic contaminants in building reject system. In this paper, our hole reject screen “Combisorter™” is described.

Fuel Conversion for Lime Kiln

Tetsuaki Tanaka
UBE MACHINERY CORPORATION, LTD.

UBE Machinery Corporation (UMC), established in 1914 to maintain coal-mining machines, has been supplying products mainly to customers in a variety of industries, including, but not limited to, automobile, ceramics, cement, and steel.

In these industries, there are many examples of fuel conversion from conventional heavy oil to less expensive solid fuel, such as coal, oil cokes, and industrial wastes to be used for the fuel in the combustion facilities.

On the other hand, in pulp industry, which consumes a large amount of heavy oil in the caustic process, the reduction of fuel cost is a major theme; however, the conversion to alternative fuel had not shown advancements.

Accordingly, as a solution of converting fuel from heavy oil to less expensive fuel, UMC has been proposing the co-firing technology of oil cokes, which realized from the combined

know-how of vertical mill and kiln, furnace, and dryer technology. As a result, with the first order in 2007 as a starting point, UMC has delivered 6 plants. The co-firing technology of oil cokes, which UMC's supplied fuel-conversion facility plays a core role in, has been receiving outstanding feedback from customers for the fuel cost reduction effect.

Challenge to "Web Breaks and Defects-Free" Pleiotropic Solution for Realization of Stabilized Operation

Yuichiro Kato
Nissin Kagaku Kenkyusho Co., Ltd.

The deposit adherent in the papermaking process causes operation trouble with occurrence of web-breaks and the defects and often brings bad influence to the productivity and the quality of the product in a pulp and paper production plant. The factor which causes web-breaks and the defects are various and therefore also different in the solution for the deposit problem depending on the situations. It's important to derive optimized solution method by analysis from pleiotropic viewpoint to a complicated deposit problem.

We keep investigating the cause of the deposit trouble in a large number of papermaking mills, studying and developing and proposing the measurements since establishment, and we're making an effort in order to propose quickness and the optimized solution by the databased solutions. We will give some examples, and introduce the deposit trouble solutions.

Development of Separation Technology of Wood Constituents for Chemicals

Shiho Tsuji
Nippon Paper Industries Co., Ltd.

Nippon paper Industries strive to maximize the value of sustainable forest resources, as a comprehensive biomass company shaping the future with trees. As a part of it, we participate in the project "Technology development of Manufacturing Process for Non-edible Plant-derived Chemicals/Development of an Integrated Process for Manufacturing Chemicals from Woody Biomass" commissioned by New Energy and Industrial Technology Development Organization. The project aims to develop a consistent chemical production process in order to produce chemicals from wood in place of fossil resourced through collaboration between the paper and chemical industries. In that, we have been developing alkaline based cooking technology and it

was selected as the most suitable preparation technology for the integrated process. Now we are refining the alkaline based cooking technology to achieve the commercialization.

Remodeling Effects and Operating Experience of Kraft Pulp Production

Kentaro Hashimoto
Kraft Pulp Div. Mishima mill, Daio Paper Corporation

Fiber lines in Mishima mill have been modified and extended step by step along with new installations of paper machines. The total energy cost was pushed up due to increased number of equipment and distance of pulp traffic line.

Most recently, with a change of the production structure after the Lehman shock, two of softwood fiber lines were unified to one. Hardwood fiber line was also retrofitted to get more production and to reduce energy. We decided to modify our softwood fiber line to get more production and energy efficiency improvement, making the most of equipment that had been idle after the retrofit of hardwood fiber line to reduce capital investment.

The concepts of the remodeling are as follows.

1. Upsizing the equipment by using larger one that had been idle
2. Operational improvement by modifying the existing cooking system
3. Chemical reduction with the washing and screening capacity upgrade
4. Improvement of energy efficiency by heat recovery flow change

To increase the production rate, continuous digester has been modified to the Compact Cooking G1™, which could accelerate the downflow of the chip column in the digester, and the capacity of screening and bleaching process has been upgraded.

At the startup, we have experienced quality fluctuations and increase of chemical consumption due to the digester operation which was not stable, but we stabilized the operation by adjusting multi charges feeding ratio of white liquor, liquor-to-wood ratio and chip compaction in digester. After this modification, the softwood production has been increased from 650t/day to 1000t/day with the most highly capacity in Japan.

Operating Experience by Decanter Centrifuge for Green Liquor Dregs Separation

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

Chuetsu pulp & paper Co., Ltd. Takaoka mill has modernized its green liquor treatment system including sedimentation tank and washing system. It has been running since December, 2015.

A Decanter centrifuge has been adopted for dregs washing aiming to achieve better alkaline recovery, space saving and less running load for operators.

During commissioning period, it was found that torque on the decanter became too low after starting the machine and dewatering efficiency was low, it took some time to tune up the machine after start up period but now as it is getting steady running, a performance trial especially to tune-up the machine more precisely has been done.

Following results are obtained:

1) When increasing torque on the screw, concentration of dregs is increased, at the same time, suspended solid concentration on filtrate is also increased.
2) In order to stop suspended solid concentration of separation liquid low, the centrifugal force beyond 1500G is required. Moreover, with the centrifugal force not more than 1000G, heavy vibration is caused with poor dewatering.
3) Suspended solid concentration in the filtrate was getting lower when increasing polymer dosing. However, too much charge of polymer resulted lower the dryness of dregs due to increasing volume of dregs required higher speed on the screw.

Development of Fiber Reinforced Thermoplastic Materials via Paper Making Technology

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In this paper we describe the feature of non-woven consisting of reinforcement fibers and thermoplastic fibers that can be molded by heat-and-compression methods.

The non-woven materials can be easily molded into relatively complex shapes because the reinforcement and thermoplastic fibers are uniformly dispersed in the non-woven.

The mechanical properties of the materials are mainly determined by the spacial alignment and the volume fraction of the reinforcement fiber in addition to the components' properties. The length of the fiber also influences the properties. The adhesive strength of the interface between the thermoplastic matrix and reinforcement fiber is important to improve the strength of the hot-press molded FRP body.

An Improvement in Operation and the Quality of the Product by Renewing the Winding Drums

Takeshi Watanabe
Niigata Mill, Hokuetsu Kishu Paper Co., Ltd.

PM8 in the HOKUETSU KISYU Niigata Mill is producing A2 grade coated paper and has two JR-winders. When A2 grade coated paper was worked on these JR-winders, PM8 had been running with a few problems for many years.

The biggest problem is the groove marks on the surface of the paper. The winding drums have grooves, so when paper touches the winding drums, the grooves' pattern transfers to the surface of paper as groove marks. These groove marks on the surface of the paper make the quality of the product go down. To prevent the incidence of these marks, we had to do some actions, for example, limiting the winding acceleration and lowering the winding nip pressures. But these actions also caused other problems in efficiency and productivity in operation.

By renewing the winding drums from the original hard steel drums to the soft covered drums, the quality of the product has been drastically improved. Efficiency and productivity in operation have also been enhanced. This renewing of the winding drums from hard roll to soft roll was the first try in Japan.

This report shows the details of the problems from which PM8 had been suffering, our work to improve these problems and what its effects were.

Operating Experience of Gas Turbine Cogeneration System

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Amagasaki Mill, Rengo Co., Ltd.

In recent years, company activities for environmental issue are required. Rengo Co., Ltd. has set a target, which is called Eco Challenge 020, of a 32% reduction in CO_2 emissions from fossil fuels during production in fiscal 2020 compared with fiscal 1990. In order to pursue this company goal, Amagasaki mill installed highly efficient and eco-friendly two gas turbine cogeneration systems as a substitute for aged facility.

This report shows outline and the reason for selection of this facility, operating experience and its effect.

Basics of Ozone Bleaching

Part 2：The Reaction of Ozone with Pulp

Takanori Miyanishi, JAPAN TAPPI

Ozone is a strong electrophile and reacts with functional groups in residual lignin. Conjugated aliphatic double bonds and enol ether structures react with ozone via intermediates to form carbonyl groups and peroxides. Most phenolic groups are oxidized by ozone. Ozone may react also with aromatic lignin structures to form acids. Ozone is better than chlorine and chlorine dioxide in solubilizing lignin by these reactions. Ozone removes most of the residual lignin. This is based on the much faster reaction of ozone with lignin than with polysaccharides. But intermediate inorganic by-products formed by direct decomposition, such as hydroxyl (HO・) and perhydroxyl (HOO・) radicals, can be very reactive with carbohydrates. Carbohydrate degradation occurs from the formation of carbonyl and carboxyl structures on the polysaccharide chains, which induce chain cleavage in alkaline environment. Reducing reaction of ozonized pulp with strong reducing agent such as borohydride converts alkali-sensitive functional groups to alkali-stable ones and prevents chain cleavage reaction. The response of pulp to an ozone treatment is characterized by the amount of lignin removal (as measured by Kappa number) and the degree of cellulose degradation (as measured by pulp viscosity or strength). The cellulose viscosity deceases with the increase of ozone charge. But the viscosity loss due to the introduction of zone in the ECF sequence does not translate into a similar loss in strength.

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New Andritz FibreSolve Pulper Rotor and TD Screen for Debottlenecking and Energy Saving

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Service & Units, ANDRITZ K. K.

Andritz has developed a new technology of FibreSolve Pulper Rotor designed for increasing pulping capacity, reducing specific energy consumption in the under machine pulpers. For rationalization, existing board machine lines are more and more integrated and upgraded that require capacity increase of under machine pulpers without changing the size of vats. The various functions with newly developed FibreSolve Pulper Rotor satisfy the needs and improve energy consumption and pulp quality.

— Blade Type Canvas Cleaner— AOKI CLEANER

Narihiro Ohtaka
Aoki Machinery Co., Ltd.

In recent years, operational troubles, poor quality of products and less production efficiency due to sticky or adhesive materials brought to paper machines have become more common as a result of poor quality of furnish caused by increasing amount of use of recycled paper. As a matter of course, the level of contamination of dryer fabrics in the dryer section is getting worse and worse.

Many paper mills are suffering from various troubles including paper breaks, increasing number of defects, more frequent splicing works on winders, increasing amount of broke and so forth. On the other hand, cleaning of dryer fabrics by hand during operation is regarded as inappropriate job considering its safety.

In order to overcome this situation, ultra-high pressure water cleaning systems or chemical cleaning systems are widely introduced, and furthermore fabrics are sometimes installed by using inside rolls of the paper machine. However, since these attempts are not able to eliminate the problems completely, the operational troubles, poor quality of products and less production

efficiency are still permanent issues for many paper mills.

The epoch-making blade type dryer fabric cleaning system “AOKI Cleaner” which is able to eliminate use of water during operation was developed by AOKI Machinery 16 years ago in order to solve the problems caused by sticky or adhesive materials caught by dryer fabrics.

In this article, the blade type cleaning system and its benefits as well as recent results at some paper mills are introduced.

Development of Papermaking Chemicals for Food Packaging Grades
— Development of Safe Products as Indirect Food Additives —

Hirotaka Sato and Kazushige Inaoka
Paper Chemicals Development, R&D Center, R&D Company, Harima Chemicals, Inc.

Harima Chemicals Group, Inc. has been supplying various paper chemicals such as strength and sizing agents for paper and paperboard mills in order to provide desired functions on papers.

Paper and paperboard have been widely used in our life not only for printing, wrapping and transporting purposes but also as food packaging materials such as boxboards, paper plates and beverage cartons. Food packaging materials have been regulated in countries around the world, and paper chemicals used in paper intended to come into contact with food also need to be compliant with the regulations.

In this situation, we have developed and begun sales of polyacrylamide (PAM) type dry strength agents, dispersed rosin sizes which were approved by FDA (Food and Drug Administration) for indirect food additives. Both PAM strength agent which has high molecular weight and amphoteric property, and dispersed rosin size which applied synthetic anionic polymer as an emulsifier, are the first products in the world of paper chemicals to meet FDA regulatory requirements.

The FDA approved PAM strength agent, “Harmide KS series”, and dispersed rosin size, “NeuRoz series” as well as the efforts to aim for “the development of safe products as indirect food additives” are introduced in this report.

New Pitch Control Agent Having a Breakthrough Characteristics

Takahito Ikeshita
KATAYAMA NALCO INC.

Kaori Fujitsuki
KATAYAMA CHEMICAL,INC.

Recycled paper utilization has risen due to environmental protection. As a consequence, use of lower quality recycled paper is increasing year by year, and because of this, problems with machine runnability and finished-product paper quality are increasing. Adhesive materials that exist in recycled paper accumulated on the surface of papermaking system or fabrics and these deposits are one cause of problems in papermaking. Thus control of low material is essential.

In this presentation, we report on the development of a chemical agent which has a revolutionary effect on adhesives. We discovered that this chemical had three effects. At first, it detackified the adhesives. Secondly disperse them. Thirdly the dispersed adhesives are attached to the cellulose fibers. This means that adhesives are discharged from the wetend with celluloses. As a result, papermaking loss is reduced.

Given these results, this chemical agent can become an important solution for discharging adhesives to the outside of the machine.

New Concept Pitch Control Agent “Spanplus FT”

Satoshi Wada and Chigusa Taguchi
Kurita Water Industries Ltd.

We developed "Spanplus FT" as a pitch control agent for the DIP process to achieve production capacity of DIP and quality improvement while using poor quality wastepaper. “Spanplus FT” is special water-soluble polymer having hydrophilic part and hydrophobic part. It has an effect to agglutinate pitch selectively.

So after dosing "Spanplus FT" in flotation part, pitch is attached on froth and pitch removal efficiency is increase. As a result, pitch volume in DIP pulp is decreased.

Moreover, "Spanplus FT" has a high selectivity for pitch, so it dose not react to suspended solid matter. It leads the decrease of outflow raw material.

We applied "Spanplus FT" in flotation of newsprint DIP, pitch removal efficiency increase 10- 20 %. And suspended solid matter was not removed. it was able to contribute to reduction of outflow raw material.

Maruishi — High-speed Full Synchro Folio Sheeter

Yoshino Hagiwara
Maruishi Co., Ltd.

Maruishi has been working for paper industry over 73 years. Today, the finishing line is the one of the main products and especially, more than 180 units of ream wrapping machine are already sold all over the worlds. Maruishi has been developed their original High speed full synchro Folio sheeter reviewing former design. Unique synchro knife cutting is designed for wide range sheet production from low GSM to high GSM board paper /special art paper. Top air jet at overwrap is another advantage for simple and quiet operation. Here, we would like to introduce the modern High speed Synchro Folio sheeter with high quality production with different models available for variable kinds of paper and need from customer.

Effective and Efficient Pest Management Based on Scientific Evidence and Risk Assessment

Tomohiro Ohba
Earth Environmental Service Co., Ltd.

Since leading to product complaints and a reduction in yield, contamination of the insect to the paper product is a major problem. In such a reason, various insect measures have been implemented in the paper products manufacturing plant. However, it is not a sufficient effect of their insect measures in some of the plant. In these plants, they do not analyze how insects contaminate the product. We call this analysis the insect contamination scenario. The next two are important to do insect measures effectively. One is to investigate the insect contamination scenario based on scientific grounds. The other is to decide the priority of insect measures based on the risk assessment of contamination.

At first the analysis of insect contamination to the product is necessary for the investigation of the insect contamination scenario. The problem of the manufacturing site is investigated based on this analysis next. The investigator needs experience and training. At the same time scientific and objective data is required. For this, various measuring equipment is recruited in the survey of the factors that influence the contamination, such as air flow and ultraviolet. Furthermore, we have introduced new powerful investigation tools such as EMS-Q which measures some contamination factors at the same time and identification technology of the insect by gene.

To take investments for insect measures effectively, it is necessary to consider the priority based on the risk analysis of contamination. The contamination risk is evaluated in points of

view such as the past contamination results, the characteristic of insect, the habitation of the insect, the exposure characteristics of the process of manufacture, the detectability. This evaluation makes it possible to decide the order of insect measures reasonably.

Evaluation of Corrosion- and Erosion- Resistant Weld Metal in Various Boilers

Tsubasa Gohira, Youichi shiraishi and Toshiichi Aota
Welding Alloys Japan Ltd.

Due to fuel and operating conditions of various boilers, surface of water-cooled panel tends to be damaged mainly by corrosion and erosion. And availability factor of boiler itself becomes low and maintenance cost problem occurs as a result. Therefore, exclusive welding system was developed by WA Japan to apply to damaged surface of water-cooled panel. And thereafter cladded tube surface by this welding system was checked after certain period of operation time. The results obtained in these activities are below summarized.

a. Welding technology, by means of exclusive, compact and solid welding system developed, is suitable to cladding of water-cooled panel in furnace and effectively applied to repair of damaged surface under the conditions with many restrictions.

b. Weld metals overlaid onto water-cooled panel with Alloy 625 and Alloy 622 are effective protection against thickness loss under corrosive and erosive environments, same as the cases in other countries.

From above-shown results, it can be safely said that welding technology developed herein is effectively applied to repair of damaged surface of water-cooled panel in various boilers and that weld metal overlaid with Alloy 625 etc. is right and permanent protection to the damage. This technology is expected to be hereafter employed in planned maintenance of various boilers in near future.

Improvement on Plant-Wide Energy System Efficiency by Thermoelectric Solutions
— Open and Closed Condensate Recovery System, Air Compressors, and Boiler Feed Water Heating Unit with Waste Heat Recovery —

Takehiro Uwafuji, Yusuke Okamoto, Kazuyuki Otani and Hiroyuki Hatanaka
Miura Co., Ltd.

MIURA as a leading manufacturer of once-through boilers has adopted “Total solution” as a

slogan, promoting various eco-friendly proposals through industrial-water treatment devices and compressors using in-plant steam, and so on. This paper explains following technologies;

・Closed condensate recovery system which recover heat from flash steam under both pressurized and vented-to-atmosphere conditions

・Various air compressors meeting expectations of energy-saving effects for each purpose or usage

・Boiler feed water heating unit with waste heat recovery type which reuses low-temperature waste hot water occurred in the production process as a heat source to heat boiler feed water.

A Report on Nanocellulose Summit 2016 in Tokyo

Takanori Miyanishi
JAPAN TAPPI

“Nanocellulose Summit 2016 in Tokyo” was held on December 9, 2016 at Tokyo Big Site International Conference Hall. Distinguished scientists, project manager, government administrator and consultant were invited from Canada, U.S.A., Sweden, Switzerland, Korea and Japan to advance commercialization of nanocellulosic nature-based materials. They made presentations on production technologies, characterization, applications, standards development and safety demonstrations. At the industrial level, applications are being developed in upstream oil and gas, wood product adhesive, pulp and paper, cement, resin composites, synthetic rubbers, paints, coating and the high-end use, for instance, in biomedical tissue engineering and electronic materials. Some of the nanocellulosic materials are already implemented in industries and several companies claim production capacities in tonnage scale. However, a straightforward material supply with marketable prices is still not given. Cellulosic materials have been safely used in many industries for centuries but current regulatory frameworks and customer supply chains demand safety demonstrations for the novel forms now entering commerce with nanoscale properties. The requirements to demonstrate safety vary by geography, product category, and life cycle stages.

Basics of Ozone Bleaching
Part 3：Medium Consistency Ozone Bleaching Plants

Takanori Miyanishi
JAPAN TAPPI

It is preferable to place the ozone stage at the beginning of the bleaching sequence to remove most of the residual lignin. This is based on the much faster reaction of ozone with lignin than with polysaccharides: the rate constant of ozone with lignin is 1,000 times higher than that of ozone with carbohydrates. So lignin should be considered and used as a protection for polysaccharides. Another important reason to use ozone in the first bleaching stage is that the higher the lignin content, the higher is ozone's selectivity expressed as the Kappa number reduction per added ozone unit ($\Delta KN/kgO_3$). If mills use ozone in the middle of the bleaching sequence or at the end, then the high oxidation potential can definitely impact bleached pulp strength. Medium consistency ozone bleaching is placed as ZD in the first bleaching sequence. ZD does not need a washer between Z and D, and removes residual lignin at the maximum efficiency with the minimum cost. Ozone charge should not exceed 5 kg/AD.pulp.ton in medium consistency ozone bleaching. Ozonization was initially carried out at 40℃ in the 90s and such a low temperature was not very convenient as the Z-stage is located after the 85-95℃ oxygen delignification and before an alkaline extraction generally carried out at 60-80℃. It is therefore necessary to cool down the pulp before heating it up. Several results have demonstrated that for hardwood pulp medium consistency ozone bleaching, Z-stage temperature can be increased up to 60℃ and sometimes even higher without any negative impact on pulp strength and brightness.

－Peer Reviewed－

Modified Operation of a Laboratory Refiner for Obtaining Dried Thermomechanical Pulp from Sugarcane Bagasse and Oil Palm Empty Fruit Bunch as Non-wood Fibers

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A process for the production of thermomechanical pulp (TMP) from non-wood fibrous materials such as sugarcane (*Saccharum officinarum*) bagasse (SB) and empty fruit bunch (EFB) of oil palm (*Elaeis guineensis*) has not yet been industrialized. On the other hand, there is a requirement for the production of dried TMP from non-wood fibers for the preparation of medium density fiberboard（MDF board） as an alternative to wood and as a possible method of treatment of agricultural wastes. Dried fibers are required to produce high quality MDF board. SB and oil palm EFB are non-wood fibrous materials that are easily available in Indonesia, and

have the potential to be developed as fibers for use in materials of MDF board. This research is aimed at modifying the operation of a laboratory pressurized TMP refiner to obtain dried fibers from both these non-wood fiber sources for fabricating MDF materials under suitable conditions. An approximate solid content of 80% of oil palm EFB dried fibers and an around 55% solid content of SB dried fibers were obtained by this modified method. These fibers could then be fully dried to obtain a solid content of 90–92%. On observing the results from fiber fractionation and the length of these dried fibers, it was found that the SB and oil palm EFB dried fibers were comparable to mixed light hardwoods fibers produced in an industrial MDF board process.

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Research Report (Original Paper)

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Vol.71, No.3 Abstracts

Innovative Changes and Future Technology for Quality Control System

Takuya Akutsu
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QCS was started by only 2 sensors, basis weight and moisture. QCS supplier was creating a lot of various sensors and MD/CD controls from 50 years ago. Currently QCS has so many sensors and MD/CD controls. The customers can have a selectable sensors and controls freely in produced by QCS suppliers. I describe the QCS history of approximately 50 years, and I want to predict the future of QCS from a new product of Honeywell. However basically, I think that QCS future will be depended on the customer require mentation.

Innovation and Future of Web Inspection System

Masahiro Suzuki
FUTEC Inc.

Since we developed our first Web inspection system in 1978, we have contributed to various industries by installing approx. 8700 sheet inspection systems; as of 2015 end, not only non-printing sectors such as paper, pulp, film, metal and non-woven materials but also printing industries of gravure, flexography and offset print.

As we look back the history of web inspection systems（WIS）, the frequency of line sensor cameras has been improved 100 times faster from 2.67MHz in the 1980s to 320MHz in the 2010s. Detected defects are realized to be classified by defect types simultaneously storing defect image data on a real time basis. In the early years, an aim of introducing inspection systems was avoiding flowing out defected products, but nowadays implication has an quality improvement tool of lines.

Furthermore, because of high image pixels and high-speed clocks with line sensor camera improvement, the number of cameras is reduced, and high-frequency fluorescent lamps have been replaced with high brightness LED of longevity light source. It resulted in being improved

efficiency of maintenance by lowering camera breakdown ratio and free from replacing lamps.

Using Color cameras, it realizes now real-time defect classification with detected color defect images, running in a great number of lines. Besides Integrated Quality Management System as IQM System, which manages the integrate data of multiple inspection systems in a network, has been supplied and monitor on-site condition remotely and analyze in real time.

In the years ahead, further advancement of high image pixels and high-speed clocks of line sensor cameras will be preceded and downsizing with high performance are to be expected. New technologies like learning with machines or deep neural learning are implemented, and inspection systems make a contribution to reducing the workload of operators and increasing productivity.

Change and the Future of the Plant Operation and Maintenance that Utilize Smart Field Devices

— Recommend Proactive Use of HART Devices —

Yasushi Kudo
Marketing Dept., Advanced Automation Company, Azbil Corporation

We now face a big data era where a variety of data such as manufacturing process in the factory, car, consumer electronics, and humans, gather in cyberspace.

In industry, communication with the field devices such as sensors and actuators have been rapidly changed from the signal transmission of a single one way by the conventional analog value to a two-way communication by a plurality of data.

In particular the spread of HART communication that is compatible with the conventional analog communication accelerated the movement of the intelligent network of field devices, and device management system to create a new value is becoming popular in industry.

In this writing, how you can change the plant operation and maintenance by proactive use of the smart field devices around the use case of the Azbil's device management system “InnovativeField Organizer™” .

Future Vision and Direction of Production Control Systems

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YOKOGAWA Electric Corporation

Change of technologies and market situation strongly affects the environment of the control systems. In recent 10-15 years particularly, various standardization and open technologies such as MS-Windows, field digital, and alarm management are introduced, and each control system vender has been applying those to its control system with avoiding the impact for the fundamental functionalities and roles of control systems. In coming decade, some larger changes are expected such as standardization of control system architecture, that of application schemes, integration between control systems and production management systems, CAPEX reduction with de-bottlenecking of project execution, and applying of cloud technology.

Control systems venders are required to adopt such technologies efficiently in order to provide customers benefits without losing the current roles of the control systems in customers' plants. Control systems venders are also required to consider the system continuity and compatibility to propose their customers the system migration plan from the existing control systems to the latest with minimum risk.

Innovation and Future of Analyzers and Measurements for Pulp and Paper Industry

Takeshi Sato and Kenichi Ishihara
Valmet Automation K.K.

Analyzers and Measurements for Pulp and Paper have been developed for stabilizing and improving of quality paper product, for reducing production loss due to paper-break and deposite and new parameters for analyzing production process. These instruments have been improved its accuracy, availability and diagnostics for capable “Advance Process Control” and “Production analysis by big data from process sensors”. This article describes, based on the above background, to consider “Innovation and Future of Analyzers and Measurements for Pulp and Paper Industry” by 3 points of “Measurement technology”, “Maintenance” and “Operation”.

The Revolution and Future for Drive Systems

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Drive Systems Department[*2]
TOSHIBA MITSUBISHI-ELECTRIC INDUSTRIAL SYSTEMS CORPORATION -TMEIC-

Since TMEIC supplied a sectional drive systems for the paper machine at a half century ago, a lot of customers have been applying the TMEIC sectional drive system to several kinds of the paper machine not only for Japanese domestic but also all over the world.

The pulp and paper manufacturers focus on the efficiency and stability of mill operation, such as energy savings, automation control for cost reduction, less maintenance and total coordination of the control system. So TMEIC is providing the state-of-arts products and technology for their mills. In the old days, the motor-generator system was one of the latest technology as the sectional drive system, however it had become obsolete for the operation and maintenance. At present, after a couple of decade since then the IGBT semiconductor technology is much improved and it has taken over the old system. From now on it is assumed the next technology is not only hardware, but also software like IoT technologies which improve a mill operation. This article describes the history of the drive system in the field of paper manufacturing facilities and introducing the latest drive system with innovative solutions for the future.

The Spot Color-Measurement by Upgraded Spectrophotometer with Paper Machine

Takayuki Oonishi
Daio Engineering Corporation

Daio Paper Co, has been producing one of the main products, coated and lightweight coated papers by N10M/C in Mishima mill. The N10M/C was the first On-Machine Coating system in Mishima mill in 2007 and also On-line Spectrophotometer by GretagMacbeth (now as xrite) was also composed in as the Close Loop Color Control system by spot color measurement. As always, even since then there have been rapid technological innovations and developments and the new Close Loop Color Control system became available and it made the prior system out of sales and thus out of service after several years after the out of sales. In March.2016, the system was finally upgraded to the most recent system and has been started to run as in the past functionality.

In this paper, they are shown and explained that the background, the features, the improvements and the operational performance of the new system.

Introduction of Chip Level Switch which Doesn't Require Radiation Controlled Area

Atsushi Hashimoto
Ebetsu Mill, Oji F-Tex Co., Ltd.

We used traditional gamma-ray transmission-type level switch for detecting the upper limit of the chip chute for producing kraft pulp at Ebetsu Mill.

However, this type of switches, containing radiation sources regulated by-law, needed to be at the radiation controlled areas.

When we planned to replace the existing transmission-type level switch, we went through a trial of new level switch with Earthnix Corp., Ltd., who manufactures the gamma-ray reflection-type level switch that will not need to be at the radiation controlled areas.

As a result, we were able to come to the conclusion to put the new level switch, and get rid of the radiation control areas at the chip chute for the first time in pulp and paper industry.

This report introduces the case.

Mill Experiences with Single Point Kappa Analysers

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

Kappa value measurement is the most important & critical pulp quality parameter to determine the chemical addition rate in Pulp production process and can become the key to optimize the chemical cost.

Chuetsu Pulp & Paper Takaoka mill's old softwood kraft bleach plant due to the ageing was closed down and was replaced with a new bleach plant which started operations in December, 2015. The new bleach plant is expected to provide better chemicals and energy efficiency while producing pulp that meets quality targets.

In Japan, it has been a standard practice to install traditional Multi-Point Kappa (MPK) analyzer to measure Kappa online. Typically, MPK analyzer has many sampling positions due to the update time is long (30 min to 1 hour), which impacts response to process variability. In addition, poor accuracy, unexplainable measurement spikes and plugging of sample transport pipelines, makes this heavy investment unreliable. When we were dealing with the equipment selection of kappa analyzer for our new bleach plant, Single Point Kappa (SPK) analyzer was proposed by Spectris BTG. Understanding the measurement principle and the function of SPK and the expected benefits. Chuetsu team concluded that this novel technology for fiber kappa measurement does offer the possibility to overcome some of the unstable conditions and has a potential to reduce the chemical cost so a trial was performed in the existing plant.

This paper reports the outcome of SPK trial and the current situation until the installation from the trial.

Color Defect Classification by New Inspection System

Atsushi Kurosaki and Shuichi Shoda
Surface Vision, AMETEK Co., Ltd.

AMETEK SurfaceVision developed new inspection system “SmartView 7.2C” with color line camera. The system allows users to set color defect classes by additional more than 20 color defect features. Learning classification tool “SmartLearn” is useful for classification especially for color defects. Users can focus on making Defect Library of color defects without struggling with color defect parameters.

International Conference Report
—Pan Pacific Conference 2016**—**

Makoto Iwasaki
MIP Consultant Office

On October 25th, 2016, the Pan Pacific Conference was held in Seoul in Korea. The researchers and engineers mainly from Pan Pacific countries attend the conference which was held once in every two years. In this conference 10 invited speech, 55 aural presentations and 59 poster presentations covered a wide range of topics such as pulping, papermaking, coating, biorefinary and nonocellulose. The summary of those presentations focused on nonocellulose, pulping and biorefinary are reported.

Basics of Ozone Bleaching
Part 4：High Consistency Ozone Bleaching Plants

Takanori Miyanishi
JAPAN TAPPI

The first commercial high consistency (HC) ozone bleaching started in 1992 at the Union

Camp mill in Franklin (Virginia, USA). According to the C-Free® process implemented there, the pulp was adjusted by pH, pressed to high consistency (40%), fluffed and transferred to the ozone paddle reactor operating at atmospheric pressure. The C-Free® was provided by Sunds Defibrator until the late 1990's in the USA, Sweden, South Africa and Germany. Modern HC ozone bleaching uses the ZeTrac™ technology provided by Valmet which is a much-simplified version of the C-Free®. The experience gained for the first industrial installations has shown that ozone requires very short contacting time with the pulp for around one minute and that a 5-10 minutes extraction stage after the Z-stage without intermediate washing is in most cases sufficient. Experience has shown that a 5-10 minutes e-stage at 11-12 percent pulp consistency, following the ozone treatment at high consistency produces results similar to those of a 60-90 minutes conventional extraction stage. The pulp at 38-42 percent consistency is diluted directly with alkali, so the alkali reaches the heart of the fibers without the need of diffusion and quickly solubilizes the oxidized material. Then the press following the e-stage removes solubilized material from the fibers when pressing the pulp. These two aspects — the quick access to the fibers thanks to their high consistency, and the quick removal of the alkali with the press — eliminate the need for long diffusion times in an extraction tower (in the case of new bleach plants). These observations permitted to reduce the size of reactors and to lower the investment costs. The plug screw feeder, the refiner fluffer and the washing stage prior to the extraction stage could all be eliminated. These drastic simplifications led to a significant reduction of the capital expenditure, energy requirement, maintenance costs as well as effluent volume.

－Peer Reviewed－

Development of Multiple Evaluation Method of Wood Pulp in Paper by Near Infrared Spectroscopy

Chika Kawabe and Hiroyuki Fukasawa
Industrial Research Institute of Shizuoka Prefecture, Fuji Technical Support Center
Tetsuya Inagaki and Satoru Tsuchikawa
Graduate School of Bioagricultural Sciences, Nagoya University

Near infrared spectroscopy (NIRS) has been applied in some fields such as medicines, chemicals and agricultural products. In this report, NIRS was applied to paper sheets to analyze the contained pulp qualitatively and quantitatively. LBKP, NBKP, CTMP and others could be classified by principal component analysis (PCA) for NIR spectra. The blend ratio of LBKP, NBKP and CTMP in the both mixtures of LBKP and CTMP, and NBKP and CTMP could be

determined respectively by partial least squares regression (PLSR) for NIR spectra within the coefficient of determination (R2 value) of 0.98. Furthermore, the ratio of mixture of KP and another pulp on the paper could be determined somewhat correctly even if we do not know what kinds of pulp were contained. NIRS could also be used to estimate the drainability of LBKP; that is, the predicted value was very close to the measured value. NIRS was also applied to evaluate the degree of degradation of pulp. PCA for NIR spectra of LBKP has revealed the linear relationships between recycled times and score.

The NIR technique is faster than staining techniques, and does not require special training. If we could have tested a wider variety of samples, if we had more time, and if we could have optimized the analysis condition, it would be possible to estimate more precisely.

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Welcoming New Emploees

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Operating Experience of Combisorter

Yoshihito Utsunomiya
Oita Mill, Oji Materia Co., Ltd..

In Oita mill, there are three paper machines, PM#1,PM#3 and PM#5.Paperboard is mainly produced in Oita mill. In addition to it, gypsum liner board, white paperboard, color board and core board paper are produced.

As the usage rate of used corrugated paperboard accounts for about 80%, the reduction of the rejected pulp in the corrugated paperboard process leads to the increase of the pulp yield rate. In this report, we will introduce the case that the pulp yield rate has been boosted by the installation of Combisorter, IHI Voith Paper Technology Co.,Ltd., at the last screen of the pulp production process.

Operational Experience of the Latest Coarse Screen Reject Treatment System “MaxiTrasher & MaxiSeparator”

Teppei Tomokuni
Kanto Mill, Nippon Paper Industries Co., Ltd.

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

Our production is running on about 99% recycle papers, based on a global environmental friendly activity that efficiently applies the recycle papers. It is however now becoming more and more tough situation to maintain the quality and the yield, due to more contaminants and increasing defibration difficulties in the recycle papers. We have now put for the first launch in Japan the “MaxiTrasher & MaxiSeparator” a coarse reject screen system from Aikawa Iron Works in place on our recycle paper handling process for the corrugated medium line, and

improved the yield and the operational performance. This paper introduces the details of this successful implementation.

Operating Experience of the Biomass Power Plant Combusting Exclusively Unused Wood

Shinichi Kasuga
Yatsushiro Mill, Nippon Paper Industries co., Ltd.

The biomass power plant installed in Yatsushiro Mill is Japan's first power plant specialized in combusting exclusively unused wood. Our aim is to contribute realization of low-carbon society and activation of forestry as an overall biomass enterprise.

Biomass power plant has started commercial operation from June 2015. During the test run period, the operation was not stable by the influence of the fly-ashy conveyance system trouble and the fluctuation of the water content in unused wood. These problems were solved before the stat-up and achieved the power sales volume as planned.

This reports operating experience of the biomass power plant combusting exclusively unused wood.

Development of Inkjet Paper for Newspaper

Kazuo Totani
Innovation Promotion Division, Oji Holdings Corporation

In the publishing and advertising industry, on-demand printing has expanded the market as a promotion tool that meets customers' needs. On-demand printing, which makes it possible to print such variable information as customers' addresses and names, local advertisement, and guidance of goods based on customers' preference, has steadily become popular in the market with the spread of the device. Credit card bill, cell phone invoice and direct mail *etc*. are very familiar to us, and we can imagine that on-demand printing related would increase in the daily life.

Inkjet printing which doesn't require plate making and is advantage of a small amount of printing, has begun to penetrate even in the newspaper business. Assuming that local newspaper, city edition of national daily paper *etc*., which have a few print copies, are replaced with inkjet printing, the authors have developed the inkjet paper for newspaper by the use of recycled pulp, selection of optimum ink fixative, the setting of optimum range of ink fixative volume and size

press coat weight *etc*. in order to add the quality of each grade required for the inkjet paper for newspaper. This paper introduces the technical development of inkjet paper for newspaper which the authors have studied so far.

Next-generation Surface Sizing Agent

Shiro Umeuchi
PAPER CHEMICAL BUSINESS DIVISION, SEIKO PMC CORPORATION

In recent years, we are faced with new challenges, including; 1) a decrease in sizing efficiency of the anionic surface sizing agents and the internal rosin sizing agents due to the reduction of the use of aluminum sulfate associated with an increasing trend of making acid-free paper; 2) destabilization of a surface sizing agent due to an increased number of calcium ions in coating liquid. This increase was caused by calcium carbonate falling from paper surfaces into coating liquid which was associated with an increase of the amount of calcium carbonate in paper, etc.

In China, the world’s largest containerboard producer, this is done in order to maintain the strength of the corrugated fiberboard in the high humidity climate, and much starch has been used for coating as a paper strengthening agent together with the surface sizing agents when manufacturing the corrugating medium. As a result, the coating liquid contains much anionic trash such as fine fibers which fell off the low-strength paper.

Thus, a high performance surface sizing agent, which can efficiently impart stable sizing performance to the paper and has superior performance related to operability such as mechanical stability, etc. even under these conditions.

We have developed a new surface sizing agent which is different from the traditional surface sizing agents and adapts to this environment by reviewing the molecular structure and synthesis method to solve the problems such as the improvement of the sizing effect of surface sizing agent; the reduction of influence by contaminants including calcium carbonate, calcium ion derived from the calcium carbonate and anionic trash; and the improvement of mechanical stability.

Application to TEMPO Oxidized Cellulose Nanofiber for the Paper Product

Masayuki Kawasaki, Kazuhiko Ishizuka and Kentaro Kawasaki
Nippon Paper Industries Co., LTD.

Our company is engaged in developing Cellulose Nanofiber (CNF) obtained by defibration of chemically modified pulp. Our aim is to establish stable mass-production of CNF with high quality and low-cost. In this report the characteristics and possible application to papermaking of TEMPO oxidized CNF, which we focus on developing, are reported. CNF as a raw material for papermaking improves air resistance and stiffness of paper. These result suggested the use of CNF as a material to give barrier property or better strength to paper. Furthermore, because TEMPO oxidized CNF's surface is easily modified by ion exchange application to various functional paper is possible.

The Operation Results and the New Match of Papermaking Machine Winder Number 10

Takahiro Kishita
Ebetsu Mill, Oji F-Tex Co., Ltd.

Our factory paper making machine number 10 starts the operation in 2002, and building materials paper, food paper, a stencil for foil, metal joined paper, a stencil release paper wind specialty paper of the low density off with production, a papermaking machine winder number 10.

When wind paper of the low density off with a winder, a difference of the apparent density by the difference in winding hardness and a machine loss of the spool bearing affect the tension control, and wrinkle and paper break occur; have a problem.

I remodel the density at the time of the line picking up speed and slowing down to plan stabilization of the tension control so that the motor output becomes most suitable to correct machine loss in the line constant speed automatically and introduce the contents to the stable operation because there was an effect.

New Type Turbo Blower Saves Energy
—Air Foil Bearing Variable Speed Single Stage Turbo Blower TurboMAX—

Go Kawazu
Design Department, Ono Plant, Fluid Division, ShinMaywa Industries, Ltd. *2
Shingo Yamamoto
Sales & Marketing Department, ShinMaywa Industries, Ltd.

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

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

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

ShinMaywa Industries, Ltd. launched TurboMAX turbo blower since 2012 in Japan, and some blowers have been delivered to paper factories. Though these blowers are used only as aeration blowers, I expect TurboMAX turbo blower can reduce the power consumption in many other uses too. One of applications is the air supply source for flotator which is used in the deinking process during manufacturing recycled paper from used paper. I hope TurboMAX turbo blower contributes to the energy saving in many fields and it leads to the reduction of environmental burden of the globe.

Report on the Results of the Fiscal 2016 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 Nippon Keidanren's call to the Japanese business community to organize “Keidanren's 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 “JPA's Action Plan for 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_2 emission rate of 2005), reduce fossil energy-derived CO_2 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 2016 follow-up survey (actual results for fiscal 2015), fossil-energy derived CO_2 emissions in fiscal 2015 was 17.81 million tons, a 28.6% 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.

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

Part 1：The Start of the Paper Industry after World War Ⅱ

Kiyoaki Iida

The Japanese paper industry lost its pulp and paper mills overseas which had covered almost a half of its production capacity after World War II. It restarted with the new strategy of vitalizing stagnated technological developments. By disintegrating old Oji Paper Co., free competition in the market as well as in technological developments was secured. The organization supporting open technical information exchange among the industry was established. Those were significant advices by R. Murdock of GHP, which have later worked quiet fine.

Though the industry lost its latest equipment overseas, the know-how was succeeded with

those who returned to home land, and helped the restart of the industry. Its style of engineering, doing everything by themselves, continued for a while until suppliers started to deliver equipment as a complete set, symbolically demonstrated in No. 6 machine of Kushiro Mill, Jujo Paper in 1960. Then, the interest of the industry's engineering turned to focus on operating mill efficiently, improving productivity and upgrading product reliability. The industry has made use of newly developed technologies, the solid state technology being one of them, for its interest and, by its efforts, the industry has been able to be competitive internationally.

－Peer Reviewed－

High Brightness Mechanical Pulp from Eucalyptus Planted Trees

Takanori Miyanishi
JAPAN TAPPI

The mechanical pulp yield is about 85 to 95% of the original wood, compared with around 45 to 55% for chemical pulp. Hardwood mechanical pulp has the desirable properties of low cost, high opacity and good printing quality due to its high bulk, high smoothness, resiliency, and good ink absorption. Hardwood mechanical pulp tends to have shorter fibers, higher light-scattering coefficient and lower strength value. Eucalyptus plantation tree is a common tropical hardwood species and is used for the production of lower yield chemical pulps such as kraft pulps. It is believed however that Eucalyptus mechanical pulp is not suitable for the production of graphical paper grades because of its low initial brightness and limited bleachability. Alkaline peroxide mechanical pulping (APMP) and thermomechanical pulping (APTMP) use caustic soda, hydrogen peroxide, and stabilizers to soften and brighten wood chips prior to refining in a disc refiner. The chip pretreatment facility employs a screw feeder device to apply mechanical compression on wood chips and squeezes out the detrimental substances for bleaching. It also partially destroys wood structures allowing for easier fiber separation and reduces refining energy. In our study, APMP and APTMP were applied to Eucalyptus-globulus planted trees by pilot plant tests and significant benefits were obtained to improve bleachability. Brightness of Eucalyptus APMP reached 87% ISO brightness that surpassed 80% ISO brightness of aspen APMP.

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Facility Improvement with Small Investment

Yosuke Okamura
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VOITH IHI Paper Technology's coaters have been maintaining the world's highest technological standard thanks to Japanese customers who are very discerning when it comes to paper coating quality. We have also focused on developing technologies and products by improving the existing technologies further, acting as a leader in the VOITH group worldwide. Our blade coater technology is the fruit of such efforts. Concerning coater business in our various fields of business, we are focusing on improving facility maintenance and additional functions of the jet-fountain-type blade coater. Concerning winder business, we are also focusing on improving operability and safety measures. So far we have delivered over 150 units of jet-fountain-type blade coater, which have been adopted as a coating material application method for various coated papers. Since some of our customers have been using our blade coaters for over 30 years, we have proposed plans for performing facility maintenance and machine updates, which are needed for the long life of machines. This paper introduces those topics which we are focusing on the improvement of facility maintenance and the additional functions of our jet fountain coater and the improvement of operability and safety measures of VOITH's winder. Concerning the jet-fountain-type blade coater, topics are facility maintenance of loading device and fountain lip, additional functions of jet flow and skip coating. Facility maintenance of loading device means exchanging the corroded and worn rotating parts to new ones, facility maintenance of fountain lip means exchanging lip blade and adjusting lip profile. Concerning the winder, topics are roller bar and safety measures of knife of slitter. The installation of roller bar leads the improvement of spread effects and the reduction of product loss.

Facility maintenance will certainly prolong the service life of the machines, maintain machine accuracy and stabilize product quality.

The additional functions, which I introduce here, and also aiming at improving operability and reducing product loss, are being received favorably by our customer.

Development of New Surface Sizing Agents

Yumi Ando
Paper Chemicals, Research & Development H.Q., Arakawa Chemical Industries, LTD.

In recent papermaking industry, since the trend of cost reduction and environmental protection, chemicals with good performance by small dosage are highly desired.

As for surface sizing agents, it has become much more difficult to achieve better and stable performance under poor condition, i.e. highly recycled fibers are used, high ash content paper is produced *etc*.

Two types of surface sizing agents, which are solution type and emulsion type, are commercially available. Emulsion type products have mainly been developed in industry, because of less foaming trouble.

We have developed three different types of surface sizing agents, Type A, B, and C. Type A, comprising a special emulsifier, is designed to enhance hydrophobicity and dispersibility, so that it suits two-roll size press machine well. Type B is designed to have anionic substituent groups, in order to perform well in rich cationic system. Furthermore, by introducing permeable components into Type C, it can easily show sizing effect in low-liquid-absorbing system such as a gate-roll coater.

In this report, more details will be explained.

Development of New Type"AXISZ System"
—Improvement of the Runnability by Proper Wet-end Chemistry—

Yuta Mochizuki, Koichi Tadaki, Kaori Sasaki, Miho Onuma and Kazutaka Kasuga
Technical Div. Technical Dept., SOMAR Corporation

As well known, on any paper making machines, any wet-end chemicals are not able to achieve its acquired effectiveness, due to excess use of waste paper pulp and due to too much dosage of filler. In last year in this conference, we introduced " New Type Dual Addition System " which had been developed with new concept to perform better even under these circumstances and we proudly told you that our on-machine trials had met favorable reception. In this paper, we would like to show

our examples of the evolved coagulant in various aspects.

"REALIZER A Series" was developed to obtain the function of pitch-control by adjusting the best ratio of hydrophilic and hydrophobic groups. Recently, as a target, we have chosen the sizing agent among the various auxiliary chemicals which "REALIZER A Series" may help sizing agent or may enhance its sizing function and have been working on the test to improve the supporting capability of "REALIZER A Series" to help the sizing agent to adhere more to pulp and other components in white water. In addition, we have already put newly developed coagulant into the market. The new coagulant is able to enhance the capability of retention aid to improve the retention of filler and pulp and at the same time, so as to improve the total paper qualities, such as formation. On the other hand, another type of "REALIZER A Series" has been developed which can help drainage agent for water to pass through the pulp fibers and other components easily.

The important thing is to establish the best collaboration of coagulant and retention aid to get better paper quality and runnability, and to reduce pitch trouble and paper defects. It is also important to find or judge the appropriate position to add these chemicals with right dosage. Therefore, in this paper, we are going to show our experiments or trials together with the results.

Validation of Pest Measures Based on A General Risk Investigation

Yuichi Hokita, Junichi Enokida and Suguru Ikuta
Technical Development Division, IKARI SHODOKU CO., LTD.
Business Division, IKARI SHODOKU CO., LTD.
Technical Development Division, IKARI SHODOKU CO., LTD.

Contamination of insects into products will lead to big problems such as market claims and complaints.

In many factories, they are using monitoring methods to investigate and understand the numbers and types of insects in factories. However, that method is not adequate enough to understand all the problems in the production areas. We need to apply the comprehensive methods. We would like to introduce you the effective methods of investigations of risks of pests.

Bleach Plant Optimization Utilizing Novel Measurement Technologies Complimented with Advance Process Control

Dan Smith, Akhlesh Mathur, Masashi Hasegawa and Greg Fralic
Spectris Pte Ltd. BTG Instruments, Singapore
Spectris Co., Ltd. BTG Instruments, Japan
Capstone Technology Corporation, Toronto Canada

Unit operations in a fiberline are designed to selectively remove lignin to achieve a pulp with desired brightness, cleanliness and strength. Pulp being a commodity there is always a pressure to reduce costs. The primary focus is generally to reduce wood costs but efforts to reduce bleaching chemicals, the second largest cost contributor, cannot be ignored.

Conventional bleach plant process control is based on the lignin content of the pulp fibers expressed as kappa number, combined with brightness measurement in the bleaching stages. There is compelling evidence that carryover consumes bleaching chemicals (Chlorine dioxide, in short ClO_2). In the absence of carry-over measurement, mills compensate by applying a high operator bias to cover peak carryover demand which results in higher bleaching costs. To overcome this challenge, the pulp industry is currently
transitioning from conventional fiber kappa number measurement using a traditional multipoint analyzer to the new total kappa measurement using an inline Bleach Load Transmitter for ClO2 charge control. In this way, the impact of carryover lignin is also included in the control of chemical charge. This continuous bleach load signal minimizes operator bias and delivers significant bleaching chemical savings.

Manipulation of multiple process variables is required to achieve effective bleach plant control and it is extremely challenging to optimize each of the controlled variables to maintain the process close to target. While it is of utmost importance of have the sensors functioning accurately and regulatory control loops in place; it is practically impossible for operators to manually optimize bleaching chemicals to achieve final brightness at minimal cost. To overcome this challenge, Multivariable Advanced Control System (MACS), a proven advanced control platform, has the potential to deliver large savings to mills. MACS uses dynamic process models to account for the effect of bleach load disturbances on downstream kappa number and brightness, and manipulates the ClO2 dose to compensate for these disturbances. MACS corrects for unmeasured disturbances via feedback

control, and accounts for varying process delays and non-linear bleaching curves via real time model adaptation. MACS also optimizes the bleach load applied at each stage to minimize bleaching cost for a given final brightness.

This paper highlights the advantages of a synergistic approach to optimizing bleach plants by utilizing proven, novel and differentiated measurement technologies with advanced process control strategies. Some case histories taking this approach are also included.

Introduction of the Latest Application of Tissue Softness Analyzer (TSA)

Daniel ohndolf
Emtec GmbH
Hiroyuki Miyaoka
Scientific Instruments Dept., Nihon Rufuto Co., Ltd.

The tissue production is a very complex process: extremely fast and at the same time it needs to be guaranteed, that the quality of the base material and also of the finished product meets the expectations of the converters and customers. Chemicals have to be added at the right time and in the right amount and the machines for the production and converting have to be set in the right way.
Besides this, producers and converters of tissue are under pressure from the consumers, because more and more these customers expect a quality on the highest possible level, but at the same time to the lowest possible cost.
This actually contains a couple of issues for tissue producers and all companies which are somehow related to the tissue production, such as pulp and chemical suppliers, but also manufactures of tissue production and converting machines.

Saving Energy by Protecting Coal from Moisture

Tetsuya Teramoto
Kurita water industries LTD.

In paper mills and power plant, coal is stored in an outdoor location. Most of the coal absorb moisture from rain or the water sprayed for dust control. Increased coal moisture causes troubles such as clogging in the transport equipment as well as

energy loss in combustion.

As a solution to these problems, a method that utilizes an impermeable and strong coating agents is reported. The Lab results as well as field results of the coating agents are reported in this document prove the moisture inhibition effects of the agents.

A solution provided by coating agents is a simple yet effective method to prevent the increase of coal moisture.

Energy Saving by Means of Lower Industrial Air Pressure in Mill

Tuneo Ito
Matsumoto Mill, Oji Materia Co., Ltd.

Oji Materia Co., Ltd. Matsumoto mill worked on the energy saving of compressors since 2013. In fiscal year 2014, we saved energy curtailing waste of electricity by controlling pressure of compressors that supply air to lines in our mill. As a result, we were able to reduce compressors electricity in 1.73 MkWh/ year from 2.24 MkWh/ year. Furthermore, compressor electricity was finally at 1.655 MkWh/year by suppressing the consumption of the air blow and we achieved reduction of 26% electricity. To plan the effective use of facilities, we enabled monitoring of compressors electricity, air pressure, air flow quantity and the remote control of the compressors.

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

Part2　Rayon and the Paper Industry

Kiyoaki Iida

The paper industry has been supplying dissolving pulp to cellulosic fiber industry, which was newly born at the beginning of 20th century, and of which development in the early stage the paper industry was in part involved in. With the study of cellulosic fiber, the concept of high polymer was invented and new industries such as those relating to synthetic fiber and petro chemistry started.

As the monopoly by Courtlaud ended in 1920, rayon was now produced worldwide,

and Japan also started its manufacturing. By 1937, it took the 28% share of the world production. The paper industry supplied pulp to them and developed the technology of using domestic woods such as red pine, beech and cedar.

After World War II, rayon production recovered very quickly from ruin. Then, synthetic fiber rapidly took the market from rayon and the domestic rayon manufacturers retreated from the business. So, the dissolving pulp manufacturers in Japan turned to paper making.

Report on 2016 TAPPI PEERS/RFR Conference and IBBC Conference

Hirohiko Koizumi
Nippon Paper Industries Co., Ltd.

The 2016 TAPPI PEERS (Pulping, Engineering, Environmental, Recycling & Sustainability) Conference/RFR (Research Forum on Recycling) and IBBC (International Bioenergy & Bioproducts Conference) were held in Jacksonville, Florida in September 2016.

There were several remarkable reports which focused on using poor recyclable papers such as packaging products in PEERS/RFR. Wide range of studies were presented to utilize wood biomass materials in IBBC: separation methods, developments of products, improvements of facilities and so on.

Some notable papers were summarized in this article.

Preparation of Lignin Composite Kraft Pulp Based on Black Liquor Absorption and the Following Acidification

Hiroshi Nonaka and Miki Takahashi
Graduate School of Bioresources, Mie University, Japan

Kraft pulp is the most expanding pulp in the world, applicable to every kind of wood species. A few drawbacks of kraft pulping are that its yield is low around 50% and the dissolved lignin is used only for energy after concentration of the black liquor. This research aims at overcoming them by development of novel lignin composite kraft pulp. We propose a unique lignin composite process based on black

liquor absorption with pulp and the following acidification. Various kinds of lignin are typically dissolved in alkaline solution and are precipitated at neutral or acidic pH. According to this mechanism, lignin could be precipitated in pulp swollen with black liquor.

Model black liquor was prepared by dissolving commercially available kraft lignin in 2 N NaOH. Bleached softwood kraft pulp was immersed in the black liquor for 5 min and the pulp was acidified with 10% acetic acid. After defibrillation, a hand-made paper was prepared from lignin composite pulp. The paper demonstrated good tensile and tear strength with increased hydrophobicity. It seemed that lignin is less oriented at the surface and included more in the cell wall of the fibers. This kind of fiber is very difficult to be produced by both mechanical and chemical pulping. Our method could contribute to increase the yield of kraft pulp and create novel fibers with various characteristics.

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Operating Experience of Wood Chip Biomass Power Plant

Takahiro Kawahara
Yashio Mill, Rengo Co., Ltd.

In recent years, energy conservation, diversification of energy sources and reduction of greenhouse gases are required for companies. Rengo Co., Ltd has dealt with these issues with a goal of 32% reduction in CO2 emissions from the 1990 level by 2020, which is called Eco Challenge 020. Saitama introduced a system in 2010 which encourage the plants using energy more than 1500kl in a crude oil equivalent in a year to reduce CO2 emissions 13% from the base year in 5 years (2015-2019).

Yashio Mill installed the wood chip biomass power plant in Jan of 2016 to achieve the goals. This report shows the performance of the new plant and approach to the three troubles as the operating experience.

Fuel Gas Production from Organic Wastewater by Hydrothermal Gasification Treatment Using Catalyst

Nobuyuki Matsumoto
Engineering Department, Osaka Gas Co., Ltd.

The new technology that can utilize the potential energy contained in organic wastewater is required in the terms of the prevention of global warming.
The hydrothermal gasification process for the wastewater containing organic matter in high concentration was developed and commercialized by Osaka Gas. In the hydrothermal gasification process, the organic matter contained in wastewater is decomposed at high speed and converted into the gas such as methane that can be utilized as fuel in the catalytic reactor under the condition of sub-critical water. The application of the hydrothermal gasification process to the wastewater conventionally treated by incineration because biological treatment cannot be applied enables the energy recovery, CO_2 emission reduction and treatment cost reduction.

The catalyst possessing high gasification activity in sub-critical water was developed. The process was developed by the laboratory scale and bench scale test. The decomposition characteristic of the typical organic matter contained in wastewater and the treating condition of the simulated or actual wastewater was clarified by the test.

The pilot plant was designed and installed in an actual factory. The performance of the hydrothermal gasification process was verified by the operation of the pilot plant for about 8,000 hours. The organic matter concentration of the treated water was maintained in low level and the generated gas composition was enough stable to be used for boiler fuel. The pilot plant has being in operation as the actual treatment plant for the factory after the demonstration test. The accumulated operation time of the plant is now more than 30,000 hours.

Efforts to improving the efficiency by changing the gas turbine operating method

Haruo Okada
Kanto Mill,Hokuetsu Kishu Paper Co.,LTD.

The gas turbine power generation equipment at the Kanto Mill Hokuetsu Kishu Paper Co., Ltd. has needed to improve its profitability to address the changes in the external environment. We examined optimum operating conditions of the gas turbine and have achieved a great efficiency improvement by controlling the input flow of high pressure steam.

In this paper, we further introduce examples of installing the intake air cooling equipment and other cost improvements for lowering the energy consumption toward a temperature rise during summer seasons.

Maximization of Energy Saving by High Efficient Control System with KAWASAKI Absorption Chiller

—Utilization of Waste Heat to produce Chilled Water more efficiently through Environmentally Friendly Product—

Makoto Uchida
Kawasaki Thermal Engineering Co.,Ltd

We Kawasaki Thermal Engineering(KTE) are the leading manufacturer of Absorption Chiller and Boiler.

Our latest model of Absorption Chiller "Efficio Series" with the highest COP and system efficiency could be operated not only by natural gas but also by several waste heats such as hot water, steam and solar heat.

We hereby introduce our control system to achieve much more energy saving for Absorption Chiller and its auxiliaries including Cooling Tower, Cooling Water Pump and Chilled Water Pump.

Activities for Energy Saving in Oji Materia Co.,Ltd.

Akihiro Yamamori
Oji Materia Co.,Ltd.

Oji Group has continued to work on energy saving activities for sustainable production. As for Oji Materia Co.,Ltd., we have been targeting over 1.5% reduction per year in total energy consumption since 2002 and achieving good results every year.

Whereas, those activities were approaches separately in each mill, so which was stagnant in some mills in the face of shortage of new items and manpower.

To solve the problems, we organized a Headquarter-centered project team with the cooperation of the engineering consulting firm. And we set objectives to move forward energy saving activities and develop human resources. By these company-wide actions, we have achieved great results.

This paper introduces the above approaches.

Energy Saving by Introducing Circulating Liquid of FGD/Water Heat Exchanger on Boiler

Takamichi Tsuchiya
Ishinomaki Mill,Nippon Paper Industries Co.,Ltd.

Nippon Paper Group was formulated Green Action Plan, that is the plan of action for environment. In Green Action Plan 2015, we formulated to reduce carbon dioxide emissions from fossil energy and the use of fossil energy. It was achieved and we formulate new target, Green Action Plan 2020, to reduce greenhouse gas emissions.

In Ishinomaki Mill, we adopt circulating heat exchanger on #1 Biomass Boiler. This is liquid of FGD (Flue Gas Desulfurization)/water heat exchanger. This heats boiler feed-water and it is energy saving by reducing the use of steam on deaerator. We installed plate heat exchanger on another boiler. This was also liquid of FGD/water heat exchanger, but it often got clogged heat exchanger for liquid of FGD and ash. So we decided to adopt spiral heat exchanger because it is strong to slurry solution like liquid of FGD. In addition, we selected the biggest heat transfer area for Kurose to be able to build it. As a result, it works well on energy saving and keeps inside clean.

From Energy-consuming Mill to Energy-creating Mill

Daisuke Nagamine、Ryo Yoshida and Chiaki Kawakami
Andritz K.K.

COP21 adopted the Paris Agreement in December 2015 that emphasizes the urgent needs to reduce greenhouse gas emission to control the global average temperature to well below 2 °C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5 °C above pre- industrial levels.

Japan is committed to reduce by the year 2030 CO2 gas emissions by 26% compared with the level of 2013.

Kraft pulp production mill system is an ideal process since it processes biomass not only to produce pulp stock but at the same time to generate energy, that is more than required for the pulping processes.

The kraft pulp mill is consisting of various fiberline processes, recovery processes and various sub-systems as well as auxiliary equipment.

By upgrading and integrating the mill processes and through optimization, it will be possible to create more green energy and more efficiently from the biomass that contributes to the reduction of greenhouse gases and pulp mill economy.

Operating Experience of Advanced Process Control (APC)
on the Kraft Pulp Bleaching Process

Yoshifumi Chiba
Akita Mill, Nippon Paper Industries Co., Ltd.

At Akita mill, fuel cost reduction in the kiln process has been achieved by use of oil cokes that started in 2013, there is more room for the energy saving because the operation of the kiln still depends on the experience of the operator. Also in the bleaching process, there is room for chemical saving because the process is always operated conservatively to keep the final brightness in the upper part of target range. For the above reasons, we introduced process optimization system to both the kiln and bleaching process in expectations of steady operation and cost reduction. Now, we are working on an early realization of the process improvement.

In this report, the management after the introduction of the system and the operation after the modification of bleaching process are explained. Although this system has many installation records overseas, it is first installation in Japan.

Development of New Retention Aid and Paper Quality Evaluation

Yoshimi Yoshioka, Goichi Hayashida, Yumi Kubota, Hiroyuki Suzuki and Kenji Sakai
Shonan Research Center, HYMO Corporation

Recently the waste paper is noticed a reduction in quality, as strong demand for export of high quality waste paper, and slowdown in domestic paper spending. Furthermore, the basis weight of paper has been become lighter and ash content in paper has been become higher, in an effort to cut cost. Therefore, it is the issue that the lower retention rate, caused by variation of such papermaking surroundings, should be solved.

In order to develop new retention aid, which will solve the issue above mentioned, we focused on the distribution in existing polymer. In this section, we report the concept of new technology 'Selection: control of polymer distribution' and high-performance retention aid developed by this new technology.

In general, polymers have certain distribution in the molecular weight, the structure, and the electric charge. We established 'Selection-technology' which enable us to select active components for retention and to remove disadvantageous components for paper quality, from the distribution of polymers.

By this technology, we succeeded to develop the new retention aid that have high abilities of both macromolecule bridging and charge neutralization, which were the main mechanism of flocculation of fibers and fillers. Because the new retention aid is superior in the flocculation of fiber and ash, it showed not only high retention but also improvement of paper quality, for different properties on fiber length and amount of ash.

These results supported that the new retention aid exerted a beneficial impact on the best performance under the changing of papermaking surroundings.

A Solution to optimize operation at a pulp plant

— Operational improvement with IIoT(Industrial Internet of Things) —

Akira Endo

Yokogawa Solution Service Corporation

Smart devices and cloud computing services have spread in our society at a rapid rate. Known as the “Industrial Internet” sponsored by companies based in the United States, and the “Industry 4.0” project led by the German government, the Internet of Things (IoT) has been well discussed in this current trend. The term, the Industrial IoT (IIoT), is often preferred in especially, manufacturing industries. Yokogawa also has proposed making the most of big data for operations analysis of customer plants, to give feedback to customers, and to help them improve their process control. However, every manufacturing plant has its own challenges to tackle. In order to seek operational improvement, it is essential to fully understand how the plant works and to clarify the key issues. In this session, I will explain our concept of IIoT and several solutions for optimized operation aiming at problem solving in the pulp and paper industry.

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

Part 3：Hardwood as a New Pulp Resource

Kiyoaki Iida

Until the 1950s, pulp was manufactured from softwood. As Japan did not have enough softwood, it was necessary to use hardwood as an alternative.

Then, USA, which was the largest paper manufacturer but scarce in good softwood resource, studied on using hardwood and developed SCP and CGP processes. Japan suffering from softwood shortage quickly adopted them and blended CGP up to 30% in its newsprint furnish. The key technology was the refiner of high power that was developed in Sweden and USA.

The effort continued and one paper company manufactured printing paper of high grade from hardwood bleached kraft pulp (LBKP). As its quality proved to be fine and the demand for that type of paper increased quickly, many paper companies in Japan started to produce that kind of paper. With technological advances that followed such as introducing chlorine dioxide for bleaching, perfecting continuous digester, and surface sizing for vessel troubles, fine grade printing paper of LBKP, invented in Japan, has become a world standard.

Japan, however, could not keep up against increasing paper demand with its domestic wood supply, and started to import wood chips overseas by chip carriers. It greatly changed the structure of the industry which will be discussed in the coming issue.

－Peer Reviewed－

Paper and Ink technology applied for high-speed inkjet production printing

Naoki Morita, Hiroyuki Ueki and Yukari Motosugi
Marking Technology Laboratory, Fuji Xerox Co., Ltd.

A High-speed inkjet production printer which prints aqueous inks onto continuous feed-roll paper has been growing by enabling digital printing such as on-demand and variable outputs. For example, direct-mail, transaction and trans-promotion with small lots, personalized addressing and contents are provided with low cost paper and ink performing medium color printing quality.

Permeable papers with inks are used in these printing outputs reflecting inkjet principles, however, printing companies expect to print on offset coated paper for commercial printing as a natural requirement because it reduces costs remarkably. The penetration into the coated paper were observed which required more than one second, although the penetration was completed in several tens of milliseconds on the plain paper, and then the fixing and the drying of the inks were the issues in printing systems. To manage these issues, a resin in the ink is utilized to fix colorants, and moisturizing agents are eliminated from the ink which was conventionally applied in traditional inkjets to maintain the dehydration performance.

As a result, monochrome ink having above improvements enabled personal addressing onto pre-printed coated paper and enhanced the concealed postcards in the folded form for example. Furthermore, for the color inks, when image density is high about more than 200 %, the system for pre-coating layer on the paper is introduced to coagulate ink colorants to avoid mixing and migrating of the printed dots. In the nearest future, ink is expected to print on coated paper and nonpermeable film materials with the system assistance, or the inkjet paper is expected to alternate coated paper in both price and quality.

Inkjet makers introduced 1200 dpi printers on drupa 2016 where the print quality has been improved although it was single pass printing, and also presented the fixing technology onto nonpermeable media. Although inkjet technology is supposed to stagnate around the beginning of the 21st century, inkjet is expected to innovate by facing the challenges in production printing market.

－Peer Reviewed－

Dependence of Enzymatic Saccharification on Residual Lignin Structure in Sugarcane Bagasse Pretreated with Alkaline Sulfite

Roni Maryana, Akiko Nakagawa-izumi, and Hiroshi Ohi,
Graduate School of Life and Environmental Sciences, University of Tsukuba
Keiichi Nakamata
Technical and Development Division, Hokuetsu Kishu Paper Co., Ltd.

Effects of residual-lignin structure—expressed as the syringaldehyde to vanillin (S/V) ratio—on the enzymatic saccharification rate was studied as a key step of bio-ethanol production. Alkaline sulfite-anthraquinone (AS-AQ) and soda-AQ cooking methods were applied to delignification of sugarcane bagasse (SB) and oil palm trunk (OPT), and the resulting pulp samples were subjected to enzymatic saccharification. The S/V ratios of residual lignin in the pulp were determined by the nitrobenzene oxidation method. This study showed that the AS-AQ method is more suitable for delignification of SB than the soda-AQ method is. SB pulp released more glucose than OPT pulp did under the same conditions of cooking and saccharification. A decrease in the kappa number (residual lignin content) significantly increased the saccharification rate. In a comparison of AS-AQ pulp samples at the same kappa number (20), the SB pulp with a lower S/V ratio (0.68) yielded a higher saccharification rate (0.0327), whereas the OPT pulp (S/V ratio: 2.56) yielded a lower saccharification rate (0.0252). In a comparison of SB and OPT, we found that syringyl-rich lignin kept in pulp results in a lower saccharification rate of the pulp samples prepared by the AS-AQ cooking method.

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Energy Saving Ⅱ

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Review Article (Original Paper)

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Energy Saving for KP Plant by Steam Reduction

Masatake Yoshizu
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The demand for paper has significantly dropped after the Lehman collapse in 2009. That was why Yufutsu Mill had to halt the operations of Paper Machine No.1. It decreased the amount of the KP production and increased the energy consumption rate in the KP process. The accumulation of small improvement projects was not effective enough to get it back to pre-shutdown level. In this study, notable reduction of the steam consumption rate in the KP bleaching process, which was considerably affected by the production curtailment, was observed without any large capital investments, as a result of three measures: optimization of hot water usage, efficiency improvement in hot water generation, and drastic changes in exhaust heat recovery. This report describes these three measures.

Energy saving using the variable speed fluid coupling

Junichi Fujimori
Voith Turbo Co.,Ltd　Hokkaido Works

In the manufacturing plant, we are seeking energy conservation for the purpose of efficient use of fossil fuel to prevent global warming and reduce environmental pollution. Efficient plant operation leads to reduction of energy cost and brings many benefits. In plants with large boilers electric motor driving a large fan or pump is consuming more power. Fan and pump variable speed drive introduction rather than a throttle or valve control will lead to big energy savings. In this paper, we consider the use of variable speed fluid coupling for realizing energy saving.

Activities for Energy Saving in Takaoka Mill

Tadashi kyoukon
Takuma Fukushima
Takaoka Mill Chuetsu Pulp & Paper Co.Ltd.

Chuetsu Pulp Takaoka mill focused on energy savings as a major cost reduction measures from the past and the whole mill have achieved results. However, in recent years, we had dealt with the projects that can easily obtain energy saving benefits, so the achievement ratio to energy saving targets set each year became generally low. Even in such circumstances, the Energy Management Committee members take the lead in doing tenacious activities in energy saving conscious and discovering a new project for energy saving.
In this paper, we introduce the recent energy saving results into three categories, electric power saving, crude oil saving and water saving of our factory.

Energy Saving Measures by Low-Emissivity Thermal-Barrier Effect for Heat Treatment Facility Like Industrial Furnace
—Thermo-Resin SV Method—

Nobuhiko Wakano
Ceramic sensor Division.　Chugai Shoko Co., Ltd.

In recent years, the manufacturing industries, in cooperation with the public sectors, have been actively adopting energy saving measures from maintenance and management.
Meanwhile, one of the highest energy consumption facility in the industry is a heat treatment one including industrial furnace.There are around 40,000 heat treatment facilities in operation throughout Japan, which accounts for about 18% of energy expenditures in Japan and about 40% of that of all industrial sectors.
Therefore, we have developed an ultrathin low-emissivity thermal-barrier paint "Thermo-Resin SV" which can reduce radiant heat transfer up to 80% by simply cladding only 5 - 15 μm as a valid measure in both environment and economic aspects by reducing energy consumption rate and improving the workplace owing to

cutting heat loss. It archives cost-effectiveness in a very short period because its initial cost is very low as users only have to clad the coating paint and yet have big heat reduction effect.

Practices for specific energy reduction in TMP process

Masaru Shinya
Tomakomai Mill, Oji Paper Co., Ltd.

In 1970's the strength on newsprint paper manufactured in Tomakomai mill, Oji Paper Co., Ltd depended mainly on mechanical pulp such as TMP （thermo-mechanical pulp）.
TMP contributed greatly to lighter grade of newsprint paper through established production system; however, the required pulp quality as well as production ratio has become less dependent on TMP after KP plant started and the production of DIP(deinked pulp) has been increasing with the rise in environmental awareness.
Once oil-saving production system was implemented in 2008 at Tomakomai due to higher fuel price, we needed to improve operating conditions such as refining system or new type of refiner plates to reduce energy cost in TMP accompanied with high energy consumption.
In a series of several practices, we have continued to optimize conditions and introduce new technology while carefully considering required pulp quality, and finally achieved 32% specific energy reduction in the refiner process of TMP production.

GL&V/Kawanoe EZ HYDROCYCLONE TECHNOLOGY
—Ultimate process performance and superior time economy—

Jose Santiago, Kozo Kishida
GL&V Sweden AB, Kawanoe Zoki Co., Ltd.

Current economic conditions put high priority to cost cutting and more effective shutdowns. Hydrocyclones are very important equipment that shall meet high standard requirements both at a process and quality level but also at maintenance. Effective shutdowns are critical to the operation of mills, whether they are planned

or unplanned, every mill aims to reduce overall downtime costs as much as its time length. Furthermore, cleaning efficiency and fiber saving demands have increased along the years and therefore existing cleaner systems can be operated at equivalent or higher cleaning efficiency at the same energy consumption while increasing fiber savings. By introducing changes in the internal surface of the hydrocyclones, separation efficiency and fiber savings are increased and run ability improved. We present the EZ technology that meets all these high demands, uniting concepts such as process performance and time economy in one single product.

Standardized and Automated On-Line Pulp Testing for Process Optimization and Control —L&W Pulp Tester – Case Studies—

Mitsuhiro Yamazaki
Pulp & Paper Group, Process Automation Division, ABB K.K.

Optimization and control of the pulp and paper making processes for cost-effective production requires more frequent monitoring of the relevant pulp and stock preparation quality parameters. A new quality monitoring system for pulping and stock preparation is developed. The online L&W Pulp Tester is a complete wet laboratory with automatic sampling from different positions along the process chain. Repeatable tests are made automatically and frequently. True variations are monitored in real time and are used to secure product quality, save time, material and energy, and increase production. The online pulp tester consists of automatic standard and established tests for CSF, SR, brightness, color, fiber length, kink, coarseness etc. suitable for building up an automatic quality monitoring and optimization system in the mill.
Australian Paper Maryvale Mill started automatic on-line freeness measurement at a pulp mill and a machine chest by L&W Pulp Tester, and closed loop controls of refiners. As a result, Maryvale mill accomplished reduction of electrical power and steam consumption and of broke generation, and their accumulated savings on key export grade was EUR 248,000/year. This calculation was based only on their export grades which is 30 % of their total production amount. If calculation on the total production is done, the saving becomes more.
In this paper, we introduce our L&W Pulp Tester showing from pulps themselves to their properties to be measured, and then, share the case study at Australian Paper Maryvale Mill.

Papermaking 4.0 new concept of VOITH Paper

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

Industrie 4.0 is a project in the high-tech strategy of the German government and is the title given to the next fourth Industrial Revolution. As part of Industrie 4.0 Voith Paper has already started to introduce and promote the Papermaking 4.0 concept globally. It based on the next generation of cyber-physical systems, encompassing the full life-cycle knowledge and intelligence necessary for the autonomous decentralized control of manufacturing plants. This coupled with big data analytics providing better insight and predictive capabilities allows for the next leap in productivity and cost reduction. Papermaking 4.0 is the sum of three main talents in a system of systems:

OnEfficiency SmartControls delivers sustainable performance. Papermaking 4.0 encompasses decentralized self-autonomous yet modular and integrated control solutions, distributed along the entire paper & board production process, enabling producers to easily drive their plant on the key parameters to continuously achieve business objectives.

OnCare SmartMaintenance delivers intelligent reliability. The smart self-diagnostic capabilities and seamless connectivity of Papermaking 4.0 ready products facilitate the highest attainable plant availability at the lowest overall cost of maintenance through a high degree of predictive foresight, automated service and material management.

SmartService delivers immediate assistance. Around the clock capabilities and assistance deployed through remote, on-site and on-call arrangements, supporting our customers with data analytics, diagnostics and real-time process optimization, ensuring highest plant performance and availability.

The most important differentiating factors from tradition automation solutions are in the high degree of modularity, step by step approach and unison between both production & maintenance faculties. The value delivered by our solutions substantially exceeds the sum of value from the individual components, generated through our USP, our know-how embedded into these solutions.

Fully Sprit Seal for Accurate Rotation
—Application to the vertical rotating equipment—

Atsushi Ebisu
Engineering Dept. John Crane Japan, Inc.

Adoption of the mechanical seal has been progressing for sealing system of rotating equipment in the pulp and paper industry. However, the applications of the mechanical seal are limited to the black liquor or coating collar of pumps or screens.

For the most cases, end users are using gland packing for horizontal and vertical agitators with axial runout and vibration that are troublesome to the maintenance persons.

In order to reduce energy conservation and maintenance costs and to provide safety and stability for the daily operation, we have over the past two years introduced the fully split mechanical seal that is based on our own design with rubber bellows for horizontal agitator with vibration problems.

Today, we would like to introduce our extensive experience of application for vertical pulper that is running under the severer conditions. For that, we propose an optimal solution using our fully split mechanical seal for the equipment with axial runout and vibration.

The History of Technological Developments of the Paper Industry in Japan after World War II
Part4　Chips Import and Integrated Mills of the Japanese Model（1）

Kiyoaki Iida

From the 1960s to the 1980s, the paper consumption in Japan increased by almost 3 times in ten years and how to supply wood was one of the critical concerns. At that time, pulp production overseas was interested and several projects were going on. Then, softwood chips were imported from the USA (1964), and the efficient process of importing wood chips was established, which was followed by hardwood chips import. Based on imported chips, the industry developed a unique mill design model. Chips from abroad were carried to their existing coastal mills where they newly installed big kraft pulp plants and resulting pulp were integrally sheeted in the mills. Most of big mills in Japan took this model.

Statistics in the 1990s are as follows. The number of chip carriers was 70-80. The imported softwood chips, which came mostly from the USA, Australia and New Zealand, shared 50% of the total softwood chips consumption, and they were used for RGP and TMP for newsprint. Regarding hardwood, the amount of the import, mostly from Australia, the USA, Chili, and South Africa, increased quickly in the 1980s and reached about 80% of the total consumption. They were used for fine paper and coated paper production.

The economy of the model will be discussed in the next issue.

PCFD technology for coating and paper making process

Masaru Yasuhara
MPM CAE Center Co.,Ltd.

Coating is a significant basic technology in the field of chemical engineering and in Japan, VOF(Volume Of Fluid) method has been frequently applied to the coating industry to analyze free surface of the coating bead. This analysis method can reproduce various coating defects such as air entrainment, ribbing, rivulet, chatter, non-uniformity of layer thickness near the coating edge, and so on. Furthermore, the operability window of coating, quantitative correlation between coating conditions and state of coating defects, shows well similar phenomena to the actual coating. Thus the coating analysis method can provide the investigation of the cause of coating defects and the estimation of coating defects under coating conditions without experience, and recently is available to design the optimum coating condition mainly in the electronic materials industry. Now this method is applied to the monolayer coating with slot coating system in general and we expect to be applied to the multilayer simultaneous coating in the near future.

On the other hand, in the field of paper making industry, the fluid structure interaction analysis method is applied to the analysis of blade coating and can reproduce the behavior of the coating layer formed under nip pressure with elastic materials e.g. blade and rubber roll, while the penetration of coating material to base paper does not be taken into account. However, on the analysis for printing process, penetration model has already reproduced the behavior when liquid penetrates to porous paper, and the next target is application of this model to the blade coating. In addition, we may expect the following themes: 1) the investigation of the behavior of solid fine particles in coating color with the application of fluid

discrete element method interaction analysis and 2) moreover, the investigation of the behavior of fiber in paper making process with the analysis of fine fiber that consists of bonded particles aggregated softly.

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Paper physics and the ways of thinking as the basis of papermaking technology

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Paper physics is decisively related to its structure from macro to micro level, and the structure is made by paper-making and converting technologies. Thus, paper physics is the basic science which covers paper-making, printing, converting, and its final use with logistics, recycling, and further the basis of some paper standards and testing methods including JIS depends on paper physics. In this article the relation between paper physics and the structure is illustrated with some examples and several important points on carrying paper physics study are explained. Considering its excellent environmental and recycling properties, paper would also be widely used from now on, and thus more studies of the physical properties related to paper converting and the use are expected in future as well as extension of a conventional study on paper physics.

Technology transition of Coater
—Technology Transition of Blade Coater applicator—

katsumi Ishizuka
Voith IHI Paper Technology Co.,Ltd. Coating and Finishing Engineering Department

Blade Coater consist backing roll, applicator and blade. Blade coater produce level coated product. And blade was main player and applicator was not main player. When Wide paper width and high speed operating production is required, level coated product could not produce by blade only. Blade metering, together with uniform application, achieve the requested coated product. Jet type applicator was research and developed as uniform applicator in Japan. Jet applicator is blade coater world standard now. Based on this jet type applicator technology, ideal contour coating head for paper product named curtain coater, was developed in

Japan. Curtain coater produce special product, for example, pressure sensitive paper, thermo-sensitive paper and inkjet paper.
Curtain coater achieves easy operation and excellent coverage. These feature make green light to produce coated pigment paper and board now.

Rheological Behavior of Coating Color and Effects of Rheology Modifier

Kazutaka Kasuga, Koichi Tadaki, Kaori Sasaki
Technical Department, Somar Corporation.

Coating color suffers the high-shear rate by coating speed and the blade after applied to base paper. In this time, coating color carries the elastic behavior by the high-speed coating. Therefore, we pay attention to this phenomenon and investigated rheological behavior of coating color by dynamic viscoelastic measurement.
As the result, we have found some correlation between the loss tangent that is a ratio of the storage modulus to the loss modulus of coating color and especially bleeding trouble. Also we have considered the mechanism of bleeding occurring by this.

We could change the rheological behavior of coating color by rheology modifier "SOMAREX" developed based on this viscoelastic data and get the knowledge to be able to improve the runnability of paper coating.

Basic Knowledge of Starch and Starch Products for Coated Paper

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Starches Sales Dept. Nihon Shokuhin Kako Co., Ltd.

Starch is produced by green plants for energy storage. Starches are isolated from botanical sources. Corn and tapioca starch are familiar to Japanese market. Starches show characteristic property by varying from plant to plant. In addition to its property, Starches that modified physically and chemically are appropriate for wide range application; food to industrial fields. As to paper industry especially, starch is utilized for wet-end, surface-sizing, coating and spraying. The utilization of starch in regard to paper coating is role as adhesion. So, starch mainly adheres between pigment and coating base. On the one hand it is necessary to gelatinized starch to exert enormous effect on paper, but at the same time the gelatinization

leads to expression of starch retrogradation. On the grounds of retrogradation, any modified starches are not only placed on the market but also controlled on their temperature et.al in the process necessarily. Talking of modified starch for coated paper, highly modified Starches are usually used like starch urea phosphated and hydroxyethyl starch. In late years, as for coated paper manufacturing, high speed coating and high concentrated coating color are required. So, it is difficult to handle starch urea phosphated under foregoing conditions. Therefore, starch carbamate have been released and used as coating binder to provide high fluidity to coating color. At one point in time, the usage rate of starch trended toward a decrease in evaluation about coating performance. Because of the quality improvement of starch and a trend of cost reduction, existential value of starch is reappraised and a usage rate of starch increases recently.

Evolution of Pigment Use in Coating Applications

Chris Nutbeem
IMERYS Minerals Kaolin Activity.　Global Kaolin Application Manager

In this paper we review the properties and performance of the main pigments (carbonates and kaolins) used in coated paper and board applications. We then go on to look at how pigment use and formulation practice has has changed in recent years, how this is influenced by regional differences and what this means for the role of kaolin in paper. We finish by looking more closely at some of the recent developments for kaolin which focus on how structured kaolin-based coatings can bring value in paper and board applications and how the functionality of kaolin can be used in speciality applications such as barrier coatings.

Recent Latex Technology Trends

Takeshi Watanabe
Technical Department-1, JSR Co., Ltd.

In order to increase the printing strength of coated paper, it is preferable to increase wettability between polymer particles and the adherend ,polymer cohesion force ， and interfacial adhesion.

Generally, the polymer particle design for improving backing roll dirt and increasing printing strength of coated paper is trade-off. With polymer particle morphology controlled and particle surface modified by water-based polymer, we have been able to improve backing roll dirt and increase printing strength of coated paper at the same time.
On the other hand, blister issue happened during off-set rotary printing process could be solved by increasing the calcium carbonate dosage during high-speed coating and double coating process. Therefore, the use of high gel type latex with strong printing strength which was generally used in off-set rotary printing for coated paper has become possible.

How to Improve Tissue Making
－Improvement and Achievement of Release Agent for Creping －

Ryo Inamatsu
Maintech Co., Ltd. Fuji Office　　Chemicals Development Team

Improving production and sheet quality have been one of the top priorities for tissue manufacturers. As press felt deposits due to recycled paper causes sheet web moisture profile uneven, coating on Yankee dryer tends to be unstable, which also leads to sheet spot and chattering mark on the dryer surface. Many kinds of Creping control agents especially polymer based coating agents have been used to solve the problems, however they have not succeeded in forming stable coating layer under the recycled furnish condition.
Maintech has developed innovative release agents “MRA series“ which protect the coating layer from the uneven moisture of the sheet web.
This report describes the concept and mechanism of MRA and its field testing cases in which MRA have been able to improve productivity and sheet quality.

Visualization of contract work

Makoto Kubota
Japan Business Innovation Consulting Co.,Ltd.

Presently, the contract work is indispensable in many manufacturing. However,

in many manufacturing, proper management of contract work isn't done.
To improve this situation, it is important to do “visualization” of contract work and build the true form. The step which builds the true form is introduced here. Necessary to the purpose, a way of an actual condition survey and a way of thinking are also introduced.
The step which builds the true form is as follows.
(1) Finding problem by an actual condition survey
(2) Planning of the important problem
(3) Making of an improvement plan
(4) Execution of an improvement plan
It's an actual condition survey to become important first among these. If you can grasp the current state by conducting surveys on it, you can establish abstraction of a problem, building of the true form and proper price of contract work.
That step is below.
1) Grasp of details of work
2) Clarification of the work scope
3) Investigation of working time
4) Investigation of operational hardness or ease
5) Building of the true form / Reduction of working time
6) Calculation of proper price of contract work
When it's being advanced by this step, the indefinite contract work you're managing is probably becoming clear.
As the step which builds the true form, this time is the introduction until planning to settle problem, making of an improvement plan and execution of an improvement plan are omitted.
However, when a problem becomes clear, you will be easier to do making and execution of an improvement plan.

Company where expenses of contract work are big and that evidence is ambiguous, are better to do “visualization” of contract.

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

Part4　Chips Import and Integrated Mills of the Japanese Model（2）

Kiyoaki Iida

As discussed in the preceding issue, the paper industry of Japan developed a unique mill design model based on imported chips. Chips from abroad were carried to their existing coastal mills where they newly installed big kraft pulp plants and resulting pulp were integrally sheeted in the mills. The model found following advantages.

1. By installing big kraft plants, the mills increased their outputs, improved their productivity and became competitive internationally.

2. Though the yield of kraft process is about 50%, the residual organic matter is

a useful energy source, burned in the recovery plant to generate electricity and steam necessary in mill operation. The energy produced at recovery plant was as much as that of heavy oil purchased by the whole paper industry (1993)

3. As logging cost in Japan was very expensive, it was understood that the cost of shipping chips from abroad would be paying.

4. As chip import business became successful in the 1970s, the price of chips overseas started to rise drastically. The deficit was offset with the sharp rise of yen rate from 1970 to 1990.

5. As the volume of imported chips became larger than that of domestic chips, the price of domestic chips were controlled, the domestic forest was maintained and the wood supply to the industry was steadily secured.

6. Though the yen got stronger and imported products became oppressive to the industry for several decades, it favored imported chip prices and worked as a hedge in currency change.

Pilot plant operations in Kita-Akita city for producing bioethanol from lignocellulosic biomass

Kengo Magara, Masanobu Nojiri, and Hajime Shibuya
Forestry and Forest Products Research Institute

Since June 2009, we have been operating a pilot plant to valuate a process for producing bio-ethanol from lignocellulosic biomass, wherein lignin is removed using soda-anthraquinone (soda-AQ) cooking as a pretreatment for enzymatic saccharification. By the end of September 2012, we completed all pilot plant operations and obtained the following results. Using a semi-batch cooking method, Sugi (*Cryptomeria japonica*) soda-AQ pulp was produced at an yield of 44%. The Sugi pulp was hydrolyzed using a commercial cellulase to obtain a sugar yield of 97%. The produced sugar solution was concentrated from 3.1% to 7.4% using a reverse osmosis membrane and then fermented using a yeast to obtain an ethanol yield of 96.5%. The volume of ethanol produced was then calculated to be 216 L from 1 BDT of Sugi chips.

Based on these operational data, we estimated the energy balance and manufacturing costs at a chip consumption rate of 250 t/day. In the entire process from pretreatment to ethanol distillation, the steam and electric energy consumption was 824.6 eT/day and 118.7 MWh/day, respectively. However, the

energy generated was calculated to be 1102.2 eT/day of steam and 189.8 MWh/day of electricity from the discharged black liquor, which exceeds the energy consumed. From these calculations of operating costs, we estimated the variable and total costs associated with producing 1 L of ethanol to be 98 yen and 263 yen, respectively. These estimations suggest that the cost of Sugi chips and depreciation expense would be substantially reduced to use this process.

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Approach the Issues on Coating Color Recycle and Effluent

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Disposal of coating color liquid in a paper mill causes in adverse effect on operation cost and environment. To avoid that, recycle of excessive coating liquid is important. The best way of the recycle is to preserve excessive coating liquid in a tank by preventing the corruption with preservatives before use it. Required long durability under the alkaline condition of coating liquid, we developed a new preservative “Kurikiller® SI-930 series “ as a suitable coating liquid preservative. Another method is to utilize discharged coating liquid to paper making process as dilution water for coating broke. It brings the matters of white pitch and anion trash problems that cause in lowering productivity and paper quality. To minimize the influence, we utilize S. sensing® system by monitoring water quality and control feeding coagulant to fix these matters on pulp stable. Final excessive coating liquid must be treated as waste water. We propose pre-treatment system before general waster water treatment to cut down the load, and also utilize S. sensing® system to stabilize the waste water quality by control flocculants.

Technology and History of Coating and Air Dryer

Ichiro Honma
Paper Technology, Valmet K.K.

In this paper, three main topics are described as technology and history of coating and air dryer. The first is the technical development of size press. Pond size, roll metering, application head size press and spray sizer are described. The technical development of some important coater heads are described secondly. Roll application, short dwell application, jet application blade coater and curtain coater are explained. The third is an update of an air nozzle of air dryer. This greatly

contributes to improvement of drying capacity and energy saving. The screen and the deaerator which are the important device of sizing and coating supply system are introduced at the end.

6 M/C　Operating Experience of OptiSizer-Combi

Hirotaka Hirai
Oji F-tex Ebetsu Mill

We invested in OptiSizer-Combi with Turn Dry Compact to PM6 at Ebetsu Mill Oji F-Tex Co., Ltd. in April 2013 to have flexible coating operation range. OptiSizer-Combi has a feature of swing machine for pond-sizing and rod metering sizing, and two alternative types of applicator chamber, baffle plate or sealing blade can be selected. The feature of Turn Dry Compact is such excellent performance of non-contact drying system with Air turn that can keep better web runnability. In this paper, we introduce the outline of OptiSizer-Combi and Turn Dry Compact, and describe solutions to problems which we have had during operation such as coating variation due to coating color properties, coating color accumulation onto TDC, coating color overflow over the rod due to excessive applicator chamber pressure.

Operating Experience of No.7 Paper Machine

Kazuki Takahashi
No.6 Production Department Niigata Mill,Hokuetsu kishu Paper Co.,Ltd.

The Niigata Factory PM7 started operation in 1990, and in the Niigata plant it was introduced as the second on-coater machine. Production variety A2 grade, A3 grade are produced, various kinds of colors are used, and the coating amount adjustment by the coater is widely. various types of adjustment are also carried out in the blade type and setting. In this report, we introduce the outline.

Technology and Development of High Performance Coating blade

Takuya Maekawa
Spectris Japan Co., Ltd.

It has been almost 30 years since BTG innovated and developed the first High-performance coating blade in the world. High-performance coating blade can improve paper quality, decrease web breaks, blade changes and eliminate running-in time

BTG Duroblade overcome the performance degradations caused by rapid wear-and-tear on steel components, delivering clear performance improvements and better quality coated paper and board products. Our blade tips are treated with the materials of ceramics, ceramic-metal compounds to enhance coated paper surface, smoothness, gloss and fiber coverage. This is turn leads to significant, sustainable gains in business performance.

In this paper, I describe a history of HP-blade development in BTG. Also explain how coating blades make influence on coated paper surface quality at a technical stand point.

Stabilization of Coating and Improvement of Roll maintenance by Rubber cover

Shigetada Kadomatsu
MEIJI RUBBER & CHEMICAL CO.,LTD.

We, Meiji Rubber & Chemical Co.,Ltd. established in 1900, have been supplying rubber covering materials for Pulp & Paper industry for 115 years. We are dealing a variety of materials and developing the optimum cover rubbers for each section of paper machines based on the years of experience.

In recent years, due to the diversification of coating & sizing liquid and high speed machine operation, the requirement of quality stabilization for Applicator rolls cover is becoming harder.

Our material " Super Polyforte " is a polyurethane material con

taining the special polymer, have been adopted in many Applicator rolls and Smoothing press rolls, etc. since starting sales in 1999.

Now we would like to introduce references of "Super Polyforte", particularly focusing on Applicator rolls in the several paper mills which have achieved

stabilization of coating and longer replacement cycle of rolls. In this report, we introduce about the superiority as the roll cover material and customer result.

Updating of air dryer blow nozzle at #32 Coating machine

Takeshi Hirose
Hokkaido Mill – Shiraoi, Nippoon Paper Industries Co., Ltd.

Shiraoi #32 Coating machine has four head off machine blade coaters mainly producing approximately 600 ton/day of A2 coated paper. Each coating head has dryers such as gas IR dryer, air dryer and cylinder dryer.

Air dryer blow nozzle was updated to improve drying efficiency in May 2015. This new type of nozzle had higher drying efficiency that made it possible to shut down gas IR dryer. In this paper, feature of this new nozzle, installing process and run-ability were reported.

Introduction of Headbox and our Experience of Rebuilding

Koji Seki
Paper Machinery Sales Dept., Kobayashi Engineering Works, Ltd.

Since the establishment in 1947, Kobayashi Engineering Works has manufactured several units of Board Machines starting from Head Boxes. In 1980, we have signed a technical cooperation with Ahlstrom in Finland and learned their technology for Air Cushion and Hydraulic Type Head Boxes to enhance our knowledge and ability to compete in the markets. Recently, more and more paper producers are challenging on thinning of board papers with faster production speed than ever. In order for us to meet these expanding requests from customers, we have signed another technical cooperation with Paperchine, USA recently and released PCR Stable Flow Head Box.

Starting from Japan, we have several clients worldwide in various regions of North America, South America, and in Asia. Since 1980`s we have delivered about 300 units of Head Boxes and that number included 100 units of Hydraulic Types. These Head Boxed are manufactured aiming on producing various sheet grades such as Liner Board, Corrugating Medium, White Paperboard and Special Papers.

On this article I would like to focus on these variety of Head Boxes. I would like to explain about the variations we could offer and talk about the rebuilds we have conducted recently.

Why Asian Pulp Producers Are Investing in Ozone Bleaching

Brendan van Wyk
Xylem Water Solutions South Africa(Pty)Ltd.

There are now more than 23 pulp mills globally that are producing almost 10 million tons per year of ozone bleached pulp. The pulp is made up of both hardwood and softwood, and final products range from fluffed pulp to dissolving pulp, to printing and writing grades. New mega-mills under construction have now chosen ozone as a bleach chemical, while mills that have been using ozone for a few years are installing extra ozone capacity so that they can convert their total production to Z-ECF or TCF bleaching.

Ozone use in conjunction with chlorine dioxide, the so called ECF light or Z-ECF sequences have proven to be the most economical while still improving pulp quality and reducing the impact of the bleach plant on the environment. The high bleaching efficiency of ozone allows a drastic reduction in the consumption of expensive bleaching chemicals - chlorine dioxide in ECF bleaching and hydrogen peroxide in TCF bleaching, and sodium hydroxide in both cases. The implementation of ozone bleaching also results in the reduction of steam requirements during the bleaching process.

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

Part5　Recovered Paper for Newsprint and Printing paper（1）
DIP for Newsprint

Kiyoaki Iida

As Historically, 30-40 % of paper and paperboard produced in Japan was recycled mainly for paperboard production. Around 1970, pollution in environment became troublesome and the environmental conservation was socially concerned. Then, following the increase of oil price by OPEC, the price of imported wood chips hiked, and alternative resources for paper making were looked for. Just in time, floatation deinking of recovered newsprint was developed in Europe and paper manufacturers in Japan blended the DIP into their newsprint furnish, replacing CGP.　Around the

same time, RGP and then TMP started to be produced from imported softwood chips, replacing GP. As a result, newsprint experienced quite a big change in its pulp furnish.

News printers were also revolutionizing their technology including printing system those days and demanded improving paper quality one after another. In order to satisfy their requests, paper companies upgraded their equipment, refined their knowhow and at the same time improved productivity to cope with imported newsprint. The conversion of newsprint furnish mentioned was accomplished interrelatedly in the technologically and socially changing situation.

In 1980, the recovery rate in Japan was 46.2 %, and the recycling rate for paper and paper board production was 41.5%.

The recycling rate stagnated for a while, and then increased in around 2000. It will be reviewed in the next issue.

Accelerate Ageing Test of Naturally Aged Paper
－Degradation Behavior of Paper by Sealed Tube Method at 80℃－

Kang Lee and Masamitsu Inaba
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Research was conducted to clarify the relationship between natural ageing and accelerated ageing of paper using paper naturally aged for 80 to 130 years. Following a previous report on a test regarding the degradation behavior of paper samples using suspension method (80℃, 65%rh), same paper samples were artificially aged by sealed tube method (80℃) to clarify the physical and chemical ageing behavior of paper.

As a result of the present experiment, it was found that it is desirable to use degradation rate indicators (dividing degradation rate by current physical value prior to accelerated ageing) in sealed tube method as well for the ageing index of the physical strength of JCS samples instead of the degradation rate. Based on this result, it was further found that the degradation of the physical strength and discolouration of paper in sealed tube method was more severe than those in suspension method but that changes among paper samples indicated similar tendency in both methods. Moreover, as in suspension method, the more organic acids had accumulated in the paper, the larger the degradation rate indicators of tear and burst indices and discolouration rate were in sealed tube method. These

degradation rate indicators were correlated to the number of cellulose chain breaks. From these results, it may be said that broken cellulose chains have much to do with the decrease in the physical strength of paper and that cellulose chain breaks are caused independent of the kind of acid, oxidation contributing as much to the break as hydrolysis.

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Pulp

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Formation and Ultrastructure of Cell Wall in Wood

Keiji Takabe
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Cellulose is synthesized by rosette composed of 36 cellulose synthases. Thirty-six celluloses are gathered together to form cellulose microfibril of 3nm width. Three to four cellulose microfibrils are subsequently gathered together to form cellulose microfibril bundle. Hemicelluloses are synthesized by the Golgi apparatus and transported to the inner surface of developing cell wall by exocytosis of the Golgi vesicles. The inner surface is covered with sol-like structure composed of newly deposited hemicelluloses and water. Newly synthesized cellulose molecules are released into the sol-like structure. Monolignols are synthesized in the cell, transported toward the cell wall, and polymerized within the cell wall. Lignin accumulation starts at cell corner middle lamella, proceeds toward compound middle lamella. Lignification of secondary wall starts at the outer portion and proceed toward the lumen lagging behind cell wall thickening.

Paper: The history of 2000 years from its Birth
－From Ts'ai Lun's Invention to the Birth of Modern Pulp and Paper Industry－

Kiyoaki Iida

Paper and its making process were invented in China and were introduced eastward to Japan. Westward, they moved to Samarkand, then to Damascus, and through North Africa to Europe. One other route was through Greece to Europe. In Europe, the old technology was revolutionized, and the modern technology prevailed in the world.
Before the industrial Revolution, wood could not be pulped, and only bast plant like hemp, flax and mulberry, and bamboo in its infant age were converted to paper after a lot of hard labor of so many days. In the course of time, every district searched

plant domestically available and modified its product (paper) for satisfying customer needs, good for writing either with pen, mouhitu (brush) or printing.

The paper served the development of civilization as a medium for expressing human wisdom and intelligence.

Chemistry of Delignification in Pulping and Bleaching

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

Most of the principal delignification reactions in pulping and bleaching are described in various books related to the field of wood chemistry and published by Japan TAPPI. These reactions are primarily reviewed in this report with being followed by introduction of the recent results on alkaline pulping obtained in our laboratory. An outline of main reactions in oxygen delignification is also introduced.

Fundamental of the KP Chemical Recovery Process

Makoto Iwasaki
MIP Consultant Office

KP pulping is the most popular pulping method not only in Japan but also in the world. The progress of KP chemical recovery system included with evaporation of black liquor, chemical recovery boiler, causticizing and calcining has played a large part in the development of KP pulping. The KP chemical recovery system has basic functions such as ①Recovery and reuse of the inorganic pulping chemicals,② Burning of the organic material and recovery of its energy, ③Extract of valuable organic by-product chemicals
④ Performance of these functions in an environmental friendly manner. In this report

KP Chemical Recovery Process included with black liquor properties, concentration of black liquor, black liquor combustion, green liquor process, causticizing process, lime kiln operation, NPE problems and the new causticizing process are briefly described.

The Introduction about a Chemical Recovery Boiler

Yoshihisa Yamamo
Mitsubishi Hitachi Power Systems, LTD. Boiler Engineering Department

In paper and pulp mills, a chemical recovery boiler plays two important roles, chemical reactor and energy source. The chemical recovery boiler burns organic matters and recover mineral chemicals in black liquor.

This paper describes features of the chemical recovery boiler. First topic is a chemical recovery process in the recovery boiler. After that, the latest technologies for the recovery boiler are described, such as combustion systems, discriminative structures, anticorrosive technologies, pollution control methods, efficiency upgrading methods, and maintenance methods.

Improving the Efficiency of the Causticizing Process

Kiyoshi Yazawa
Shimada Mill, Shin Tokai Paper Co.,Ltd.

The Shimada mill has been operating two fiber lines of NUKP.

However, for reasons such as increasing the cost competitiveness, we came to stop 1 line in 2016.

The efficiency of the causticizing process turned worse while pulp amount of production decreased. Therefore we worked on reduction of the grits discharge and the heavy oil consumption because the efficiency deterioration was particularly remarkable in these points.

About the grits discharge reduction, we paid our attention to the Slaker ability becoming the overspecifications.

On the other hand, about the heavy oil consumption reduction, the Draft fan ability paid its attention excessively.

We think that it is a valuable case that we could modify current facilities to efficient facilities with small investment.

Fundamental Knowledge of Bleaching Chemicals

Hiroshi Kurata
Basic Chemicals Department,
Inorganic Chemicals Division, Specialty Chemicals Company,
MITSUBISHI GAS CHEMICAL COMPANY,INC

Among bleaching chemicals used for paper pulp breaching process, we will explain functions and precautions for using hydrogen peroxide and sodium hydrosulfite. Breaching chemicals are roughly divided into oxidizing breaching agents and reducing breaching agents. Oxidizing breaching agents are widely used in chemical pulp and mechanical pulp while reducing breaching agents are mainly used in recycled pulp and mechanical pulp. In chemical pulp field, the usage of hydrogen peroxide as breaching chemical has expanded due to environmental issues which enforce conversion to ECF (Elementary chlorine free) breaching.

In this study, outline of common breaching chemicals will be explained initially, followed by detailed explanation of hydrogen peroxide and sodium hydrosulfite. Characteristics of agents, precautions and remarks in breaching process will be explained in details for each hydrogen peroxide and sodium hydrosulfite. Hydrogen peroxide which is oxidizing breaching agent is used for breaching chemical, mechanical and recycled pulp. Sodium hydrosulfite which is reducing breaching agent is used for breaching mechanical and recycled pulp. In addition, the characteristics, manufacturing method, strong points as well as usage examples for peroxymonosulfric acid will be introduced. Peroxymonosulfric acid has been popular in the market as new breaching agent by resolution method for the discoloration problem ,cost performance and increase production.

Stabilization of KP O_3 generator

Takashi Masuda
Hokkaido mill - Yufutsu, Nippon Paper Industries co., Ltd

The bleaching sequence was changed from C-E-H-D to ECF (elementry choline free) due to environmental problems such as dioxin, chloroform drained from KP bleaching process. D-Ep-D was mainstream, but ZD-Ep-D was installed in our mill. The ozone bleaching plants is installed at the first among Nippon Paper Industries.

We had various problems in a few years from January 2001, and now it is stable and becomes important on pulp quality, cost and environment side.
However, the ozone generator performance could not be kept appropriately for the first time installation at KP bleaching plant, and gas production rate was down to approximately 60% after 13 years from setting. In this presentation, I will report about the construction of the ozone plant which recover the gas production rate in September 2016 and importance of the periodical maintenance.

History of Mechanical Pulping and Recent Trend in China

Masaharu Menjo
Valmet K. K., Sales department

In this paper, there are two topics regarding mechanical pulping. As the first part of this paper, the history of mechanical pulping will be briefly described from the view point of equipment. The birth of stone grinders for GP (Groundwood Pulp) as well as recent disc refiners for TMP (Thermomechanical Pulp) will be explained. In 1844, the first grinder for GP was founded in Germany and USA. About 130 years later, the PGW (Pressure Groundwood pulp) as an improvement of GP's stone grinder was developed in 1977. The current type of disc refiners originated from a vertical reject refiner which were used in GP process in 19th century. There were 3 important developments in the history of disc refiners.; the invention of pressurized disc refiner by Dr. Arne Asplund in 1931, the change from low consistency to high consistency as refining consistency in 1960's and the birth of TMP (Thermomechanical pulp) as an improvement from RMP (Refiner Mechanical Pulp) in 1970's. The era of mechanical pulping finally reached at a booming of BCTMP (Bleached Chemi thermomechanical Pulp) in China in 2003. As the second part of this paper, the recent trend in China regarding BCTMP will be introduced. By showing a flow sheet of newly installed BCTMP plant, the comparison between nowadays and future on paper grades, sources of raw material, waste water treatment and energy consumption will be described. By knowing the history of mechanical pulping as well as current BCTMP plant, the future prospect of mechanical pulping will be also given as a conclusion.

Role of Deinking Agent and its Challenge

Hiromichi Takahashi
R&D – Performance Chemicals Research, Kao Corporation.

Wastepapers are recycled as raw materials to produce the paperboard such as a corrugated board and the paper such a newsprint. In the former case, pulps after disintegration are mainly used for the contents such as the corrugated board. In the latter case, pulps after disintegration are deinked and used to produce the paper.
The total wastepaper availability of 2015 reached to 64% and achieved the aim of the industry. When each wastepaper availability (wastepaper consumption / amount of production) of paperboard and paper was calculated, the availability of the paperboard was around 99% and that of the paper was around 40%. This means that there are some kinds of printed matters which are hard to be deinked. The representative examples are printed matters printed by UV ink and inkjet ink.
In this seminar, the basic deinking process, the role of the deinking agent and the good condition for deinking are reviewed. Then, the present conditions and the future problems of printed matters printed by UV ink and inkjet ink are provided.
UV inks were hard to be detached from the pulp and detached inks were too large to be rejected out in the flotation process. Recently, recyclable UV inks were developed by the effort of the ink company and the related association. Although wastepapers printed by the old UV ink are still left in the wastepaper market, the problem will disappear in near future.
In commercial printings, the transition to on-demand printings is in progress. Especially, the inkjet printing has attracted attention in terms of its printing speed. Therefore, it is thought that the wastepapers printed by inkjet ink should be used as raw materials in pulp manufacturing in near future.
Water-based pigment inkjet inks can be detached easily from the pulp. But, detached inks are too small to be rejected out in the flotation cells. For increasing the efficiency of the flotation, it was found that the weakened shear in the ink-detaching process and the combined use of the aggregating agents such as fatty acids in the flotation process were effective. However, by this method, it is considered that ink-detaching will be not enough in the deinking of old newspapers or electrophotography prints.
It is necessary to establish the deinking method of mixed wastes of inkjet prints, electrophotography prints, and old newspapers by adopting the suitable deinking systems and/or improving the inkjet inks.

The latest technology of DIP system

Takanori Goto

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

For the past decades, the situation surrounding paper industry has been changing dramatically. To enhance the production efficiency is one of the most important concerns. A DIP production process has an affect on the cost of raw material, energy, and chemical etc. In this paper, we will introduce the latest DIP technologies related to DIP system.

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

Part5　Recovered Paper for Newsprint and Printing paper（2）

The second breakthrough for further DIP consumption

Kiyoaki Iida

From around 2000, the concept of recycle-based society was established and 3R (Reduce, Reuse and Recycle) was promoted as a national guide line. LCA evaluation was introduced after the COP Kyoto protocol, and Forest Certification System internationally prevailed. Those efforts induced an incentive for using more amount of recovered paper. The technology of producing DIP good for printing paper was developed by adopting high consistency dispersion and high brightness bleaching. Then, newsprint contained DIP up to 80% of its total furnish. In the printing and communication sector, the DIP use ratio was probably about 20% as a whole. In 2010, recovered paper's utilization rate reached 63%. These goals were accomplished by technological development not only in deinking but also in modernizing equipment in general, coping with severe demand for product quality and volatile nature of recovered paper quality.

The conversion in pulp sources of this scale affected wood chip supply. Imported softwood chips for mechanical pulp declined. Hardwood chips for LBKP., imported as well as domestic, was also less consumed.

The next issue will be on the use of recovered paper in the world.

Accelerate Ageing Test of Naturally Aged Paper
－Effect of Humidity, Amount of Oxygen and of Organic Acids on the Degradation of Paper in Sealed Tube Method－

Kang Lee　and Masamitsu Inaba
Graduate School of Fine Arts, Tokyo University of the Arts

Research was conducted to clarify the relationship between natural ageing and accelerated ageing of paper using paper naturally aged for 80 to 130 years. Following a previous report on the degradation behavior of naturally aged paper by sealed tube method (80℃), samples were artificially aged by sealed tube method in conditions of different humidity or amount of oxygen to clarify their physical and chemical ageing behavior.

In the closed condition of a sealed tube, hydrogen ion concentration, which causes hydrolysis, was higher than in suspension method. This is because organic acids do not escape from the system in sealed tube method. On the other hand, oxidation of cellulose was higher in suspension method than in sealed tube method. This is because available oxygen for reaction is limited inside a tube. Regarding the behavior of organic acids in sealed tube method, it was found that the composition ratio of oxalic acid and glycolic acid, major and second major organic acids in paper, before and after accelerated ageing remained similar in spite of the changes in humidity or amount of oxygen. Thus it was confirmed that sealed tube method simulates the natural ageing of paper better than suspension method.

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Ionic liquid treatment for increasing the wet strength of paper and its application for aquatic condition

K Hideaki Ichiura, Yuka Hirose, Misaki Masumoto and Yoshito Ohtani
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Kenji Taniguchi
Kawano Paper Corporation

In this study, ionic liquid treatment for increasing the wet strength of cellulose paper was studied. The effects of treatment conditions with the ionic liquid 1-butyl-3-methylimidazolium chloride ([BMIM]Cl) on the wet strength were investigated. First, the [BMIM]Cl (20 g) was melted at 80–100 °C and the paper was immersed in it for 5–30 s. Next, the paper was immersed in ethanol, and finally, it was washed with distilled water. The paper was dried in a hot press at 110 °C and 1.1 MPa for 5 min. The [BMIM]Cl treatment improved the wet strength of the paper. Disintegration of the papers was investigated by immersing them in distilled water, and the paper treated with [BMIM]Cl did not disintegrate. The minimum treatment time required for improvement of the wet strength of the paper was only 5 s. Excess [BMIM]Cl from the original treatment was recovered by vacuum distillation and dehydration was used to treat new paper. This recovered [BMIM]Cl enhanced the wet strength to a level similar to that obtained with the virgin [BMIM]Cl. Therefore, the [BMIM]Cl can be efficiently re-used in this method. The paper treated with [BMIM]Cl will be composed completely of cellulose. Therefore, this method is a viable alternative to treatment by adding chemical such as a polyamideamin epichlorohydrin (PAE).

Estimation of forest biomass volume by Unmanned Aerial Vehicle (UAV)

Kenichiro Suyama , Kazuya Nantou and Akiyoshi Kawaoka
Agri-Biotechnology Research Laboratory, Nippon Paper Industries Co., Ltd.
Kazunori Hayashi
Amapa Florestal e Celulose S. A.,
Akira Kato
Chiba Univ.,
Hiroyuki Obanawa
VisionTech Inc.

In this study, we have developed high efficient estimation method of forest biomass volume using an Unmanned Aerial Vehicle (UAV). Three-dimensional data of forest canopy was generated by Structure from Motion from sequence aerial photographs taken by UAV and the biomass volume was calculated from the spatial volume between canopy and terrain on 15 plots (0.04 ha/plot) in northern Brazil plantation. We could investigate larger forest area by UAV than current method. The coefficient of correlation between spatial volume and actual biomass volume was high (R=0.88).

The Reality and the Future of Digital Print
－ How to Make a Personalized Brochure: the Key Point of Digital Solution from the Case Study －

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This report illustrates the recent trend and the future of digital print as well as a digital print solution. As for the recent trend, most OEMs launch new high-speed machines with high resolution. Furthermore, they propose new solutions trying to print on offset coated paper using aqueous pigment inks. The solutions are classified into three ways; 1) primer treatment, 2) direct print without any primer and bonding agent, and 3) intermediate transfer system. On the other hand, as for the printing market, “the value of paper” is now being re-evaluated. Because the paper media is a device sensuous to the human five senses. Many marketers realized that particularly, catalogues, brochures, and direct-mails are very stronger

tools to impress customers than the web marketing alone. We show these case studies from the global media, and the making of the personalized brochure based on a real content.

The New Technology & the Transition of Thermal Paper

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The thermal paper, which is imaged and printed by heat, has been launched for over 40 years. The application at the dawning of the thermal paper was for facsimiles, and then the receipt of stores was developed. The applications of the thermal paper have been extended to various areas, such as transportation and logistics labels, food packing and weighing labels, tickets and the imaging media for medical.

The quality at the dawning of the thermal paper was not so good. The dynamic sensitivity was low and the printed image faded out little by little. The dynamic sensitivity was improved with various technologies. As one of the examples, an undercoat layer was applied between base paper and thermal layer to improve insulation. The image fading also was improved with thermal formulas, which applied new developers and various kinds of chemicals as additives.

This article describes the development and the changing applications of the thermal paper, and introduces the latest technology of the thermal paper.

Development of Digital Printing Paper
－Technical Development of Inkjet paper－

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In the publishing and advertising industry, digital printing has expanded the market as a promotion tool that meets customers' needs. Digital printing, which makes it possible to print such variable information as customers' addresses and names, local advertisement, and guidance of goods based on customers' preference, has steadily become popular in the market with the spread of the device. Credit card bill, cell phone invoice and direct mail etc. are very familiar to us, and we can imagine that digital printing related would increase in the daily life.

Inkjet printing which doesn't require plate making and is advantage of a small

amount of printing, has begun to penetrate even in the printing industry. The authors have developed the inkjet paper by the selection of optimum ink fixative, the setting of optimum range of ink fixative volume and size press coat weight in order to add the quality of each grade required for the inkjet paper. This paper introduces the technical development of inkjet paper which the authors have studied so far.

For sound or noise in industrial world　Part VIII
－It thinks about the noise as part of T.F.O from SKF－

Yasuhiko Yamasaki
RSS RS SKF Japan.

“For sound or noise in industrial world” is the five in this time.　This explanation is a noise by the contamination. The contamination accounts for 14% of the whole of the problem that the damage at the early stage of the bearing doesn't reach the calculation longevity. The contamination exists from small one to the big one, and from rigid to soft. And, there is the solid and liquid. I present the example of the soft solid one by this contamination, deprave the longevity of the bearing by it, and tell how the noise is generated.

Equipment diagnosis in Rotary lime kiln

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Lime kiln is important in the causticizing process, but it is hard to notice abnormal for large facilities. Therefore, we made equipment diagnosis in order to understand the current state of the kiln. The main diagnosis item is the kiln core accuracy, shell ovality, and wear of tires and rollers. A result of the diagnosis, it was found that kiln core runout and shell ovality and roller wear is large.

We have promoted the repair using the submitted recommended maintenance items from the facility diagnostic manufacturers.

New automated method for macro-contaminant analysis: Industrial experiences

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In recycled paper processes, stickies are at the origin of many production disturbances. In this paper, we present how the recently developed method for macro-contaminant analysis was used with industrial samples for process analysis. The new automated stickies measurement method allows to (i) determine the 3 dimensional morphology of screened particles (without any deformation) and (ii) classify the particles as stickies among contaminants. This is achieved by a combination of laser triangulation and local near-infrared (NIR) spectroscopy.

Measurement of macro-contaminants in pulp samples and their classification allows concluding on their specific removal. Chemical nature and amount of the macro-contaminants coming from different raw materials was studied and was shown to be very different in two different mills. In an Asian mill, a low PSA removal in the process (46%) was found in comparison with high other stickies removal (99%).

Optimization of fiberline operation by multi-variable model predictive control

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Multi-variable model predictive controller (MPC) is widely used at process industry for more than 20 years. MPC makes significant quantities of benefit by stabilizing and optimizing process operation. MPC is also widely applied to fiberline units in North America and Europe. However, only few application experiences are exist in Japanese pulp and paper industry at this moment. This paper introduces Honeywell's proven state of art MPC, Profit Controller and its application results to continuous digester. Profit Controller already has many experiences at other process industries in Japan. Some implementation and maintenance tips obtained from these previous experiences will help MPC application and utilization at fiberline units. MPC will make large benefits at fiberline units and enhance

international competitiveness of Japanese pulp and paper industry.

Technology of Pulp Analyzer system with Fiber Wall Thickness measurements

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Fiber wall thickness is an important parameter as it influences the strength properties of the pulp, but so far it has not been possible to measure it online. There can be a number of reasons to measure fiber wall thickness online. It is an efficient method for raw material control to make sure that the mix of e.g. saw mill chips, roundwood from thinnings, different species etc. is done so that a consistent pulp quality is maintained. The FWT module can control the efficiency of a fiber fractioning process. By measuring fiber wall thickness it is possible to calculate strength data and suggest level of refining to pulp customers, helping them achieve the requested paper and board strength properties.

Color Defect Classification by New Inspection System

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AMETEK Co., Ltd. Surface Vision

AMETEK SurfaceVision developed new inspection system “SmartView 7.2C” with color line camera. The system allows users to set color defect classes by additional more than 20 color defect features. Learning classification tool “SmartLearn” is useful for classification especially for color defects. Users can focus on making Defect Library of color defects without struggling with color defect parameters.

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

Part5　Recovered Paper for Newsprint and Printing paper（3）
The progress of using recovered paper in the world

Kiyoaki Iida

Worldwide, the use of recovered paper accelerated around 1990. The yearly increment of paper and paperboard production was supplemented with recovered paper, leaving wood pulp production stagnated. By region, Europe as a whole and especially Germany among them promoted the use of recovered paper like Japan. In the USA, on the other hand, its utilization rate was limited, 21% for newsprint and 27% for paper board. It exported 40% of the recovered mostly to China (2015). China is increasing its output, using imported recovered paper since 2000, and now the largest producer in the world.

According to the statistics by FAO, the world production of paper and paperboard in 2014 was 400 million tons and that of wood pulp was 173 million tons and that of recovered paper was 221 million tons. The world paper industry could not exist without recovered paper.

The recycling rates of other industries in Japan in 2012-2014: glass: 35%, steel: 25% and cupper: 24%. The paper industry is a recycling industry indeed.

Accelerate Ageing Test of Naturally Aged Paper
－Comparison of Predicted Degradation Rate Indicators at Room Temperature by Suspension Method and Sealed Tube Method－

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Research was conducted to clarify the relationship between natural ageing and accelerated ageing of paper using paper naturally aged for 90 to 130 years.

In order to estimate the degradation rate　of paper at room temperature,　sealed tube method was conducted in four temperature comditions between 60 and 90℃. The degradation rate indicators at room temperature were calculated by Arrhenius plots. With regard to the estimated degradation rate indicators of tear and burst indices of paper samples at room temperature , degradation tended to be faster in sealed tube method than in suspension method.

On the other hand, degradation rate of discolouration showed an opposite result. The correlation of the hydrogen ion concentration before accelerated ageing and the estimated degradation rate indicator of tear index at room temperature showed better relationship than those at uniform higher temperature. Thus, in order to evaluate the permanence of papers, it is desirable to obtain room temperature degradation rate through Arrhenius plot.

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Environment

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Vol.71, No.12 Abstracts

The lecture of Activated Sludge Treatment and The introduction of "extremely low DO control"

Takao Ogawa
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This lecture explains the basic traits of a microbe called activated sludge in the first half, and introduces the "extremely low dissolved oxygen (DO) control" technique in the second half. The "extremely low DO control" is a method of keeping the DO level in the aeration tank at nearly 0mg/l. The operation is as follows: Inject strong air in the activated sludge mixed liquor in the aeration tank and then stop injecting it; based on the change in the DO levels of the time, calculate the air volume which would make the oxygen supply through aeration equal to the oxygen consumption speed of the sludge, and inject the calculated volume to keep the DO levels in the aeration tank at nearly 0mg/l. A comparative study was made using the glucose-peptone wastewater and methanol-involving wastewater between the new technique where DO≒0mg/l and the normal technique where DO≒1.5mg/l. As a result, with the new technique, the aeration volume was reduced to approximately 35% of the normal volume, and the total organic carbon (TOC) within the treated water improved equal to or more, and the nitrogen removal efficiency was seen to be greater than 90%.

Furthermore, the new technique was seen to be able to properly keep up with a very large daily variation of raw water load with the maximum/minimum ratio of 5. Meanwhile, we showed the specific configuration of the "extremely low DO control" system, and showed that if it is applied to the existing activated sludge process, the system can be installed with small initial investment without the need of building a partition in the aeration tank, if the output volume in the aeration blower can be controlled from the water control room.

In the aeration tank, areas in which DO levels are nearly 0mg/l are neither aerobic nor oxygen free nor anaerobic. It is quite noteworthy that areas which have rarely been used previously can become usable using the "extremely low DO control" system.

Practical know-how of odor control : Case of paperboard factory

Hidenori Kojima
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Considering from the viewpoint of water used in the paperboard factory, following points are important about the odor problems.

1. White water of the paperboard factory has a water quality that is prone to smell.
2. Odor substances such as hydrogen sulfide and volatile fatty acids generated in white water cause deterioration of products quality and factories productivity.
3. Control of microbe improves problems both the odor and the productivity during the papermaking process.

Energy-saving Diffuser "MICRAS"
-The Best Way to Reduce the Power Consumption of Aeration System-

Yuko Matsuzaki
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In wastewater treatment process, air blowers consume vast amounts of power to send air to aeration tanks. One of the effective technologies to reduce power consumption of blowers is the ultra-fine bubble diffuser system, which generates small bubbles and efficiently transfers oxygen into the water. This paper illustrates the outlines and the energy-saving effect of "MICRAS", pipe shaped ultra-fine bubble membrane diffuser. MICRAS has reduced 40% of air requirements at the municipal wastewater treatment plant without sacrificing treated water quality.

Trends of Forming and Scum Troubles in The Activated Sludge Treatment Process and Countermesures

Kenji Hayashi
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One of the troubles that are easy to occur by activated sludge treatment of the pulp

and paper wastewater treatment has foaming scum trouble.The large amount of scum is not only increasing the load to a latter half processing process under the effect of scum flowing out, but also decreasing the MLSS and decline in performance of the activated sludge treatment process in itself and cause the serious trouble to deteriorate the water quality of final effluent synergistically.

With most cases, the defoaming agent as the symptomatic treatment is added more, but there is the case that an effect is not provided. It is the present conditions that effective measures have not been established.

In this paper, we describe about the tendency of the foaming scum trouble and a conceivable factor and measures from the experience that we were concerned with pulp and paper wastewater treatment.

Basic and the case study of low-frequency noise Countermeasure in a factory　Part2.
― Listen and feel how we can resolve the noise problem ―

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Several interesting cases of the countermeasures for the noise problems in plant are introduced. In addition, during our experiences, we have met many countermeasures.　Some of them are effective for noise reduction, however, we met several cases which cannot reach expectations. Both effective and non-effective countermeasures are introduced. And the comparison of actual noise reduction and predicted by simulation are presented for helping to understand these differences.

What is “Waste” ?
―Dilemma between proper disposal and recycling.―

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Waste Management and Public Cleansing Act." （Act No. 137 of 1970.） is most important for the practice of waste disposal. But, what is “Waste”. It is pointed out that its judgment is difficult.

Administrative agencies and the court assert that this can be decided by “total judgment". However, this "total judgment" has a bad reputation. It is criticized that the standard is unclear. Still why "total judgment" necessary. The regulation of

waste is reversing the guarantee of personal property rights. This is an important key. On the other hand, promoting the recycling of waste will not proceed if the proper treatment of waste is thoroughly ensured. This "dilemma" is occurring. Criminal trials also struggle with this dilemma（or harmony）. In any case, citizens and administrative agencies share awareness about the necessity of recycling based on the current situation concerning the proper disposal of waste and the ideal of leaving a beautiful environment for future generations. It is of great importance.

Revision of Soil Contamination Countermeasures Act and Case Concerning Soil Contamination and Underground Obstacles

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Introduction of new effluent management procedure have been discussed at the committee of Ministry of the Environment, Japan from 2010. The existence of the effluent management with bioassay will be discussed in 2016, with the participation of newly selected committee member from industry. Introduction of new effluent management is considered as voluntary management system. The bioassay is considered three toxicity tests which are fish embryo larvae short term toxicity test, daphnia reproduction test and algae growth inhibition test. Some major company voluntarily addressed new effluent management with bioassay as part of activities for a conservation of biodiversity. Major issue facing test facilities are raring management of test animals, the cost of bioassay and accuracy management of bioassay.

Environment measurement technology using Drone
－Application to maintenance and inspection－

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In order to maintain and manage the infrastructures efficiently, it is important to accurately grasp soundness through regular inspections.

Therefore, the research on utilization of infrastructure structure for maintenance

and inspection by using Drone (Unmanned Aerial Vehicle) which can approach to the place where access is difficult, measure and take pictures, is under way.

In this paper, we report some examples of application to measurement and facility maintenance and management by using Drone.

Significant points for operation of the new e-Manifest
－Small mistake could lead to violation of laws and ordinances－

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First of all, the article describes some case studies in an inappropriate operation on a paper based manifest with some questions and answers and actual manifests, such as omission of quantity on a manifest form A, lack of confirmation of a manifest form E, D and B2, excess of the return limit, returning a manifest before treatment and entrusting waste to a disposer without manifests.

In the next section, the e-Manifest system which started the operation in December 1998 is described. The system is for three parties involved the generator, the transporter and the disposer to exchange computerized manifest data via the Information Processing Center over the internet. A clear explanation of comparing operation with a paper based manifest on the three parties and advantages by the introduction of the system such as reduction effect of a paper work are given using a table and flowchart.

In addition, mistakable points in the operation of e-Manifest as for delivery of waste before registration, deadline for manifest registration and use of the e-Manifest are explained with some questions and answers and charts.

The reinforced effect of micro-fibrillated cellulose on composites prepared from paper sludge ash

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Fiber In this study, we investigated reinforcement effect of micro-fibrillated cellulose (MFC) on composites prepared from paper sludge (PS) ash. The bending strength of MFC + PS ash composites was 1.5-5 times higher than that for PS ash

only when additive rate of MFC was adjusted at 1, 3, 5, 10, 20, and 40%. The reinforcement effect of MFC on the composites was due to adhesive effect between PS ash particles coated with MFC. The bending strength of MFC 5 + PS ash 95 composite was equal to the value of Japanese Industrial Standards for calcium silicate board (10 MPa).

PS ash and wet MFC were mixed in equal amount of additive water to the solid content (PS ash + MFC solid). The additive water (free water) was regulated depending on MFC content. The free water content in the compound had a large influence on PS ash hydration rate and the structure of resultant hydrate, consequently PS ash particles dispersion in MFC network varied by a combination of PS ash, MFC, and free water ratio. The increase in bending strength of PS ash + MFC composites may have decreased when free water content for PS ash was small.