

Businesses supporting Kaneka's next growth phase

# Radical business transformation through intensive investment in priority areas

We position new large-scale and leading-edge businesses as driving forces to lead the next phase of our growth. "Biodegradable polymer PHBH" and the "Probiotics business" are designated as our priority product and business, representing our intensive efforts at the frontline of research, manufacturing, and marketing.

## New large-scale businesses

Driving-force of business transformation

- Organic EL Lighting
- Biodegradable Polymer PHBH
- Opto-Electrochemicals
- Regenerative medicine and cell therapy, etc.

Case

1



Biodegradable Polymer PHBH

→ P27



## Leading-edge businesses

Multiple business

- E & I Technology / Pharma
- Medical Devices
- Supplemental Nutrition / Agris
- PV & Energy management

Case

2



Probiotics Business

→ P31



New large-scale + Leading-edge businesses

Foundation businesses

## Foundation businesses

Strengthen Only One, Global No.1

- Vinyls and Chlor-Alkali / Performance Polymers
- Foam & Residential Techs / Performance Fibers / Foods



Case Study

# Biodegradable Polymer PHBH

We apply Kaneka Biodegradable Polymer PHBH (“PHBH”), which is 100% plant-based and biodegradable in sea water, to daily life, leading to innovation in lifestyles and the environment to help communities achieve sustainability.



In recent years, marine pollution caused by microplastics has become a global social issue due to its impact on ecosystems.

PHBH, developed through fusion of our long-cultivated fermentation and micromolecular technologies, will be a major factor in resolving marine plastic problems facing the world. Further broadening the application of our 100% plant-based and marine biodegradable polymer technology, we are developing easy-to-use products that help to resolve social issues together with partner companies that share our principles.

## Timely action to change risks into opportunities

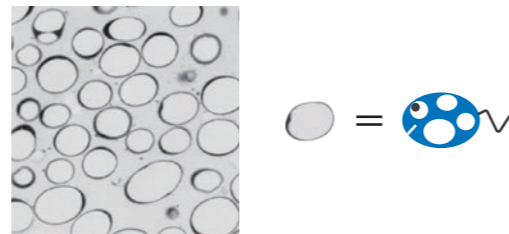
Since our foundation, we have deployed our know-how with fermentation methods as one of our core technologies. Broadening the application of our culturing technology, fostered by many years of research on yeast, through company-wide, cross-sectional projects, we have established a mass-production method for Kaneka Ubiquinol. We have also developed various raw materials for pharmaceuticals and functional food materials. We are currently working to realize a bio-economy society through manufacturing using smart cells (finely-designed biological cells), making use of rapidly-developing synthetic biological technologies.

PHBH has been developed due to the fusion of fermentation and chemical processes that we realized as a chemical company with the technical ability to run large-scale plants and expertise in advanced biotechnology.

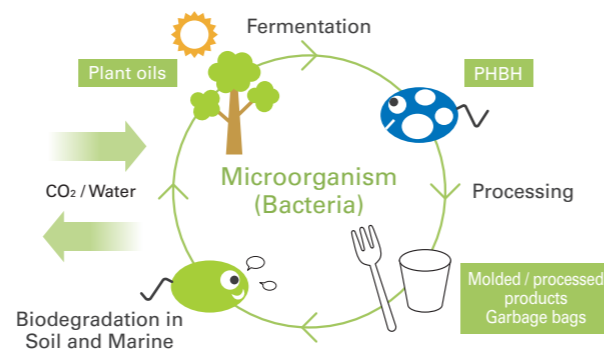
PHBH is a 100% plant-based polymer extracted from microorganisms that process plant oils. It is produced through the cultivation of microorganisms and is biodegradable by them.

While considering how to apply PHBH, with these

### Characteristics and life cycle of PHBH



PHBH accumulated in microorganisms (Electron micrograph)



features, we focused on the fact that microbeads\* were becoming a major social issue and began to collect data on marine degradability, following trends in legal restraints in Europe, where plastic issues had been rigorously addressed. Thus, our timely action succeeded in transforming the risk to the global environment caused by microplastics issues into business opportunities.

\* Microbeads are plastics produced in a micro size of 1mm or less, used as scrub materials in facial cleansers, tooth paste, and cosmetics.



**Takeshi Chiba, Ph.D.**  
General Manager  
BDP Technology Laboratories

## Foreseeing market needs to develop products tailored to each market

Marine plastic issues, one of the major agenda items at the G20 Osaka Summit held in June 2019, have become recognized throughout the world, including Japan, and specific measures and restraints have been implemented.

We began to operate a PHBH production facility, with the capacity of approximately 1,000 tons a year, at the Takasago Manufacturing Site in May 2011, earlier than other companies.

Since it was impossible to replace all plastics with PHBH, we drew a road map for its application and production capacity for it from the perspectives of technology and the most effective measures to resolve marine plastic issues.

We planned to gradually market PHBH by 2020, applying it to checkout bags, beverage labels, straws, and cutlery, while developing these products in conformity with market needs in each country. For instance, in Europe, products are often required to be biodegradable in soil due to social infrastructure and customs concerning composting of garbage. We also plan to develop and introduce products substituted for PET bottles by 2025, first developing disposable products related to food and beverages and then expanding the product range.

In our plan, in accordance with the expansion of PHBH product lineup, production capacity is increased by five times to 5,000 tons per year by the end of 2019 and will be gradually expanded to 100,000 to 200,000 tons per year by 2030. We believe that no other companies have comparably concrete plans to mass-produce PHBH.



**Kenji Kurosawa**  
Marketing Manager  
Green Planet Project (Japan)

Road map to develop and disseminate PHBH products and a plan to increase product capacity



Aiming to ensure stable quality and supply through manufacturing fueled by technology

Our attempt to develop technology that manufactures polymers industrially through fermentation was unprecedented, world-wide. Despite achieving

positive results in the laboratory, we were initially unable to obtain similar success at a mass production scale at the plant. We repeatedly adjusted cultivation conditions and manufacturing technology, verifying the obtained results every day. In addition, we had to disassemble and wash manufacturing equipment several times a day at first, when mass production was impossible. Currently, we still have to do the same maintenance work, but only once every six months. Through so many trials and modifications it became possible to manufacture polymers with a guaranteed level of quality.

Aiming to further enhance production capacity, we will improve operational technology and incorporate AI and IoT technology to create a cost-competitive and highly productive manufacturing base.



**Yoichi Kitadani**  
Manager  
BDP Production Group  
Takasago Manufacturing Site

Business model focusing on sharing principles and values as well as marketing products

For the development of PHBH, it was important for us to find companies that could share the principles of resolving marine plastic issues. Based on this, we aim to embody a new partnership-type business model to promote joint development with B-to-C companies that are sensitive to the needs of consumers and society and have a strong brand image, brand holders, and process manufacturers.

To correctly inform people of the function of PHBH and expand its application, it is important to obtain certification and pass screening criteria, including legal restraints related to food hygiene and new chemical substances, in each country. PHBH is permitted to be sold for use in major countries, including Japan, the United States, and European countries.



**Sosuke Takemura**  
Group Leader  
Strategy & Business  
Green Planet Project

Status of the acquisition of certification related to PHBH

	Japan	Europe	U.S.	Food Contact
Bio-based				U.S. Listed in Inventory of Food Contact Substance Notifications with U.S. Food & Drug Administration
Compost (Industrial)				Europe (EU) Listed in the positive list of Commission Regulation (EU) No. 10/2011
Compost (Home)				Japan Listed in the positive list for food utensils, containers and packaging by Japan Hygiene Olefin and Styrene Plastics Association
Marine				
Soil				

<Some grades>

Realizing economic value and creating a sustainable management system

Through PHBH, we pay attention to values benefitting society and are actively expanding such values through sharing with other companies and stakeholders.

In Japan, PHBH has been adopted in straws for Seven Cafés at about 10,000 Seven-Eleven stores. We are also jointly developing cosmetic containers with Shiseido Japan Co., Ltd. Outside Japan, PHBH has been adopted for wide-ranging purposes, including fruit and vegetable bags, garbage bags, seedling pots, and coffee capsules. It is also being newly adopted by many global brand holders for various purposes, including cutlery, checkout bags, home delivery bags, cup lids, paper coating materials, and food trays. Our current production capacity of 5,000 tons per year can barely satisfy these demands when operated at full capacity. We are therefore planning to build a plant with a capacity of 20,000 tons per year.

Under our mission of "Kaneka thinks 'Wellness First'", we are engaged in our unique wellness-first management. We believe that PHBH is one of the

symbolic products that help us provide socially valuable products to produce economic value and create a sustainably developing system. We will contribute further to society in the future.



TOPICS

Various products made of PHBH provided at the G20 Osaka Summit

At the International Media Center of the G20 Osaka Summit held in June 2019, Japan's advanced technologies and efforts to resolve environmental issues were introduced to the media from various countries. At our booth, we exhibited various molded products, such as spoons and forks made of PHBH, as materials proposed to resolve marine pollution issues, and samples showing biodegradability in seawater. Compostable garbage bags and cutlery made of PHBH were used at the Summit venue.

In his address at the Science and Technology in Society forum held in October 2019, Prime Minister Shinzo Abe expressed high expectations for our PHBH.



Stationeries made of PHBH introduced and distributed at the G20 Summit



Case Study

# Probiotics Business

We are creating new value in the field of lactic acid bacteria with an immunity improvement function as one of our innovative solutions empowering people to live healthier lives.

Our fermentation technology, one of the core technologies that we have cultivated since our foundation, has made possible bakery yeast and functional food materials, such as Kaneka Ubiquinol. The development of these products is strongly supported by the management and individual employees who seek to develop new materials that meet safety requirements and are supported by clear data proving positive effects for humans, thereby helping people live healthy and active lives.

To expand a new business, in 2018 the Spanish company AB-Biotics S.A. ("AB-Biotics"\*1), engaged in original research on lactic acid bacteria, became a Kaneka Group company. By combining AB-Biotics's probiotics products with our functional food materials and dairy products, we bring unique products to the market, developing a new business to contribute to people's wellness.

\*1 AB-Biotics was founded in 2004 by Sergi Audivert and Miquel Àngel Bonachera, as students at University Autònoma de Barcelona. Having actively engaged in R&D since its foundation, it currently has operations in more than 60 countries with over 200 core patents.

## Diversity of intestinal bacteria being lost from the human body, and the roles of lactic acid bacteria

Approximately 1,000 kinds and 100 trillion individual intestinal bacteria live in the human intestinal tract, mainly in the large intestine. Categorized into three groups: beneficial, harmful, and neutral, they are

closely related with each other, maintaining an intricate balance, and are deeply involved in human health.

However, it is said that the original diversity of intestinal bacteria in people living in urban areas today

### Features of AB-Biotics's functional lactic acid bacteria

**Possesses more than 550 original bacteria strains**

**Clear effects, such as reduced risk of heart disease, intestinal environment improvement, periodontal disease reduction, and infection prevention**

Effect	Product name	Product features
Cardiovascular	AB LIFE	Reduces LDL cholesterol by 24%
Immune system	AB IMMUNO	Reduces influenza infections
GI (Gastro Intestinal)	I3.1	Comprehensively alleviates symptoms of IBS (irritable bowel syndrome), in addition to alleviating IBS related pain.
Oral	AB DENTALAC	Efficiently reduces periodontal disease bacteria
Children	AB KOLICARE	Reduces crying in 68% of infants with baby colic
Women	AB INTIMUS	Reduces the recurrence rate of infectious diseases

is being lost, due to the effects of antibiotic drugs and artificial additives. It has been proved that a decrease in diversity, or a decline in the number of kinds of bacteria, is associated with various diseases. Lactic acid bacteria, among others, play an important role in restoring the balance of intestinal bacteria.

Lactic acid bacteria have recently attracted attention for their new effects, such as allergy symptom relief and infection prevention as well as the effects of improving the intestinal environment and immunity. Their application is rapidly expanding to dairy products, including yogurt, functional foods, and supplements.

## Establishing an advantage through inimitable combination of strains

Among many companies in lactic acid bacteria-related markets, AB-Biotics, a subsidiary of Kaneka, possesses advanced R&D capability, with more than 550 original probiotics\*2 strains from human healthy intestinal samples. One of the distinctive features of its strains is that they have clear effects and mechanism in humans, including improving the intestinal environment and decreasing risks of cardiovascular, periodontal, and infectious diseases.

A key feature of probiotics products produced by AB-Biotics and Kaneka is that several kinds of highly effective strains for specific targets, such as immunity improvement, can be combined. Even if symptoms are identical, their causes vary among individuals. The supply of products with diverse effects and mechanisms can increase the ratio of those who can enjoy their benefits, leading to higher effectiveness. We believe that this gives an advantage over competitive products.

\*2 Probiotics: Live microbial community and foods containing it, giving beneficial effects to the human body by improving the intestinal environment and controlling intestinal function and the immune system.



**Takahiro Ueda**  
Manager  
Nutrition Strategic Unit  
Pharma & Supplemental Nutrition Solutions Vehicle

## Kaneka's knowledge and technologies enhancing added value



**Kaku Nakagawa, Ph.D.**  
Officer  
Nutrition Strategic Unit  
Pharma & Supplemental Nutrition Solutions Vehicle

Having engaged in R&D on fermentation products and plant extracts for 40 years, we have accumulated a wealth of knowledge and know-how based on scientific evidence from clinical tests. The collaboration between us and AB-Biotics, with extensive knowledge of lactic acid bacteria, makes it possible to increase our portfolio of more effective lactic acid bacteria products supported by scientific evidence.

Use of our know-how in fermentation production in AB-Biotics's production of probiotics products leads to cost reduction. It also generates many synergies, including expanding the application of our pharmaceuticals and foods and marketing products on a global basis, thereby enhancing added value. Although we have different areas of expertise, we are engaged in R&D on lactic acid bacteria toward product commercialization, sharing the mission to disseminate safer products supported by scientific evidence to society in order to support wellness.

Grasping the market's features to pursue value for customers

The U.S. market for lactic acid bacteria is the world's largest, making it the most important market for us. We have therefore launched an organization dedicated to lactic acid bacteria on the West Coast of the U.S to focus on business development. We also work on introducing our brand "Floradapt" at exhibitions and academic conferences.

Since the U.S. does not have a universal health insurance system, people in America are highly aware of self-medication\*3. Meeting needs for preventive health care, the market share of lactic acid bacteria products is steadily increasing as products available at reasonable prices. Considering that needs for preventive health care will grow in Japan, we expect stable growth in this market.

Ways of consuming lactic acid bacteria products, their required functions, and their categorization vary among countries. In Japan, more than 90% of products are yogurt-based, many of which highlight their functionality. In the U.S., yogurt is a product with a strong focus on palatability, and more than one-third of lactic acid bacteria products are consumed as supplements. The situation in Europe is midway between the two. While a variety of new functions are pursued in Japan, including lowering uric acid and neutral fat levels, in the U.S. emphasis is placed on categorization such as products for women and the elderly. We will pursue value tailored to customers, considering differences in marketability.

\*3 Taking responsibility for one's own health and treating slight physical disorders by oneself.



**Hiroyuki Miyaji**  
Senior Manager  
Nutrition Strategic Unit  
Pharma & Supplemental Nutrition Solutions Vehicle



Our probiotics product brand, "Floradapt" series

Original position established in terms of function and taste

Products offered by us and AB-Biotics are supported by clear evidence. In the U.S., functionality can be described based on clinical data but in Japan it is necessary to pass rigorous screening to gain authorization for Foods with Function Claims, and notification to the Consumer Affairs Agency is essential. We will clearly describe functionality through function claims in the supplement market so that product effectiveness and efficacy can be easily understood by consumers.

In the food market, including dairy products, consumers do not repeat purchase of the same

product if it tastes unpalatable, in spite of its effectiveness. Accordingly, in January 2018 we established a technical tie-up with Pur Natur, a Belgian company marketing its organic dairy products in European countries, to bring to the Japanese market our unique functional yogurt products with good taste, a feature of Pur Natur's products, and effectiveness, a feature of AB-Biotics's products.

In the B-to-B market, we aim at differentiation from others by considering what value should be provided to consumers in cooperation with clients as well as simply marketing probiotics products. We also conduct presale of products through Kaneka Your Health Care Co., Ltd., a Kaneka Group company engaged in the mail order business, to have consumers recognize their commercial value, thereby encouraging clients in the B-to-B market to choose our products.



From Japan to the world, with our steadfast mission to contributing to healthy longevity

As human longevity increases, thanks to medical advances in Japan and the world, in the future it will become crucial to live a long healthy life. In particular, as a country with long life-expectancy, Japan is on the leading edge of this trend. We plan to create a model project for contributing to healthy longevity and expand it on a global scale.

We aim to further contribute to society by not only developing and marketing better probiotics products, but also incorporating them into our solutions as materials contributing to our "wellness-first management" and healthy longevity.



Our co-creation further spurring a highly competitive edge  
Message from the founders of AB-Biotics

AB-Biotics was founded in 2004 by Sergi Audivert (right) and Miquel Àngel Bonachera (left), as students at University Autònoma de Barcelona.

Having actively engaged in R&D since our foundation, we currently have operations in more than 60 countries with over 200 core patents. Becoming a member of the Kaneka Group in 2018 has improved the motivation of our staff members and has accelerated our business growth through various types of cooperation. We expect that your many years of manufacturing experience and global market expansion capabilities will help improve our competitiveness and productivity, generating a wide range of synergetic effects. We will do our best to show a strong presence in the health care field.



On our way of developing the market in the U.S with  
unprecedentedly valuable probiotics products

In North America, which has the largest health food market, we are engaged in market expansion, setting up a dedicated team, with probiotics products based on AB-Biotics's evidence serving as the core of differentiation. With the "Floradapt" brand launched in 2018, we are involved in sales promotion, customer development, scientific research enhancement, and responses to pharmaceutical regulations to become a provider of finished products with higher added value. Since lactic acid bacteria are hard to handle and technology accumulation is required for quality control, it is important to create an on-site manufacturing and supply system. We are therefore promoting collaboration with local business operators to enhance competitiveness. We aim to build a new pillar of our health food business by establishing our position in the U.S. market, overcoming any obstacles through support from the U.S. team and other global support.

