

CONTENTS

Biomass/Deplasticization

- 1 The Biorefinery Status of Nippon Paper Industries, Gotsu Mill
—Old and New Business Model—……Yuki Kokufu
- 5 Eliplapaper
—Eco-friendly Product Alternative to Plastic—……Toru Ikeda
- 8 Development of the Consistent Chemical Production Process from Woody Biomass……Ayumu Tagami
- 12 Development of Water Based Emulsion for Paper Coating that Achieve Reduction of Plastic Usage……Yasushi Fujiwara

Topics & Information

- 17 Odor Analysis of Paperboard Mills……Sho Misawa
- 22 Insect Characteristics to Consider for Design of Effective Insect Control Measures……Tomohiro Ohba
- 27 An Essay on Methodology for Innovating “*JAPAN TAPPI JOURNAL*”
Part 11 : The Reason for Existence of “*JAPAN TAPPI JOURNAL*” as viewed from Its Readers Standpoints……Fumihiko Onabe
- 30 Revolutions in the History of Civilization Induced by Paper
Part 4 : Papyrus That Enriched Civilization in Egypt, Greece Rome……Kiyooki Iida
- 37 Research Projects of Universities and Government Research Institutes
……Wood Science Committee, JAPAN TAPPI
- 44 Corporate Profile & Product Information (46)
C. T. TAKAHASHI CO., LTD.

Research Report (Original Paper)

- 49 Development of a Novel Method to Distinguish Poor-recyclable Prints and the Application of the Method for Field Survey
……Hirohiko Koizumi, Moe Fuchise-Fukuoka, Takanori Otsuhata and Shisei Goto

- 03 Committee report
- 48 Coffee break
- 65 Papyrus
- 71 Industry News (Domestic and International)
- 75 List of Patents issued and Laid-open Publication
- 84 Price list of Domestic Logs and Wood Chips by District
- 85 Other Monthly Statistics
- 87 News from the Association

**The biorefinery status of Nippon Paper Industries, Gotsu Mill
-Old and New business model-**

Yuki Kokufu
Gotsu Mill, Nippon Paper Industries Co., Ltd.

Effective use of bio-derived resources, especially wood, have attracted worldwide attention in recent years. Nippon Paper Industries' Gotsu Mill is the sole sulfite pulp plant in Japan and has been manufacturing various products from wood using our unique biorefinery technology.

Cellulose, hemicellulose and lignin are three main components of wood and they can be separated with sulfite cooking. The Gotsu Mill uses all of them effectively to manufacture wide range of products. Cellulose obtained as sulfite pulp can be used as a raw material to produce cellulose derivatives. We have also produced powdered cellulose, carboxymethylcellulose (CMC) and cellulose nanofibers from sulfite pulp. Decomposed products of hemicellulose derived with sulfite cooking are used as a nutrient source to produce yeast. Lignin is converted to lignosulfonates with sulfite cooking and lignosulfonates can be used as dispersants and/or binders. We also use a part of hemicellulose and lignosulfonate dissolved in black liquor as fuel to generate energy.

With such wide range of wood-derived technologies and products, Gotsu Mill has been practicing old but new biorefinery business for almost 70 years. We will continue to provide a wide range of products and services that take advantage of the outstanding properties of wood.

**Eliplapaper
-eco-friendly product alternative to plastic-**

Toru Ikeda
Kani mill, Daio Paper Corporation

Plastic is used as a light and durable material in various forms around us, but in recent years its environmental impact has been drawing attention, and the flow of deplasticization has become active. Under such circumstances, the importance of paper has been recognized again.

We have started to sell "Eliplapaper" as a paper alternative to rigid plastic. Eliplapaper is a high-density cardboard that has rigidity close to that of plastic. In addition, it has excellent biodegradability and is a product with a lower environmental load than plastic.

Development of the Consistent Chemical Production Process from Woody Biomass

Ayumu Tagami
Nippon Paper Industries Co., Ltd

Nippon Paper Industries joined the NEDO project "Technology development of Manufacturing Process for Non-edible Plant-derived Chemicals/ Development of an Integrated Process for Manufacturing Chemicals from Woody Biomass". In this project, we are developing a technology for separating major wood components, cellulose, hemicellulose, and lignin, based on the sulfur-free soda cooking. Lignin is one of the main components in the second most abundant bio-macromolecule after cellulose in nature.

This work summarizes the outcomes of project, especially product quality of lignins. We provided kg-scale of lignin products to chemical companies which derived from different batch of black liquor. The quality of products listed below, molecular weight, purity, solubility in acetone, and content of functional groups, are stable.

Development of Water Based Emulsion for Paper Coating that Achieve Reduction of Plastic Usage

Yasushi Fujiwara

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Recently ocean plastic pollution has been highlighted, and the demand for 'reduction of plastic usage' is increasing worldwide. In Japan, the use of paper for products, including plastic straws and confectionery bags, has been promoted. Superiority of plastic to paper includes resistance/barrier property against liquid and vapor and processability derived from thinning/adhesiveness, etc. Polyethylene laminated paper products are widely used in making a composite of paper and plastic. However, since these laminated paper causes obstacles for recycling, European countries are requesting their manufactures to replace laminated papers with resin coated papers. Polyethylene laminate is a highly reliable material in terms of safety as has a coating film physical property that works excellently with various resistances and processabilities, and is used for food packaging paper, etc. We have developed an emulsion for paper coating that replaces polyethylene laminate, for the use of paper instead of plastic. Regarding 'performance', we focused on water resistance, oil resistance, moisture-proofness, and heat sealability. Regarding 'safety', we studied the conformity with the US FDA (Food and Drug Administration) CFR (Code of Federal regulations) Title 21. Among the studies, we have succeeded in developing a water based emulsion for paper coating that shows a comparable level of performance to that of polyethylene laminate. In this report, we introduce styrene acrylic type 'HIROS-X·NE-2260', which conforms with the FDA and has a wide application range for overseas inventories, wholly acrylic type 'HIROS-X·PE-2273' with excellent characteristics in heat sealability and without usage restriction by the FDA, and 'XP8812', a coating agent for paper processing, having moisture proofness and heat sealability.

Odor Analysis of Paperboard Mills

Sho Misawa

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In 1971, the Offensive Odor Control Law was enacted to control offensive odors generated in the course of business activities at mills or other places. The Offensive Odor Control Law has regulation on site boundary line, emission gas, and discharged water.

At our group company's paperboard mill, odor of paper and sludge smelled sometimes around the area of the boundary line. Odor analysis was carried out and odor level, odor causing substances and locations of odor occurrence were researched. As a result, sulfur substances contained in the gas of the boundary line and discharged water were under the regulation standard. Odor of paper smelled from gas taken at the north site boundary line, and longifolene and longicyclene which has characteristic of odor of paper were detected by Adsorbent Collection-Thermal Desorption-Gas Chromatography Mass Spectrometry. Gases were taken from the wastewater treatment facilities, and odor of sludge was smelled. Hydrogen sulfide which has characteristic of addled egg like odor was detected by GC at relatively high concentration. Also, longifolene and longicyclene were detected at relatively high amount. Hydrogen sulfide, longifolene and longicyclene were specified as odor causing substances. The wastewater treatment facilities were specified as the locations of odor occurrence of the odor causing substances. These were thought to be carried by winds to the area around the boundary line and caused odor of paper and sludge.

The odor from mills can cause unpleasant and disgusting feelings to people who live around mills. Hence, odor analysis is needed. Odor is needed to be controlled when manufacturing paper and we move forward business activities harmonizing with the environment by odor analysis.

Insect characteristics to consider for design of effective insect control measures

Tomohiro Ohba
Earth Environmental Service Co., Ltd

In order to design effective insect control measures, it is important to consider where and what kind of insects will be a problem in your factory. It is not known that the measures that were effective at other factories are effective. It is necessary to take measures that are appropriate to the problems of your own factory. Before planning concrete measures, it is necessary to carry out a risk assessment.

It is useful to understand the characteristics of insects when risk assessments and designing insect control measures. Insects respond variously to environmental factors such as temperature, light, air flow, and odor. There are also variations in insect habitat and individual size. In this report, we summarized the main characteristics of flying insects that are likely to cause problems in paper mills. Then, we discussed the precautions for designing insect control measures based on these characteristics.

An Essay on Methodology for Innovating “JAPAN TAPPI JOURNAL”

Part 11: The Reason for Existence of “JAPAN TAPPI JOURNAL” as viewed from Its Readers Standpoints

Fumihiko Onabe
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The writing and reading are fundamental human mental behaviors. The eleventh article of this series is intended to analyze the relationship between journal's editor and readers with particular attentions on cognitive scientific theories. The overall contents are described as below.

1. Introduction
2. Reading and Writing
3. The objective of editor's side
4. The requirement of reader's side
5. A variety of perspectives required for readers
- 5.1 Phenomenon and Essence
- 5.2 Human characters and environments that determine the human way of thinking
- 5.3 Macroscopic and microscopic views
- 5.4 Short-term and Midterm or long-term views
6. Lessons learned from historical studies
7. Sensationalism and populism that affects on human evaluation on journal's articles
8. Roles of journals in transmission of information in contemporary society
9. Epilogue

Revolutions in the history of civilization induced by paper

Part 4: Papyrus That Enriched Civilization in Egypt, Greece and Rome

Kiyooki Iida

Papyrus was developed as a recording media in Egypt at around 3000 B.C. and was used till the Roman age for about 4000 years.

Though the process of making papyrus was once lost, it was restored in the 20th century. The stem of papyrus is spitted vertically to thin pieces, about 40 cm long. After retting, they are laid parallel each other like a sheet. The other layer is put on them, its axis being rotated at the right angles to the lower. The composite is beaten to make some fibrization, pressed for dewatering and dried. Egyptian dynasties monopolized the product and got high return.

In Egypt, literature texts written on papyri appeared in the 20th century B.C., after early administrative documents. Ostraca were also used to supplement papyrus in daily life.

Since the 10th century, Greece became dominant in the Mediterranean world, and used papyrus delivered by Phoenician as a media for their civilization. The Roman Empire succeeded hegemony in the region and still used papyrus from Egypt.

In the 3rd century B.C., parchment was developed which gradually took over papyrus and replaced it in the 5th century.

Development of a novel method to distinguish poor-recyclable prints and the application of the method for field survey

Hirohiko Koizumi, Moe Fuchise-Fukuoka, Takanori Otsuhata and Shisei Goto
Nippon Paper Industries Co., Ltd.

In recent years, the quality of recovered paper has been deteriorated due to an increase of materials to be avoided, such as prints with Ultra Violet (UV) curable ink. The aim of this paper is to develop a method which can easily and promptly distinguish those poor-recyclable prints from recovered paper, and to put the method into practical use in deinked pulp (DIP) mills. In order to achieve this purpose, first, the spectrum data of several kinds of prints were obtained by using the attenuated total reflection infrared spectroscopy (ATR-IR). Second, the recyclability of those prints was evaluated by lab-experiments. Third, a database was made by correlating the spectrum data and their recyclability, so as to develop the ATR-IR method. Finally, the ATR-IR method was applied to inspection of bales in DIP mills. By examining each print with ATR-IR apparatus, characteristic peaks were detected which helped to determine the type of ink. From the results of lab-experiments, the numbers of dirt speckles in DIPs from UV, UV varnish over coated, and polystyrene over coated prints, respectively, were much higher than those of conventional prints (oil-based ink). In case of using the ATR-IR method, those prints were distinguished more precisely compared with the conventional solvent detection method used in DIP mills. As for the application of the method for incoming inspection in the mills, it has turned out that there was a certain tendency to decrease incidence rate of dirt troubles in DIP production after the application.