JAPAN TAPPI JOURNAL
5
May 2025
Vol. 79, No. 5

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Resource circulation, Biorefinery and Plastics substitution

2025 May JAPAN TAPPI JOURNAL
Vol.79, No.5 Abstracts

Recycled fiber systems for Used Beverage Carton (UBC) with aluminum

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Japan has a high recovery rate of used paper; however, as of today, Used Beverage Cartons (UBCs) are not included in the recovered paper for recycling but are classified as prohibitive material for paper recycling by the Paper Recycling Promotion Center. This is due to the nature of the UBCs. UBCs are similar to milk cartons in that they are made from high-quality virgin pulp. The difference lies in the silver-colored inner surface, which is made of six layers of paper, polyethylene, and aluminum. The inner materials are seen to bring unfavorable influences for paper manufacturing if mixed with raw materials, and as a result, UBCs are being incinerated as waste. This paper explains the current recycling situation surrounding UBCs in Japan, and where the difficulties lie for their recycling, keeping these valuable recycled paper resources from playing their part in the circular economy.

ANDRITZ, committed to assisting industries making the green transition, proposes its "FibreFlow Drum Pulper" as the optimal solution, enabling the separation of aluminum from paper and allowing for recycling of fiber from UBCs, along with "Reject Treatment Systems" recovering beneficial products from the rejects after fiber recycling. It is clearly shown that the ANDRITZ solution will bring benefits to help tap into this valuable source of fiber for paper recycling, making UBCs an eco-friendly product for the environment.

Development of non-fluorinated oil-resistant internal agent

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Oil-resistant paper is a functional paper with characteristics that do not allow oil to penetrate or soak through, and is also required to have air permeability and water resistance depending on the environment in which it is used. Oil-resistant paper using fluorinated oil-resistant agents is superior in that it has features such as water and oil repellency and air permeability. In recent years, however, the need for non-fluorinated (fluorine-free) oil-resistant agents has been increasing against the backdrop of stricter regulations on the use of perfluoroalkyl (hereinafter referred to as “PFA”) compounds, which pose a health risk concern.

Figure 1 shows an illustration of the mechanism by which fluorinated and non-fluorinated oil-resistant agents develop oil resistance. Fluorinated oil-resistant paper exhibits excellent oil resistance even when there is a gap for vapor to pass through. This is thought to be due to the distribution of PFA groups with low surface tension inside the paper. In contrast, non-fluorinated oil-resistant paper is generally coated, and oil resistance is achieved by forming an oil-resistant layer without gaps on the paper surface (film formation), resulting in low paper permeability and oil resistance on the edge surface.

Therefore, we have developed a non-fluorinated oil-resistant agent with internal additives to solve the problems of non-fluorinated oil-resistant agents of these coating types, such as reduced air permeability and oil resistance on the edge surface. This paper reports on the properties and performance of AW-600, a non-fluorinated oil-resistant agent.

Development of Resource Circulation Process Paper

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Against the backdrop of the increasing global population and economic development in recent years, the demand for and utilization of resources worldwide continues to rapidly expand. As a result, it is projected that the amount of global waste generated will more than double by 2050 compared to 2010. This increase in waste generation leads to various environmental issues, such as overcrowding of landfills and the release of hazardous substances into the environment. In order to achieve sustainable production and consumption, it is necessary to minimize these environmental burdens. From the perspective of creating a circular society, it is essential to reduce the consumption of natural resources while effectively utilizing recycled resources, making the transition towards a resource-circulating economy a significant challenge.

At our company, with a focus on contributing to the construction of a sustainable society, we have been planning and proposing environmentally friendly paper products that leverage our paper and pulp manufacturing technology. Through collaborations with various companies and local governments, we have successfully commercialized the "MEGURISH" series, which utilizes waste cotton generated during towel production and discarded coffee bean jute bags, as well as "OJO+," which pulverizes various waste materials disposed of by businesses and municipalities and incorporates them into paper yarn base paper.

The technology of "MEGURISH" can be applied to fibers other than cotton and hemp, and we are exploring ways to collaborate with various industries to make use of this technology. "OJO+" is also expected to be applied to upcycled products from various waste materials that are currently being disposed of. With an eye towards expanding into other applications beyond those currently adopted, we aim to expand our market. Paper made from recycled resources is a project that connects the past and the future, as it is rooted in the origin of paper. We remain committed to contributing to the construction of a sustainable society through the development of various environmentally friendly products in the future.

Material recycling of used paper cups
-Establishment of a recycling system for used paper cups and development of environmentally-friendly paper cups-

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Oji Group is working on the material recycling of used paper cups. Generally, used paper cups were not recycled but were incinerated. However, Oji Group has developed a system for material recycling of used paper cups using shredding and washing machines, as well as special dissolution facilities. In the Kansai region, we have already recycled approximately 1 million used paper cups per month, and we are aiming to expand and promote the recycling system further. We will continue to expand our paper cup recycling system nationwide. In addition, we have developed environmentally-friendly paper cups that reduce plastic usage while maintaining excellent performance. These paper cups achieve this by replacing the conventional polyethylene-laminated coating with a water-based resin coating. Compared to traditional polyethylene-laminated paper cups, our developed paper cups offer equivalent water resistance and lower heat-sealing temperatures, contributing to energy savings, improved productivity, and reduced environmental impact. Moreover, these paper cups can be recycled without special dissolution facilities, making them highly beneficial for the expansion of the recycling system for used paper cups.

NCG Recovery and Refining Technology from Valmet
-Production of Methanol and Sulfuric Acid-

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The pulping process produces many by-products, and their reuse in a useful form is an important issue in achieving sustainable production activities.

The CNG gas produced in a typical pulping process contains sulfur, some alcohol and so on, which are usually prevented from being released into the atmosphere by incineration. Valmet has long been involved in the development of systems for the recovery and reuse of these substances in CNG, and for the sulfur content of CNG, Valmet has developed and is operating a system for the recovery of sulfuric acid in cooperation with Metsä of Finland. In addition, methanol, which is incinerated together with CNG, can be extracted, and purified to recover high-purity methanol that can be used in a ClO_2 plant. These systems contribute new added value to mills and make a significant contribution to the sustainable production activities by mills.

NCG contains flammable substances and is usually stored in hazardous material storage tanks at levels above explosive limits, but the risk of explosion increases dramatically when air enters the tanks. Inadequate facility management can lead to accidents such as fires and explosions. To prevent valve operation errors and improve safety management, we will introduce a valve monitor for On-Off valves that can check the valve operating status via wireless Bluetooth communication connection.

Development of Plastic and Fuel from Woody Biomass

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Petroleum-derived plastic and fossil fuel are necessary for our modern life due to their economical and useful properties. However, the reserves of these limited resources are running out annually and greenhouse gases are emitted from incinerated plastics and fuel combustion. It is needed to replace depletable resources by renewable biomass. As the biomass such as corn starch and cane sugar are almost used but their utilization is liable to compete with food production. Therefore, we have been developing biomass plastics and biofuel derived from woody biomass.

To develop a biomass plastic called poly lactic acid (PLA), we selected optimal lactic acid bacteria and sophisticated purification methods. As a result, we have achieved producing PLA at large scale. This is the first example in the world regarding the production PLA derived from woody biomass on bench plant scale. Additionally, we have been able to produce colorless and transparent PLA firms from the PLA. In view of recent environmental pollution problems caused plastic wastes, we have been developing PLA based copolymer to vest biodegradability in ocean.

Furthermore, we have been developed bio ethanol production processes. Bio ethanol is increasingly demanded as source of sustainable aviation fuel. We are planning to construction of pilot plant with a capacity of 1,000kL per year by the end of 2024.

Application of Fine Delaminated Kaolin to Barrier Packaging Materials
-Introduction of Micro Delaminated Clay-

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In recent years, paper packaging materials with barrier properties have been attracting attention due to the growing environmental awareness of the microplastic problem. These paper barrier packaging materials are often coated with layered silicate minerals with a high aspect ratio.

High aspect ratio kaolin has high barrier performance. However, this performance is only realized when all particles are arranged in the same direction, parallel, and oriented in the coating layer to which it is applied. Even when dispersed in a film or coated, if the layered silicate is not arranged parallel to the film or coating layer, there was a problem that particles with a large diameter will be obliquely crossed, creating large voids, and excellent barrier properties cannot be achieved. To address this issue, we have been considering particles with a small diameter that do not cause major defects even when obliquely crossed, and even thinner ones. In addition to the effect, we found that the number of particles increases when the long diameter is short and the thickness is thin, they neatly follow the unevenness of the coated object, the voids between the particles become small, and they show good barrier properties.

Application of cellulose fibers in fiber-reinforced plastics

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Oji Holdings have vast company-owned forests domestically and internationally, aiming to contribute to a sustainable society through the creation of products that utilize forest resources. In recent years, we have developed cellulose fibers composite materials that combine plastics with cellulose fibers. We have developed three types of cellulose fibers composite materials: Resoil-Green®, Pulplus®, and Toughcel®. This report provides an overview and analysis about Resoil-Green® and Pulplus®.

Resoil-Green® is a fiber-reinforced plastics made from a combination of biodegradable plastics and cellulose fibers. Wood pulp as cellulose fibers and PBS (Polybutylene Succinate) as biodegradable plastics are combined for Resoil-Green®. After the selection of pulp and additives, we have developed Resoil-Green®. The standard Resoil-Green® contains 30％ pulp, resulting in improved flexural modulus comparable to polystyrene, as well as enhanced heat deformation temperature like polypropylene. Resoil-Green® has a biomass content of over 60％ and exhibits improved compost biodegradability compared to PBS resin alone. The intended applications include various household goods and outdoor gear and leisure products that take advantage of its biodegradability for outdoor use.

Pulplus® is fiber-reinforced plastics that combines recycled PP resins with cellulose fibers. It aims not only to make efficient use of unutilized PP but also to improve its properties by compounding pulp, achieving upcycling. After conducting studies on pulp and additives, Pulplus® has been developed. It was found that the flexural modulus improved to a level comparable to polystyrene and ABS, and the flexural strength increased to approximately 1.5 times that of PP. Pulplus® is being proposed as an environmentally conscious alternative to general-purpose resins and other fiber-reinforced plastics.

Paper-based packaging materials alternative to plastics

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Paper holds great potential as an environmentally friendly material due to its biodegradability, recyclability, and the use of sustainable plantation forests as its primary source. However, its limitations in water resistance, barrier properties, flexibility, strength, and uniformity hinder its broader application for packaging materials. This is particularly relevant as the enactment of the Plastic Resource Recycling Promotion Law in Japan and bans on disposable plastics in many countries drive the need for alternatives. The Hokuetsu Corporation Group is actively involved in initiatives and efforts to expand the use of paper products, recognizing its potential as a sustainable alternative.