



Initiatives to Help Achieve the SDGs

SDGs and Realizing KAITEKI

The Sustainable Development Goals (SDGs) are a set of development goals for international society as a whole to pursue from 2016 to 2030 that were adopted as part a resolution titled “Transforming our world: the 2030 Agenda for Sustainable Development” at the UN Sustainable Development Summit in September 2015. The SDGs comprise 17 goals and 169 targets for realizing a sustainable world. Governments and civil society, as well as the private sector, including corporations, are expected to utilize their resources and coordinate to help achieve the SDGs.

In accordance with its vision of realizing KAITEKI, the sustainable well-being of people, society and our planet Earth, the Mitsubishi Chemical Holdings (MCHC) Group adopted improving sustainability as one of its management axes in 2011. We aim to not only help solve environmental and social issues but contribute to the sustainable development of society and the planet. As such, we believe that many aspects of our vision of realizing KAITEKI parallel the SDGs.

Furthermore, MCHC has laid out how the SDGs relate to its important management issues (materiality) and MOS (Management of Sustainability) Indices—which it uses as key performance indicators to enhance sustainability—and has linked these issues and indices with SDG efforts.

Mitsubishi Chemical's Initiatives

As a member of the MCHC Group, Mitsubishi Chemical (MCC) has made realizing KAITEKI its vision and declared that it will seek to address societal issues by creating new value and providing said value to customers as solutions, thereby sustainably growing in concert with society. As a result, many of the products and services we provide contribute to the realization of the SDGs.

The MCC *Sustainability Report 2018* features the following three items, chosen as representative examples of MCC's many products and services that contribute to realizing KAITEKI and the SDGs.

**Plant-Derived,
Biodegradable Plastic BioPBS™**



SDG 12:
Ensure sustainable consumption
and production patterns

**Structural Repair and Strengthening
Carbon Fiber Fabric Replark™**



SDG 11:
Make cities inclusive, safe,
resilient and sustainable

**Decentralized Water Treatment
& Supply System**



SDG 6:
Ensure availability and sustainable
management of water and sanitation for all

Plant-Derived, Biodegradable Plastic BioPBS™



Relevant SDG

SDG 12: Ensure sustainable consumption and production patterns

Striving toward Sustainable Production

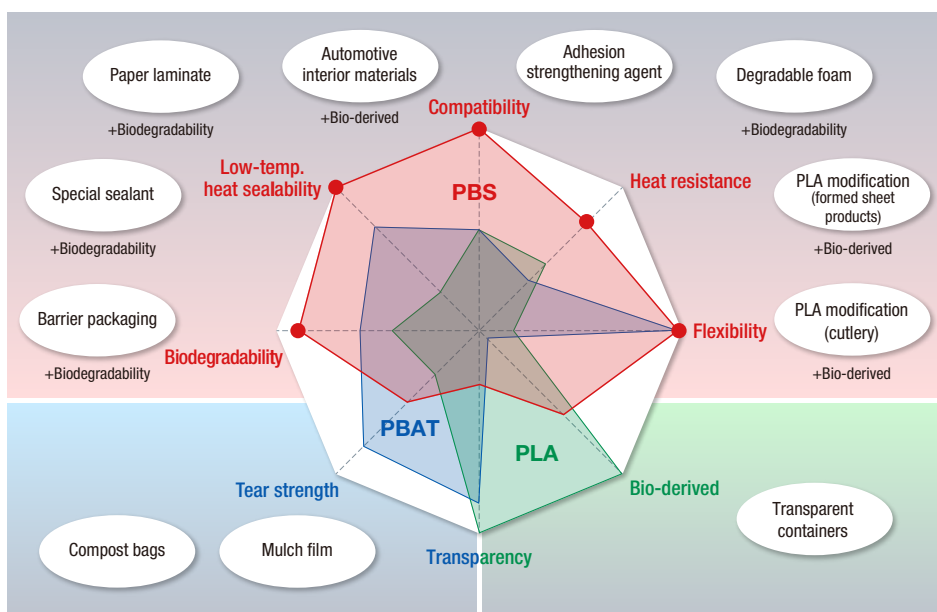
We are now facing such global-scale risks as accelerating climate change, the depletion of natural resources, disparities in water resource distribution, expanding and graying populations, and food and agricultural issues. Given this critical situation, as a chemical company, we believe it is our mission to realize, through innovation, the efficient use of natural resources and energy, the utilization of renewable resources, and the reduction of environmental burden and to thereby enhance environmental and social sustainability.

Initiatives to replace non-renewable petroleum with renewable biomass as the raw material for plastic production are helping to more efficiently use resources and greatly contribute to ensuring sustainable production, part of one of the SDGs. At the same time, making plastics biodegradable while retaining their useful properties makes it easier for them to break down in the environment, helping to reduce environmental burden. With BioPBS™, a renewably sourced and biodegradable product, Mitsubishi Chemical (MCC) has developed a plastic that offers both of these unrelated attributes.

Features of BioPBS™

Polybutylene succinate (PBS) is an aliphatic polyester resin made from succinic acid and 1,4-butanediol, two raw ingredients typically manufactured from petroleum. In contrast, BioPBS™ is made with succinic acid derived from plant materials, a renewable resource. Its excellent biodegradability at low temperatures—ultimately breaking down into water and CO₂—sets it apart from other biodegradable plastics like polylactic acid (PLA) and polybutylene adipate terephthalate (PBAT). BioPBS™ also boasts such outstanding qualities as low-temperature heat sealability, compatibility with other materials, heat resistance and flexibility. Moreover, many properties that BioPBS™ does not have by itself can be achieved when it is used in composites with other resins and materials.

Characteristics of PBS



Plant-Derived, Biodegradable Plastic BioPBS™

Applications of BioPBS™

BioPBS™ is manufactured and sold by PTT MCC Biochem Co., Ltd., a joint venture of PTT Global Chemical Public Company Limited (previously Petroleum Authority of Thailand) and MCC. Furthermore, MCC is advancing the development, manufacture and sale of compounds that impart new functions to BioPBS™, leveraging its excellent compatibility with other materials and biodegradability. BioPBS™ is currently being used in applications including the two below.

Agricultural Mulch Film

Agricultural mulch film is used to cover the rows of soil in which agriculture products grow, helping prevent insect and weed infestation, stabilize ground temperature, maintain soil moisture and prevent fertilizer runoff. Because of the wide range of useful effects they offer, such films are in widespread use. However, after crops are harvested, ordinary mulch films must be collected from the fields and disposed of as waste plastic or incinerated. The biodegradability of BioPBS™ is thus of great use in this application. Agricultural mulch film made with BioPBS™ need not be collected after the harvest, and can instead simply be plowed into the soil, where it naturally breaks down. This helps achieve sustainable production, part of one of the SDGs, while contributing greatly to labor saving in agriculture.



Use in agricultural mulch films

Coffee Capsules

Capsule coffee makers have rapidly grown in popularity in recent years. These machines heat water at high pressure then force it through the ground coffee beans, which are kept fresh inside a capsule, to brew coffee. For this to work, the capsules need to have a number of attributes, including heat resistance, impact resistance and sealability to preserve flavor. Because it meets these needs, BioPBS™ is used as a material for coffee capsules.



Use in a coffee capsule

The heat and impact resistance of BioPBS™ composites are useful in this application, but the biodegradability of BioPBS™ plays a major role as well. Because used coffee capsules contain wet coffee grounds, they are difficult to recycle as plastic. However, if they are made with biodegradable BioPBS™ composite, used capsules can be composted, a method of disposal with minimal environmental impact. By providing such products, we aim to enrich lifestyles while contributing to sustainable production, part of one of the SDGs.

Working toward the SDGs

MCC continues to advance R&D aimed at eventually producing the raw ingredients for PBS, including 1,4-butanediol, entirely from plants. We also aim for even higher biodegradability to better realize sustainable consumption and production patterns, one of the SDGs. MCC is putting its full strength—including advancing R&D, establishing production technologies, ensuring quality that meets demands, developing markets, and developing global business—into realizing these goals.

Structural Repair and Strengthening Carbon Fiber Fabric Replark™



Relevant SDG

SDG 11: Make cities inclusive, safe, resilient and sustainable

Targeting Sustainable Infrastructure

Recent years have seen numerous heavy rains, earthquakes, volcanic eruptions, tsunamis, droughts and other natural disasters around the world. Typhoons, heavy rains, and the subsequent flooding are becoming more frequent and more severe, and damage from earthquakes is unending. In addition to the harm they inflict in terms of human life, the economic toll of such disasters is a major barrier to the realization of a sustainable society. Natural disasters significantly impact highly developed countries and, in countries where infrastructure is underdeveloped, can wreak even greater harm.

As bridges, expressways, tunnels and other such infrastructure components age, their safety becomes harder to ensure; incidents involving collapsing or failing infrastructure in and outside Japan have been occurring one after another. Furthermore, the decreased utility of aging structures and the expense of repairing and strengthening them are major social issues.

The Mitsubishi Chemical (MCC) Group provides a range of products and services that aid in addressing the critical state of infrastructure and contribute greatly to the realization of the SDG "Make cities inclusive, safe, resilient and sustainable." One such product is the structural repair and reinforcement carbon fiber fabric Replark™ offered by Mitsubishi Chemical Infratec Co., Ltd.

Features of Replark™

Carbon fiber boasts many advantageous features: It has a specific gravity just 1/4 that of iron, yet approximately 10 times the strength of steel, and it is highly chemically stable, making it resistant to salt damage. Replark™ is a repair and reinforcement material for steel and concrete structures made of unidirectional carbon fiber. This product offers all the advantages of carbon fiber in an easy-to-work-with sheet form. The grade of Replark™ made with PAN-based carbon fibers can be used to enhance the tensile strength of such structures as bridge columns, while the high-elastic-modulus grade made with pitch-based carbon fibers can greatly reduce the stress on rebar. In addition to Replark™ fabric, we offer a range of formed carbon-fiber reinforcement materials, such as e-plate (strips) or Leadline™ (rods), to meet the needs of various applications.



Replark™



e-plate



Leadline™

Structural Repair and Strengthening Carbon Fiber Fabric Replark™

Applications of Replark™

Replark™ provides the following functions when used with existing structures.

- It reinforces bridge beams against bending and enhances the fatigue durability of bridge deck slabs.
- It improves the seismic resistance of bridge columns and other structures by absorbing energy from earthquakes.
- It prevents material stripping from tunnel interior walls and chimneys.

In addition to offering the lightness, strength and elasticity of carbon fiber, Replark™ is simple to install; fabric impregnated with epoxy resin need only be applied to the structure surface. As such, it offers the following advantages for repairing and strengthening structures.

- Because it is lightweight and simple to install, carrying and handling the necessary materials at the worksite is easy.
- It enables repairs in tight spaces where maneuvering and installing steel components is difficult.
- It adds almost no weight to the structure being repaired or strengthened, helping reduce the load on the existing structure.

The development of Replark™ goes back to the 1980s. Recognition of the need for such a product and its usefulness has gradually increased, and today it is starting to be used not only in Japan, but also in Southeast Asia and Europe.

Installation on Genta Bridge

Genta Bridge, located in Tottori City, Tottori, has stood for more than 60 years. While in relatively good repair, the bridge was narrow, making passage difficult for large vehicles, and its load capacity was no longer sufficient due to the increasing size of vehicles on the road.

To address these issues, Tottori Prefecture sought to broaden and strengthen the bridge, but doing so by conventional methods would significantly increase the bridge's weight, requiring large-scale construction. Instead, the bridge's reinforced concrete suspended girders were replaced with steel; external cables and Replark™ carbon fiber fabric were used for strengthening; and Leadline™ carbon fiber rods were used to strengthen the deck slabs. As a result, the overall cost was approximately halved from what it would have been using conventional construction methods. In recognition of these achievements, the bridge received the Japan Society of Civil Engineers 2014 Tanaka award.



Genta Bridge under construction

Working toward the SDGs

As expressed by the SDG “Make cities inclusive, safe, resilient and sustainable,” building safe, reliable infrastructure is among the most important tasks we face. However, securing the funding and manpower needed to renovate infrastructure remains difficult. The MCC Group strives to find solutions to these two difficult and conflicting issues through innovation and global business development.

Decentralized Water Treatment & Supply System

6 CLEAN WATER AND SANITATION



Relevant SDG

SDG 6: Ensure availability and sustainable management of water and sanitation for all

Safe Water for the World

While approximately 70% of the Earth's surface is ocean, fresh water accounts for just 2.5% of all water on the planet. Most of this fresh water is in glaciers and ice sheets, groundwater, or otherwise difficult to access; readily available surface water¹ in such forms as lakes and streams is estimated to make up just 0.01% of all water on Earth.

Furthermore, this readily usable water is unevenly distributed. According to the United Nations Development Programme (UNDP) *Human Development Report 2006*, more than 1.1 billion people worldwide have inadequate access to clean, safe water. Achieving the SDG "Ensure availability and sustainable management of water and sanitation for all" will bring immeasurable benefits to people and society, saving lives by improving public sanitation, thereby helping prevent the spread of infectious disease and reducing infant mortality, while also reducing the gap between rich and poor, creating educational opportunities and contributing to regional economic development.

Moreover, given the frequency of major natural disasters around the world, securing water supply lifelines in times of disaster is a major issue facing developed countries, as well.

Wellthy Corporation has been working to solve these problems for more than 20 years. Focusing on groundwater, which accounts for 0.76% of the planet's water, Wellthy strives to contribute to the supply of safe water using the decentralized water treatment & supply systems it has developed. These systems are currently supplying water—an essential for daily life—both in Japan and overseas.

¹ Surface water: Water that originates mainly from precipitation and is present entirely above ground in such bodies as streams and lakes.

What is a Decentralized Water Treatment & Supply System?

Capable of processing water from a wide range of sources, Wellthy's decentralized water treatment & supply systems employ the company's accumulated membrane filtration technologies. Wellthy handles everything from development and manufacture to the management and maintenance of these systems. Wellthy systems are mainly used with groundwater in Japan and with surface water overseas. Their compatibility with diverse water sources gives the systems a major advantage. In addition, these systems offer the following advantages.

- The system can be installed on an area the size of a few parking spaces and requires less investment than a large-scale centralized water purification plant.
- Customers can select the optimal system configuration for the type and characteristics of their water source and the usages and required supply capacity of treated water.
- A remote monitoring system ensures a safe and stable water supply.
- The system can reduce water supply costs.



Decentralized water treatment & supply system

Decentralized Water Treatment & Supply System

Furthermore, because these water supply systems are decentralized and enable local production for local consumption, they also offer the following merits.

- Construction does not take long, so the lead time from the start of installation to the start of water supply is short.
- Maintenance requires little cost or labor.
- The training necessary for upkeep and management is simple.
- As a secondary water supply in addition to public water supply, the system can provide a water supply lifeline that is resilient to disasters.
- The system can fill gaps in public water supply systems in rural or remote areas of developing countries.

Applications of the Decentralized Water Treatment & Supply System

Wellthy's decentralized water treatment & supply system business is aimed at realizing safe, stable water supply for everyday use, helping secure an uninterrupted water supply at times of natural disaster, and supporting the business continuity of its customers.

■ Clean Water and Agriculture Promotion Project in Kenya

Wellthy is working with the United Nations Development Programme (UNDP) on a project to supply clean water to a community of approximately 40 households in Machakos County, Kenya.

Because there is no electricity supply in the community, we installed a slow sand filtration system (a filtration system that uses gravity) that requires no power and only simple maintenance. This system purifies water taken from a nearby canal for use by the local residents. At the same time, we have developed a clean water business model whereby local residents can sell purified water to their neighbors to secure a cash income.

In addition to supplying clean water, we are focusing efforts on promoting local agriculture. By installing facilities for drip irrigation (in which water is supplied in small amounts only where needed) and reusing activated carbon previously employed in water filtration as a soil conditioner, the project is improving water use efficiency and reducing waste. With an eye to promoting traditional leafy vegetables that offer high added value but are not currently grown in the area as possible cash crops, we aim to help expand the cultivation of cash crops rooted in the area and thereby increase incomes in the community as a whole.

These efforts are helping local residents achieve economic independence and creating educational opportunities. Furthermore, through such knock-on effects as the health benefits to local residents of eating highly nutritious traditional vegetables, we are contributing to the world via the supply of water.



Clean water project in Kenya

■ Groundwater Membrane Filtration System

Our groundwater membrane filtration system is a decentralized water supply system that uses the sophisticated membrane filtration treatment that Wellthy has developed to process groundwater into safe, reliable drinking water. Used as a secondary water source alongside a public water utility, this system can provide a water supply lifeline during times of disaster. The system offers the following merits.

- The system facilitates operational continuity in times of disaster, most notably at medical institutions and nursing care facilities, where water supply is essential, as well as at retail facilities, hotels, schools and other important public facilities, and at factories.
- The system enables social contribution by enabling the user to supply neighboring residents with water when public water supply is cut off, such as at times of disaster.
- Using groundwater in the course of regular operations can help reduce water utility costs.
- By using groundwater, which has a stable temperature year-round, the system can increase cooling tower efficiency in the summer and fuel efficiency for hot water supply in the winter, reducing both cost and environmental burden.

In areas where public water supply was cut off after the Kumamoto Earthquake and Northern Osaka Prefecture Earthquake, these systems continued to operate. As a result, hospitals that had groundwater membrane filtration systems had no interruption in water supply and were able to continue operating. We also heard from many customers that they were able to contribute socially by providing water to nearby residents.

Working toward the SDGs

Safe water is a limited resource; even those of us who enjoy its benefits every day are reminded how precious it is when a natural disaster strikes. As such, although achieving the SDG “Ensure availability and sustainable management of water and sanitation for all” will be extremely difficult, its realization will help not only ensure safety and peace of mind in everyday living for people around the world, but contribute greatly to the sustainable development of people and society.

We at the MCC Group will persistently work toward the achievement of this challenging task through innovation and global business development.