

# **Bioplastics – Good Application Practices in Japan**

January 2021

## Case 1. Containers and Packaging (Daily Goods)

- Introduction of Bio-Based Plastics into Containers of Daily Goods by Kao Corporation -

### 1. Overview of the Initiative

#### ■ Target products and substitute materials

Kao introduces bio-PE into the bottles of toiletries to reduce CO<sub>2</sub> emissions and to build a sustainable circulation system.



| Target products   | Conventional material | Substitute material | Content                            |
|---|-----------------------|---------------------|------------------------------------|
| Bottles of Merit shampoo and conditioner  | Fossil based PE       | Bio-PE              | Approximately 30% of bottle weight |
| Pump-type bottles of Essential, Asience, and Segreta shampoo, conditioner, and treatment. | Fossil based PE       | Bio-PE              | Approximately 20% of bottle weight |
| Cucute bottle (large refill for 7 times)  | Fossil based PE       | Bio-PE              | Approximately 35% of bottle weight |

#### ■ Progress to date

The company-wide use of bio-based plastics in 2019 was 463 tons (1.2 times more than in 2018). The results of the initiatives for bio-based plastics are disclosed in the reports such as Kao Sustainability Data Book and Kao Integrated Report.

### 2. Considerations for the introduction

#### ■ Background and context of the initiative in the company

In 2009, Kao announced Kao Environmental Statement with targets including reduction of CO<sub>2</sub> emissions throughout the life cycle (35% reduction). In the process, the policy of using bio-based plastics was adopted to reduce CO<sub>2</sub> emissions throughout the life cycle of containers and packaging, and efforts have been made to introduce it into bottles, etc.

In recent years, the company has been addressing the issue of plastics from the perspective of its responsibility to the world to use plastics. The company is thus working to reduce plastic waste, including those discharged into the oceans, and to build a sustainable circulation system. The use of bio-based plastics is also positioned as one of the initiatives.

#### ■ Selection of materials

Kao considers various alternative materials without prioritizing them, but since plastics are more processable than paper, there are cases where the introduction of bio-based plastics is superior because it can be made from biomass while maintaining quality at conventional levels. When biodegradable plastics were considered in the past, there were issues with slow biodegradation speed and hydrolysis, so now bio-PE is often used in bottles and pouches (refills).

For blister packs and other items where paperboard can be used, paper materials are also being adopted.

■ **Technical challenges**

There are not many technical issues in introducing bio-PE into contains and packaging. If anything, even though bio-based plastics, such as bio-PE, are equivalent to fossil based counterpart as polymers, their lineup as resin compounds is smaller than that of fossil based materials. Also, although there are basically no problems with their use, they may not be the same substitute as conventional materials down to the detailed specifications, which may have some impact in cases where the entire volume is switched to bio-PE. For example, even if there is no problem with the specifications, such as fracture strength or bending strength in the test piece, the actual manufactured bottles may have uneven thicknesses and become brittle at low temperatures. Thus, the company conducts tests in advance to ensure that there are no problems with container filling, transportation, display, etc.

■ **Measures related to cost**

Kao does not allow price increases due to change in material. Therefore, efforts are being made to reduce and absorb the cost increase by reviewing the structure of the components and the number of parts in order to change the material. Regardless of the material change, Kao is constantly reviewing its products and considering improvements for products that have the potential to reduce costs, such as those that use larger number of parts or larger amount of resin.

In general, cost reductions are difficult to optimize as a whole because of the tradeoffs that occur between departments. For example, there are cases where the cost of materials goes down, but the labor cost goes up because of increased labor at the factory, or the transportation cost goes up. The company has established a system where managers or those in higher positions from each department gather for discussions and accredit their cooperation in the initiatives even if individual departments suffer losses, so that decisions are made in a way that is optimal for the entire company.

In the future, it is possible that products that are not environmentally friendly will be eliminated from the market, in which case the company may need to change its approach to cost increase.

■ **Estimation of environmental impact reduction effects**

The introduction of bio-based plastics has achieved a reduction in CO<sub>2</sub> emissions throughout the life cycle. The reduction in the amount of CO<sub>2</sub> emissions has been estimated by a life cycle assessment (LCA).

■ **Appeal to consumers**

Kao indicates on its product label that it uses plant-based plastics. The company also places the mark of "eco together" certification on its products, which is based on the company's own standards for environmentally friendly products. Consumer response is examined by questionnaires conducted during the simulation of a material change.

Criteria for environmental claims in "eco together" certification (excerpt)

| Environmental claims             | Criteria   |
|----------------------------------|--|
| Use of plant-based raw materials | <ul style="list-style-type: none"> <li>• When containers and packaging consist of 20% or more plant-based raw materials</li> <li>• When product content consists of 50% or more plant-based raw materials</li> </ul> |

**3. Future policy**

Going forward, the company set a target of tripling the amount of plant-based plastics used by 2025.

## Case 2. Containers and Packaging (Food)

- Introduction of Bio-Based Plastics for Food Containers by FamilyMart -

### 1. Overview of the Initiative

#### ■ Target products and substitute materials

FamilyMart has introduced bio-PE and bio-PET for food containers (lunchbox, salad, and cool noodle containers) with the aim of reducing CO<sub>2</sub> emissions.



| Target products                                | Conventional material | Substitute material | Content |
|--|-----------------------|---------------------|---------|
| Some kinds of lunchbox containers              | PPF (PP with filler)  | Bio-PE              | 3%      |
|  | PP foam               | Bio-PE              | 1%      |
| Some kinds of salad and cold noodle containers | PET                   | Bio PET             | 3%      |

#### ■ Progress to date

The percentage of environmentally friendly materials (including bio-based plastics) used in the original products, to be discussed later, increased from 10% in 2019 to 33% in the first half of 2020 (2030 target: 60%).

### 2. Considerations for the introduction

#### ■ Background and context of the initiative in the company

With the aim of reducing CO<sub>2</sub> emissions, the company began using bio-based plastics for salad containers in 2007 and has continued its efforts since then. In February 2020, the company formulated the FamilyMart Environmental Vision 2050, a set of medium- to long-term environmental goals for 2030 and 2050. One of the three main points of the Vision is plastic initiatives, and the goal is to raise the ratio of environmentally friendly packaging in original product packaging to 60% by 2030 and to achieve 100% by 2050.

Plastic initiatives in the FamilyMart Environmental Vision 2050



#### ■ Selection of materials and technical challenges

The selection of materials is based on the conditions that the containers are comparable in function and usability to those using 100% conventional plastics derived from fossil resources, and that they

allow stable operations without significantly reducing manufacturing efficiency. As a result, bio-PE has been partially introduced for heat-resistant lunch containers made of PP, and among general containers, bio-PET has been partially introduced for salad and cool noodle containers that used PET as the material.

For technical verification, the company asked packaging material manufacturers to produce prototypes using bioplastics and to check whether they can be molded first as sheets and then as containers. After that, microwave resistance, display, and logistics tests are conducted. These are carried out based on in-house development meetings, and verification is being carried out in cooperation with trading companies specializing in plastics and food manufacturers.

In addition, recycled plastics and paper materials are used as environmentally friendly containers and packaging, depending on the product application.

#### ■ **Measures related to cost**

The company is absorbing the increased cost of materials by adopting environmentally friendly materials and consolidating the types of containers used.

Economic rationality is being pursued with suppliers, with priority given to clearing technical issues and minimizing cost increases. With the goal of adopting environmentally friendly materials for the packaging of all original products, rather than concentrating the introduction of bio-based plastics in specific containers, the company is aiming for stable operation by first broadening the target products and then taking an approach to increase the biomass ratio.

#### ■ **Estimation of environmental impact reduction effects**

The company manages the actual consumption of all container products, including target products, on a monthly basis, and has established a system to set targets, monitor the progress of effectiveness, and report the results to the Sustainability Committee and the Board of Directors.

#### ■ **Appeal to consumers**

The company widely reports its goals and achievements in its Sustainability Report and through other means. The company is also developing PR activities that emphasize environmental considerations through various media outlets.

Example: Press release (June 1, 2020) "Completion of switching to environmentally friendly containers for salads" (Japanese only)

#### ■ **Challenges and risk recognition**

The company believes that the significance of the company's existence in society is to deliver convenient and affluent lifestyles to customers and local communities through the provision of products and services as an essential services provider, and its mission is to ensure a stable supply of products and services in an evolving and sustainable manner. On the other hand, in the field of bio-based plastics, the company recognizes that the challenges are the limited availability of materials and suppliers, meaning the risks to stable supply and sustainability, and cost competition is rigid at a high cost level compared to fossil resource-derived plastics.

### **3. Future policy**

Currently, the company is prioritizing the expansion of the use of bio-based plastics to a wide range of products as the first step and will consider increasing the bio-ratio as the second step. In addition to the continuation and expansion of current efforts to meet the target, the company is also considering the introduction of bio-based plastics produced on the basis of the mass balance approach. Specifically, the company is currently considering the introduction of Japan's first bio-PP-based food containers in the spring of 2021.

## Case 3. Containers and Packaging (Food)

- Introduction of Bio-Based Plastics for Packaging of Food by Seven & i Holdings -

### 1. Overview of the Initiative

#### ■ Target products and substitute materials

In order to reduce the environmental impact of containers and packaging, bio-based plastics are used for some of the packaging materials (multi-layered materials such as three-layer and five-layer) of the private brand Seven Premium food products.



| Target products   | Substitute material | Content  |
|---|---------------------|----------|
| Packaging materials for some food products of the private brand Seven Premium | Bio-PET and bio-PE  | 3% to 5% |

#### ■ Progress to date

Bio-based plastic packaging has been introduced into a total of 156 product types, including breads and prepared meals. The percentage of products that use environmentally friendly materials (bioplastics, recycled materials, and paper) is currently around 20% (excluding biomass inks).

### 2. Considerations for the introduction

#### ■ Background and context of the initiative in the company

In 2019, the Group's environmental declaration, GREEN CHALLENGE 2050, was released. The target is to increase the use of environmentally friendly materials (bioplastics, recycled materials, and paper) in the packaging of original products to 50% by 2030 and 100% by 2050.

Based on this policy, an internal order was issued instructing those in charge of purchasing products and containers and packaging to implement measures to reduce the environmental impact, starting with the introduction of biomass inks and FSC-certified paper, which are the easiest to implement, and as part of these measures, bio-based plastic film was introduced.

#### ■ Selection of target products

The private brand Seven Premium has 4,150 items and annual sales of 1.4 trillion yen, accounting for around 10% of the Group's sales. This Group is a retailer, and the range of products the Group handles is wider than that of a typical manufacturer. Therefore, the company has not set a policy for the introduction of alternative materials for each product. However, the development of private brand products is done in collaboration with manufacturers, and the basic approach is to ask them to be environmentally conscious, as we as all the products will be environmentally friendly.

#### ■ Selection of materials and technical challenges

The company is also working with manufacturers on packaging materials. The top priority is to keep the quality of the product (freshness, taste, etc. in the case of food products), and on top of that, to

promote environmental consideration.

There are several options for material substitution: bio-based materials, recycled materials, and paper, but bio-based plastics are the easiest to work with at the moment considering their technical aspects, production volume, and price. At present, there is not much of a supply of recycled materials except PET. Paper has weak barrier property, is relatively expensive (four to five times that of fossil-based plastics), and is difficult to use from the standpoint of water resistance and hygiene.

Since the release of the environmental declaration, the company has received many proposals for new materials and is conducting sample prototyping and testing of various materials other than the ones already announced.

#### ■ **Measures related to cost**

The company is trying to absorb the increased costs on its end. However, in the case of bio-based materials, substitution from conventional plastics will not result in a large price difference compared to substitution for paper.

In the case of paper, the cost becomes higher, but in such a case, the company does not simply absorb the cost, but looks at the overall balance between value and price, taking into account improvements in quality through changes in materials.

#### ■ **Estimation of environmental impact reduction effects**

The number and percentage of private brand products that use environmentally friendly materials in their containers and packaging are used as indicators. The introduction of bio-based plastics has achieved a reduction in CO<sub>2</sub> emissions throughout the life cycle. The reduction in the amount of CO<sub>2</sub> emissions has been estimated by a life cycle assessment (LCA).

#### ■ **Appeal to consumers**

The company believes it is important to communicate the environmental benefits to consumers, and since the environmental declaration, many of its products have been labeled "Green Challenge 2050". The company is also trying to include phrases, such as "made from plant-based materials" and "made from thinned wood" on the package. However, there are some legally required items to be labeled (allergies, ingredients, etc.), and it is difficult to indicate all things in a limited space. Since some consumers may not be familiar with the word "bio-based", the expression "plant-based materials" is used for bio-based materials.

In addition to product labeling, the company intends to strengthen PR and communication through exhibitions (e.g., EcoPro) and the company website as a way to appeal to consumers.

#### ■ **Challenges and risk recognition**

The company believes that the challenge is to create a world where consumers choose environmentally friendly products. In addition to the efforts of the government, it is also necessary to communicate from the retail side. Since there is nothing in the Group's environmental declaration that can be achieved by the company alone, the company believes that it needs to play a role in raising awareness among its stakeholders.

### **3. Results to date and future policy**

In order to achieve the challenging target of using 100% environmentally friendly materials by 2050, the company needs to think in terms of backcasting. First of all, the company has set internal targets for the introduction of environmentally friendly materials into each product for the nearest five years toward 2025 and plans to increase its volume.

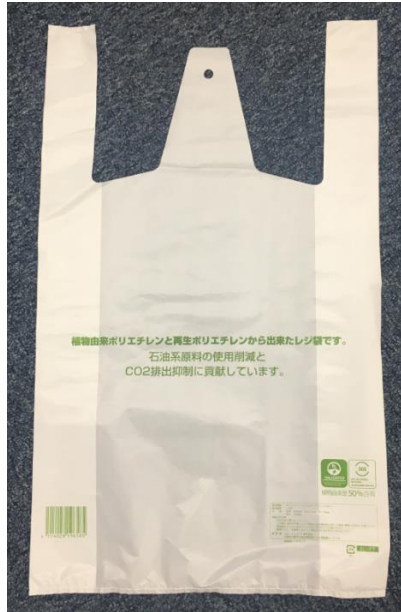
## Case 4. Plastic Shopping Bags

- Introduction of Bio-Based Plastics into Plastic Shopping Bags by AEON -

### 1. Overview of the Initiative

#### ■ Target products and substitute materials

In order to reduce CO<sub>2</sub> emissions, bio-PE has been introduced into plastic shopping bags and is provided for a fee.



| Target products       | Conventional material | Substitute material | Content |
|-----------------------|-----------------------|---------------------|---------|
| Plastic shopping bags | Fossil based PE       | Bio-PE              | 50%     |

#### ■ Progress to date

The company introduced plastic shopping bags made of bio-PE for the first time in the world (April 2013). Since then, the company has spread and led the use of bio-based plastics for this purpose, including the use in “my basket” (a shopping basket to bring purchased goods home).

### 2. Considerations for the introduction

#### ■ Background and context of the initiative in the company

In 2008, the company announced the Aeon Manifesto on the Prevention of Global Warming, making CO<sub>2</sub> reduction a major theme. Initially, the company was considering the use of PLA for product packaging etc., but as bio-PE became available around 2010, it began using bio-PE for shopping bags in April 2013 after internal discussion.

From the beginning, top management had the strong will to use bio-based plastics, and the direction of the organization was clear. In this context, the team in charge of creating supplies took a lead in its development process with conviction and succeeded in implementation. AEON became the first company in the world to use bio-PE for plastic shopping bags.

#### ■ Technical challenges

The company asked a film manufacturer to make a trial product of bio-PE to make a prototype shopping bag, and after confirming that there was no problem with the physical properties, it started experimental sales in stores in 2011. As a result, there were no problems, so the full-scale use of the bio-PE shopping bags started.



#### ■ Measures related to cost

As a basic strategy for procurement, the company has secured overseas manufacturing plants that can manufacture properly at low cost as the best source in the world. In addition, by using the products in the entire Group chain, the company is able to generate economies of scale and reduce the cost per unit by manufacturing them over a certain period of time. Having said that, at one time, when the unit price of resin increased and the increased cost could not be absorbed, the decision was made to reduce its content.

#### ■ Corporate response to the nation-wide introduction of plastic shopping bag charges

From the perspective of environmental consideration, the "my bag" campaign has been implemented since 1991, and the plastic shopping bag charge has been implemented in some stores since 2007 and in all AEON general merchandise stores since 2013. Furthermore, before the legalization of the plastic shopping bag charge comes into effect in July 2020, the "my bag" campaign expanded to approximately 7,300 stores in April 2020, including small stores and drugstores. As a result, the percentage of shoppers declining to buy plastic bags is now over 80%.

The company recognizes that the purpose of the government's policy of charging for plastic shopping bags is to avoid disposing of resources in a disposable manner as much as possible. Thus, even though the bags would not be subject to the charge if they were made of bio-based plastics, the company did not have the option of distributing them free of charge. From the beginning, the proceeds from the sale of the shopping bags have been donated to local governments and organizations for use in local environmental conservation activities.

#### ■ Estimation of environmental impact reduction effects

Initially, there was no general recognition that bio-PE would contribute to CO<sub>2</sub> reduction. Therefore, AEON has been taking the initiative in studying the effects of introducing bio-PE in an advanced way, including LCA. Believing that third-party verification is essential in confirming the CO<sub>2</sub> reduction effect, AEON conducted joint research with the University of Tokyo and Toyota Tsusho and visited Braskem (Brazil), a company that manufactures bio-PE, to estimate the CO<sub>2</sub> reduction effect before the plastic shopping bags were adopted. The results were presented at the conference of the Institute of Life Cycle Assessment, Japan and the LCA data are still being used to this day.

#### ■ Certification

The shopping bags have been certified by the Bio-based Product Content Validation program of SGS SA and UL Inc., international certification bodies, as containing appropriate bio-based content.

AEON pays attention to global and third-party certifications, not only in this field. As for shopping bags, the company has obtained certification to verify whether bio-based materials are really used in the manufacturing process and to avoid reputational risks if they are not. SGS and UL conduct unannounced audits of factories, thereby ensuring reliability.

#### ■ Appeal to consumers

Marking, on plastic shopping bags and in-store displays indicate that they are plant-derived.

AEON is asking its customers to bring their own bags first. Yet, even if they do not happen to have a bag and want to buy one, AEON provides them with an environmentally friendly one, which shows the direction of the company's environmental efforts.

### 3. Future policy

A considerably high ratio of shoppers is declining to purchase plastic shopping bags; thus, the company is considering what applications would be the next best use of bio-based plastics. The company is considering using materials with the lowest environmental impact based on strict evaluation rules, although there is also the issue of cost.

## Case 5. Mulch Films

- The Use of Biodegradable Mulch Film in the Cultivation of Tomatoes for Processing by Kagome -

### 1. Overview of the Initiative

#### ■ Target products and materials

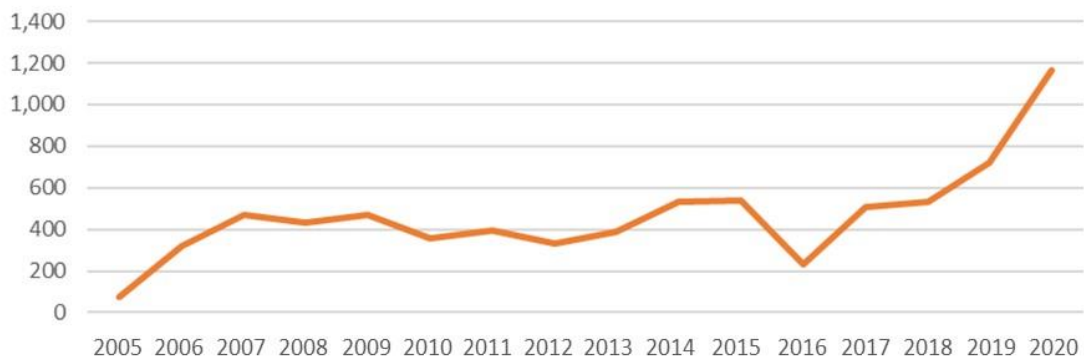
Even if the mulch film is torn during mechanical harvesting and it takes a lot of labor to collect it, biodegradable one can be decomposed by plowing it into the soil. Thus, Kagome is promoting the use of biodegradable mulch film by contract farmers in the cultivation of tomatoes for processing.



#### ■ Progress to date

The use of biodegradable mulch film is increasing with the expansion of mechanical harvesting, and the feedback from farmers who use it is good. Currently, an increasing number of hand-harvesting farmers are also using the biodegradable mulch film to improve the efficiency of post-cultivation cleanup.

Trends in the amount of biodegradable mulch film used by Kagome (200-meter rolls)



## **2. Considerations for the introduction**

### **■ Background and context of the initiative in the company**

With the aging of the population in the agricultural sector and the sense of crisis that farmers would not be able to take on production in the future, Kagome introduced mechanical harvesting into the cultivation of tomatoes for processing around 2000. Tomato cultivation requires the use of mulch film to maintain soil temperature and to control weeds and pests, but the mulch film is usually torn during mechanical harvesting. Therefore, at the same time as mechanization, the introduction of biodegradable mulch film, which degrades when plowed into the soil even if torn, has made it possible to reduce the load on the collection and disposal of mulch film.

For the agricultural materials required for cultivation, Kagome collects orders from each contract farmer, places orders with material manufacturers, and sells the purchased materials to the farmers.

### **■ Selection of materials**

As a result of testing biodegradable mulch films at the company and confirming degradability and disintegration, no significant differences were found between the fossil based and bio-based products tested. In addition, during actual use, it may happen that the mulch film degrades during use and adheres to the tomato surface, so the appropriate biodegradable mulch film is selected while also verifying degradability under actual use conditions.

### **■ Technical challenges**

Biodegradable mulch film has a tendency to tear easily when stretched compared to conventional one, and farmers are trying to come up with techniques and devices to apply mulch films without tearing it. Compared to conventional one, the speed of quality deterioration in storage is considered to be faster; therefore, orders are placed on a case-by-case basis to avoid keeping them in storage for a long time.

### **■ Measures related to cost**

The price of biodegradable mulch film is 1.5 to 2 times higher than that of conventional one. However, considering the fact that there is no need for collection after the end of cultivation and the effect of reduced disposal costs, Kagome believes that the increased cost will be offset. Many of Kagome's contract farmers are elderly, and the company believes that the introduction of biodegradable mulch film will have a significant effect in reducing labor. This effect is particularly significant for producers with large cropping areas.

### **■ Challenges and risk recognition**

Since the degradability of biodegradable mulch films can vary depending on the product and the conditions of use, it is necessary to verify the degradability under actual conditions of use and select an appropriate product.

## **3. Future policy**

In the future, Kagome believes that the switch to mechanical harvesting will be essential and expects that the use of biodegradable mulch film will exceed that of non-biodegradable mulch film in the future.