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### **Hybrid Power Conditioner Cooler -The High Efficiency Cooling Unit with a Thermo-Siphon HEX-**

Shoichi Yamaguchi  
DENSO AIRCOOL CORPORATION, Design Center 3, Engineering Dept. 2

DENSO AIRCOOL CORPORATION developed a high-efficiency hybrid cooler for power-conditioner used in a PV power plant. The new hybrid cooling system can save the power consumption and also can be a long-life operation. The key technology of the hybrid cooler is a thermosiphon. A thermosiphon works by the differences of a heat-energy between ID and OD air temperature. We put a thermosiphon heat exchanger at the upwind of the evaporator in the hybrid cooler unit. We also developed the special heat-exchanger for thermosiphon based on an automotive air conditioner technology. These technologies make the hybrid cooler work more efficient than conventional air-conditioner.

### **Factory Equipment Optimization Solution based on Data Science**

Toshihide Mochizuki  
NTT FACILITIES

Ferdinand Baulez, Kyohhei Kamono  
METRON JAPAN GK

As a major contributor to global warming, the industry in general and the paper manufacturing industry is compelled to find solutions to not only reduce its energy consumption but also decarbonize its production assets. To contribute to this endeavor, our platform was integrated with a paper manufacturer in Colombia to visualize key performance indicators, model and optimize the energy consumption of its paper machines, in real time. That manufacturer produces paper pulp from bagasse, the fibrous residue of sugar cane, passed through a mill to extract the juice, which is primarily composed of cellulose. Such a waste recovery method is used by less than 10 plants worldwide.

As the paper-making process is a large consumer of steam, each optimized area can bring significant results in terms of energy consumption. Hence, the optimizations were focused on the paper machines, which allowed for a 4.5% reduction in steam consumption in one year, in addition to significant reduction of the chemical agent consumption.

### **Energy-saving Technology for Public Water Treatment Energy-saving Rotary Blower "TBS/RSH series**

Masayuki Kinoshita  
General Manager of Industrial Division TAIKO KIKAI INDUSTRIES CO.,LTD

Actions for development of water resources to solve the global water problem and reduction of greenhouse gases to prevent global warming are increasing worldwide. In the water treatment market, since roughly 60% of the electricity is consumed by blowers including rotary type, reduction of power consumption has become a major issue, and energy saving of blowers is the most important issue.

Therefore, we have developed a new rotary blower "TBS / RSH" series that fulfills high energy saving to reduce the environmental load.

By adopting a unique "RiS-brid curve" for the impeller shape, optimizing the rotation speed, improving the silencer and gear case, etc., it achieved energy saving of 10 to 20% compared to the conventional product.

As of December 2021, we have sold 300 units or more, a large number record has been made including replacement / new projects.

In the future, in addition to the water treatment, it could be used for various applications, such as a pneumatic transportation, combustion air supply, vacuum pumps for paper mills machines, and dust collection. we will contribute to society by supplying energy saving blower to a wide range of field.

## **Energy saving by modifying drainage system of paper machine 1**

Kotaro Iiyama  
Mishima Plant, LINTEC Corporation

Amid calls for concrete action for global warming, The Japanese government declared that Japan aims to reduce its greenhouse gas emissions by 46% in fiscal year 2030 from its fiscal year 2013 levels, setting an ambitious target which is aligned with the long-term goal of net-zero by 2050. Furthermore, he stressed that Japan will continue strenuous efforts in its challenge to meet the lofty goal of cutting its emission by 50%. To realize this, it is much more important for companies to make an effort to reduce their CO<sub>2</sub> emission. Besides, company must address energy-saving and CO<sub>2</sub> reduction activities as the Energy Saving Act calls for an effort to decrease annual average energy consumption intensity more than 1%.

This paper introduces a case of energy-saving and CO<sub>2</sub> reduction by remodeling drainage system for paper machine 1 at Mishima plant of LINTEC corporation.

## **Energy Saving Case Study of Futatsuka Manufacturing Department, Chuetsu Pulp & Paper Co.,Ltd.**

Taisuke Kato  
Futatsuka Manufacturing Department, Chuetsu Pulp & Paper Co.,Ltd.

In order to prevent global warming which is caused by the greenhouse gas CO<sub>2</sub> emission is taken measures on a global scale, responsibility is increasingly against the corporate environment. In the pulp and paper industry, energy saving and resource saving are proceeded and making efforts to reduce CO<sub>2</sub> emissions also. In addition, cost reduction by energy saving in terms of production has become a major subject, it is still the situation that must be stacked to further effort.

In our manufacturing department established the Energy Conservation Committee in 1990, it has been focused on day by day energy saving activities. Due to the recent paper demand reduction, improvements by large scale equipment modification are not expected, we only have to build up a small energy saving result.

This time, we will introduce the efforts content and examples that we have implemented.

## **Energy Saving of Chlorine Dioxide Generation System (R8)**

Joichi Nii  
Ebetsu Mill,Oji F-tex Co.,Ltd

Ebetsu mill is working on the environmental objectives for ISO14001, such as promoting energy conservation, controlling waste, designing products with low environmental impact, and devising manufacturing methods.

As part of the environmental response of the pulp and paper industry, the pulp bleaching process was converted to ECF (Elemental Chlorine Free), and a chlorine dioxide generation system (R8) was installed accordingly.

This report introduces several examples of energy saving implemented by this chlorine dioxide generation system (R8).

## **New Challenge to Paperboard Machines with “AXISZ System”**

Miho Kato, Koichi Tadaki  
SOMAR Corporation

“REALIZER Series” , which is retention aids and coagulants that introduce our new technology, “Reactive Polymer Technology” , has been used more and more in the paper field. In this field, there were many issues such as improvement of ash retention and fixability of paper chemicals. In recent years, we have tried many tests to introduce “Reactive Polymer” into the paperboard field. A major problem for paperboard machines is improvement of papermaking speed to increase production. In addition, deterioration of quality of DIP causes decline of paper strength and sizing. This problem is also critical. Particularly it is difficult to increase papermaking speed with conventional “Reactive Polymer (1st-Generation)”. Therefore, we have developed “Reactive Polymer (2nd-Generation)” to be suitable for paperboard machines. In this paper, we report the results of laboratory tests and actual machine tests to improve the speed of papermaking with this polymer. The concept focuses on improving water squeezing rather than improving yield.

In addition, this is effective for paper defect and improvement of the fixability of paper chemicals, so we will introduce the mechanism and examples.

## **Split Mechanical Seal for Agitator, and Auxiliary Seal**

Mioko Takaya, Yuya Sadahiro  
Engineering Dept. John Crane Japan, Inc.

The economic environment surrounding the pulp and paper industry is becoming more severe year by year, and it is important to minimize downtime in factories, improve productivity and reduce maintenance costs through stable operation of production equipment. In addition to this, in recent years, it has become necessary to reduce the environmental load by saving energy such as power saving and water saving.

Under these circumstances, shaft sealing devices for rotating equipment such as pumps and agitators are becoming more important, and reliability is required even under even more severe specification conditions.

John Crane has introduced a fully split mechanical seal that makes effective use of the characteristic rubber bellows for horizontal axis rotating equipment such as tanks/chests with axial runout, and has achieved many achievements. Furthermore, as a measure for workability and cost reduction during maintenance, we will also introduce an auxiliary seal that does not require drainage in the tank/chest.

## **Recovery Boiler Online Ash Analyzer and Ash Balance Advisor Applications**

Yongse Cho, Matti Selkälä and Jukka Koskinen  
Valmet K.K.

An online analyzer for recovery boiler electrostatic precipitator (ESP) ash chemical composition has been developed and piloted in a recovery boiler. The analyzer measures CO<sub>3</sub>, SO<sub>4</sub>, Cl, K and Na concentrations from a dry ESP ash sample automatically taken from the ash stream. In addition to the full chemical composition the melting temperatures of the ash are calculated.

By combining recovery boiler flue gas and steam temperature information with ESP ash chemical composition, an advanced ash balance advisor has also been developed. The solution calculates the location in the superheaters where ash is sticky, i.e., 15 – 70 % of ash is molten, and adjusts the ash treatment amount to minimize boiler plugging as well as enabling sootblowing focus to critical areas. The first ash melting temperature is compared to superheater steam temperatures which determines if there is corrosion risk in the superheaters. Overall, the advisor suggests an ash treatment target based on operational marginals that maximize recovery boiler availability and minimize makeup chemical needs. Additionally, optimal ash chemistry allows certain boilers to operate at a higher steam temperature leading to more electricity being generated.

This paper presents the results from the ash composition analyzer with comparisons to laboratory measurements. Further application possibilities utilizing the analyzer are also discussed.

## **Preparation of Antimicrobial $\beta$ -cyclodextrin Microcapsules containing a Mixture of Three Essential Oils as an Eco-friendly Additive for Active Food Packaging Paper**

Peifu Kong

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This study aims to prepare antimicrobial microcapsules which can be used as an eco-friendly additive for active food packaging paper. Essential oils from aromatic plants, possessing antimicrobial activity, are commonly employed for the treatment of some diseases and symptoms. In this study, an equal volume mixture of three essential oils: oregano, tea tree and cinnamon oils, were embedded into hollow cavities of  $\beta$ -cyclodextrin to form microcapsules via a microencapsulation technology: co-precipitation. The recovery yield of the mixture of three essential oils/ $\beta$ -cyclodextrin after co-precipitation and the embedding ratio of the mixture of three essential oils in  $\beta$ -cyclodextrin were 86.5 % and 30.5 %, respectively. Based on the results of morphological and X-ray diffraction analyses, the crystal structure appeared to differ before and after microencapsulation. The results of gas chromatography-mass spectrometry and Fourier transform-infrared spectroscopy confirmed the formation of microcapsules. A satisfactory antimicrobial activity of the fabricated microcapsules was proved by an antimicrobial assay using *Bacillus subtilis* as the object microorganism, suggesting the microcapsules containing a mixture of three essential oils could be a promising additive for food packaging paper.