

Transformative product innovation 102-12, 102-15, 103-1



Pursue essential research to unleash breakthrough innovations that help realize more sustainable lifestyles by solving social issues and easing people's pains.

Kao's creating value to address social issues

Social issues we are aware of

Progress in science and technology has benefited our lifestyles in numerous ways. Governments and enterprises are working to deploy science and technology to address the pollution and health problems that arise as a side effect of progress. But the expansion of the mass consumption society is driving a global-scale increase in waste and CO₂ emissions, and to address these challenges, cross-border efforts will be essential. For example, we must find a way to reduce the usage of plastic film packaging and make total recycling* strategies possible. Sustainable Development Goals (SDGs) incorporate a call for Responsible Consumption and Production, and we believe that responsible production includes reuse of waste.

In addition, the expanding movement of people and products around the globe heightens the risk of infectious disease spread. Climate change may be another risk factor in this respect. Access to safe water supplies, and maintaining a hygienic society while conserving water, are important goals.

* Total recycling
Recycling for same-product production with no reduction of strength, durability or quality. Today, plastic film is typically subject to cascade recycling, in which materials are recycled into material of lower quality and functionality than the original.

Kao's creating value

To address social problems, innovations that gather wisdom are essential. To enable people everywhere to enjoy enriched lives, we are promoting R&D activities from three perspectives: environmental, social and human.

From the environmental perspective, we are evolving our packaging forms while applying the 4R principle to reduce the amount of plastic in packaging, with the goal of realizing a recycle-based society. We are working to develop stronger, lighter resins, recycle used refill packaging for new uses, and achieve the material quality and functionality needed to allow the use of recycled materials for the same packaging and film. We are also working to reduce environmental impact due to products themselves, and are promoting research in an effort to find ways to conserve water and energy during their use.

From the social perspective, we are working to realize a cleaner, more hygienic society by using microbial control technology to develop safer, more reliable disinfectant and antibacterial products. We are also deploying this technology toward prevention of viral and disease infection through substantive elucidation of the causes of infection. In addition, products like *VISCO TOP*, which does not cause water pollution, and other highly functional chemicals for construction use, contribute to the making of tough, robust roads, bridges and other structures, and help

build a safe society.

From the human perspective, we have strived since our founding to enhance consumer quality of life (QOL). So that everyone can lead comfortable, beautiful, healthy lives, we will continue our efforts to satisfy diverse senses of beauty and value, and research the use of big data to improve human motion and cognition, to enable us to innovate for richer lifestyles.

Risks and opportunities related to realization of our vision by 2030

Promoting innovation involves a wide range of risks, such as number of years to product development as well as the business environment changes and uncertainties. Schedule delays involve opportunity loss, not only in terms of investment but also for society. For important innovations, we publicize them to society at an early stage, and by gathering wisdom through co-creation and dialogue, seek to convert imaginative ideas into businesses and products.

Contributions to the SDGs





Policies

We have adopted the following three basic policies for our R&D activities.

1. Create the seeds for new businesses.
2. Bring about innovation that creates new customers' needs in existing business domains.
3. Share scientific technologies with society.

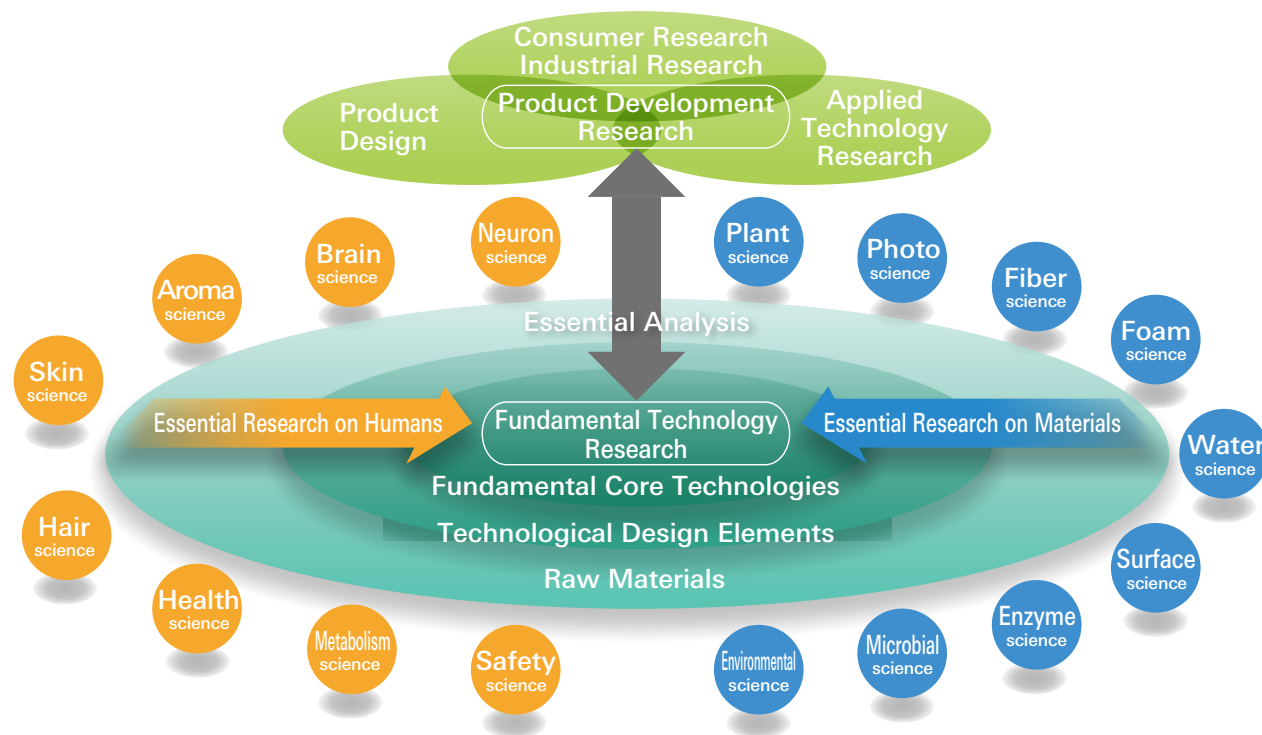
Based on these basic policies, we seek to enrich people's lives through innovation, promoting research activities in two directions.

One direction is the promotion of technology innovation to create seeds for new businesses and products. This innovation is driven by Essential Research. We believe that the essence of phenomena and objects as discerned through the eyes of science can lead to innovation that has a major positive influence on lifestyles.

The other direction involves recasting our accumulated technology assets from an ESG perspective, and incorporating them in the planning of Kirei Lifestyle products. In carrying out that planning, business strategies for a purpose driven brand, assurance of high safety and quality, and development and procurement of materials with low environmental impact are essential.

Through the accumulation of these innovation activities, our aim is for all Kao brands to have a social mission and exert a positive influence on people and society.

Essential Research



Kirei Lifestyle Plan

Making my everyday more beautiful

Making thoughtful choices for society

Making the world healthier & cleaner

Walking the right path



Education and promotion

Promoting R&D activities requires opportunities for all of our research staff to familiarize themselves with the latest technology and research results, and occasions where they can collaborate to generate ideas. To this end, we maintain a research report database that is available to all research staff, hold presentations to facilitate discussion across business boundaries, invite specialists to give lectures and provide research guidance, and offer a wide range of other, similar opportunities. These have the potential to lead to new discoveries and innovation.

Collaboration and engagement with stakeholders

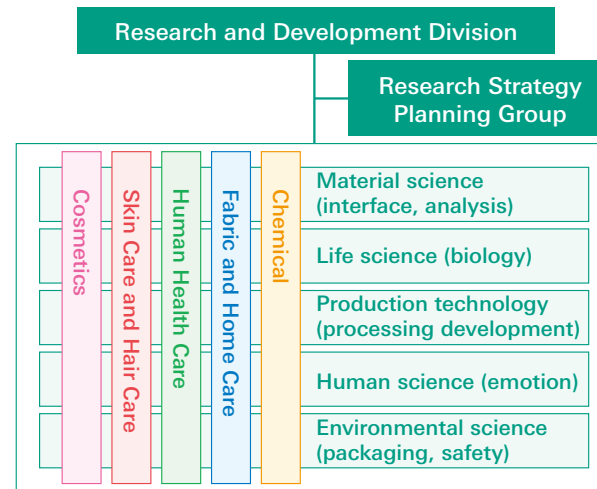
Multi-faceted linkage and collaboration between industry, government, universities and other players are necessary to solve challenging environmental and social issues. Open innovation is one example of this approach. We are working to present knowledge gained from R&D activities through academic societies and research papers, and propagate science and technology. To obtain broad consumer support for those activities, we convey the value and future of science and technology through dialog and awareness-raising activities.

Framework

To gather knowledge across business and technological boundaries, we are promoting matrix management. Each research facility reports directly to

the R&D Division. R&D policy sharing with management and business divisions, and strategy implementation and progress confirmation at each research facility, are carried out as part of the yearly plan. This results in faster decision making and accelerated global growth.

Research and Development structure



Mid- to long-term targets and performance

2020 mid-term targets

We will strengthen existing businesses and offer new innovation within existing business boundaries. We are working to generate new businesses in such domains as hygiene, centered on infectious disease prevention: health and beauty maintenance using biological information including RNA: and domains related to preservation of the environment, including recycling.

2030 long-term targets

- Offer 10 or more products with a major positive impact on lifestyles by 2030.
- Increase the ratio of new or improved products which meet Kao sustainability guidelines to 100% by 2030.

Anticipated benefits from achieving mid- to long-term targets

Business impacts

We will achieve higher sales from new or improved products and create new business areas through R&D activities.

Social impacts

We will solve environmental and social issues and create new businesses and products by offering innovations for the new recycle-based society and healthy lifestyles.



Performance in 2019

We developed Fine Fiber Technology in 2018. This technology has applied in a wide range from foundation makeup to skin care, that respond to consumer desire for products reflecting their individuality. In 2019, we accelerated open innovation, developed a small, high-performance diffuser, and launched it in conjunction with specialized skin care products.

Going forward, we will systematize our sustainable policies from the environmental, social and human perspectives to offer impactful technologies and products.



Our initiatives

Recently developed products and technology

At the Kao Group Technology innovation session in November 2018, we announced our new technologies in five domains: skin, health, hair, surface chemistry and environment. This presentation accelerated collaboration with enterprises in other business domains, and is leading to commercialization of new products.

Skin science: Fine Fiber Technology

In 2018, we developed Fine Fiber Technology, which involves depositing ultra-fine fibers with a diameter of 1 micrometer or less directly on the skin, to create an ultra-thin, multilayer membrane. This membrane is light and soft, and follows the movement of the skin while being resistant peeling off. It does not create a completely sealed layer despite fitting naturally on the skin, but allows for adequate moisture permeability and distributes products used with it throughout the entire membrane.

In 2019, we developed a small, high-performance diffuser able to create this ultra-thin membrane at home and the Veil Potion used with the diffuser to create ultra-thin layers on the skin along with a specialized essence. We then launched sales of the skin care products to offer moisture-rich skin care in a two-step regimen. Our small, high-performance diffuser was developed in collaboration with Panasonic Corporation's Appliances Company, a leader in beauty appliance technology.

Going forward, we will promote the development of base makeup products that firmly cover pores, color irregularities, spots and other imperfections. In the future, we will also aim to use this Fine Fiber Technology to create new value in the medical field, such as contributing to skin care following laser treatments and treatment of skin maladies accompanying injuries.



Health science: RNA Monitoring

In 2019, we announced RNA Monitoring, a proprietary technology enabling comprehensive analysis of the approximately 10,000 varieties of RNA expression information contained in sebum. While DNA is useful in assessing a person's innate characteristics, RNA is especially useful for understanding the state of day-to-day changes influenced by environmental and other factors. Using RNA obtained from sebum, we have also demonstrated the ability of this technology to detect characteristic changes in the skin condition of patients suffering from atopic dermatitis. Skin problems can lead to lowered QOL, making them a social issue. We have announced a collaboration with Preferred Networks, Inc. and have begun a project to understand the skin condition of individual customers by combining large data sets of RNA reflecting individual differences with

machine learning, deep learning and other AI technologies. We are proceeding with research and development in anticipation of improved QOL and empowering customers to achieve healthier skin by offering appropriate care methodologies.

Surface science: Utilizing Bio IOS and algae

Due to global population growth, preserving ecosystems and ensuring a stable supply of surfactant materials that use natural fats as raw materials has become a challenge. In response, we developed Bio IOS, a sustainable new detergent base produced from a part of the oil palm that has traditionally had very little application in surfactant materials. This detergent base is highly hydrophilic yet also highly lipophilic, which enables it to work into and remove stains when used in detergent while not readily remaining as a residue in laundry items, leading to benefits including reduced water consumption. Consequently, significant future demand is anticipated.

We are also currently working to on a project to manufacture surfactants made from microalgae that take the place of natural fats. As algae production does not compete with food production and algae are expected to demonstrate high fat productivity, we are focusing our efforts to achieve microalgae application.