

**CSR FOCUS AREAS**

Customer Satisfaction and Quality  
Management (Car Maker/  
General Customers and Dealers)

Employee Health and Safety  
Management

Climate Change and  
GHG Management

Employee Value Creation

**Focus 05**

Integrated Environmental Management

Community Involvement  
and Development

Transparency and Business Ethics

Win-win Supply Chain  
Partnership

**Tire design/raw materials**

We conducted lifecycle assessment (LCA), which confirmed that the use phase in the product life cycle accounts for 95% of climate change impact and 85% of respiratory inorganics generation. It is essential to identify environmental impact from the development stage and conduct activities to reduce it.

**Establishing a chemical management system through process improvement**

As the Act on the Registration and Evaluation, etc. of Chemical Substances and the Chemical Control Act takes effect in Korea, greater importance is being placed on safe chemical management. As a response, in 2018 we produced a full list of the chemicals we use, based on which a chemical management process was established to allow teams responsible for procurement, raw material development, and other chemical-related areas to share the information and take appropriate measures. We have screening procedures to identify the harmfulness of newly-adopted chemicals, and in 2019 we plan to establish an IT system to comprehensively manage information on the chemicals managed in our worksites and on material safety.

**Conducting LCA**

We began conducting life-cycle assessment (LCA) on our products from the Geumsan plant in 2012 and have expanded it to plants in Hungary and China. In 2019, we will select two products from the Daejeon plant for LCA. In addition, the data accumulated over the past seven years will be utilized to quantify the results of activities to improve our products and environmental management. We will continue to devise new methods of using the data in our decision-making process.

**Tire use/disposal**

**Developing energy-saving curing technology**

Curing is the process of applying pressure to the green tire within a mold in order to establish its final form. We put considerable R&D effort into efficient use of thermal energy and enhanced product quality in the curing process. We have standardized data by identifying curing time, temperature, and pressure under high energy efficiency conditions, which allows each plant to optimize curing conditions for elevated productivity. In 2018, we studied optimum conditions for the inert gas that creates pressure for curing PCR and LTR tires in order to boost productivity and product quality.

**Developing technology with the application of sustainable materials**

Under our E-Circle program, in 2018 we grouped all of our studies on eco-friendliness into sustainable research categorized into one of four areas: use of green materials, re-use of tires, use of reclaimed materials, and minimization of environmental impact by tire products. This year, we focused on green carbon<sup>1)</sup> in an effort to increase its purity and explored reclaimed rubber with a goal of improving its processability and quality. The results were evaluated in on-site testing and production was eventually completed. Studies on the application of reclaimed materials were also performed and we were able to manufacture tires utilizing reinforced substances extracted from biomaterials as a compound. Its performance will continue to be tested and evaluated.

1) Green carbon means recycled carbon black generated from pyrolyzed end-of-life tires

**Reducing rolling resistance of tires**

Over the lifecycle of tires, their impact on the environment is the greatest during their use. In this sense, the rolling resistance and weight of tires are critical elements for reducing their environmental impact. In response, we have conducted studies on product structure, raw materials, additional substances, and manufacturing to decrease rolling resistance and consequently increase the fuel efficiency of vehicles. As a result, we improved the rolling resistance of our PCR tires supplied for the Mercedes-Benz S-Class by 24%<sup>2)</sup> compared to existing products and 18%<sup>3)</sup> for TBR tires. If we attempt to improve fuel efficiency purely by lowering resistance, it could hamper braking, handling, and wear performance. In response, we are working on the development of compounds by considering their eco-friendliness and the balance between ground contact pressure and performance.

2) PCR tires for passenger car: new products (255/50R18Y XL K117) were compared with existing product (245/55R17W K115).

3) TBR tires for trucks and buses: the comparison was made between TL10+ and TL20 (435/50R19.5).

**Manufacturing lightweight tires**

Lightweight tires contribute to reducing the use of raw materials and increasing fuel efficiency through lessened vehicle weight. To develop lighter products, we are continuing with our efforts at achieving optimal structures. For enhanced ground contact on icy roads, we have applied lightweight technology to studded tires with metal inserted in the treads. Over a total of 44 specifications, we achieved 7% weight reduction on average. This technology is being applied in regular production at our domestic and overseas plants.

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**Managing the work environment**

According to our LCA, the product manufacturing process accounts for 5% of the impact on water resource depletion and acidification and 9% of respiratory inorganics. To minimize the environmental impact of our manufacturing activities, we are managing environmental indexes, standardizing the pertinent facilities, installing high-efficiency equipment, and conducting research on reducing factory odors in cooperation with academics and in accordance with our CSR Vision 2020 Roadmap.

**Reducing waste and increasing recycling**

For the reduction of waste generated at our plants, we are steadily conducting activities to decrease product defect rate in the manufacturing process. As our product defects occurred mostly in textiles and steel cords, we focused on improving processability in calendaring. As a result, in 2018 waste dropped 3% and 2.9% year on year for the Daejeon and Geumsan plants respectively. In 2019, we will strengthen our efforts by creating a task force for reducing scrap of semi-finished products.

The Geumsan plant used to bury the sludge generated during the treatment of wastewater. Starting in 2018, however, it is providing it as supplementary fuel to companies using thermal energy. In addition, 75% of treated wastewater is being used as toilet water and cleansing water for wet scrubber. The Daejeon plant has applied wastewater for cleansing and as cleaning water for wet scrubber since 2012. In 2018, instead of discharging wastewater, the plant re-used 100% of it.

**Proactively responding to tightening environmental law**

As part of the efforts to promote Daejeon as an area with high air quality, our Daejeon plant signed an agreement with Daejeon Metropolitan City on particulate matter reduction in June 2017. In order to improve local concentrations to 18 µg/m<sup>3</sup> by 2020, the plant is operating pertinent facilities under only optimal conditions, regularly conducting water-cleaning, and implementing an odd-even traffic rationing policy.

The plant is making remarkable efforts to minimize its environmental impact on the surrounding area by installing high-efficiency environmental facilities. Still, local residents are calling for improvement measures. Under contracts with local universities, we are analyzing the characteristics of factory odors and the results of pertinent projects to effectively ease any smells.

To maintain the efficiency of combustion equipment at the plant, its key components were replaced. As a result, its efficiency has increased over 90%. The plant will measure odors and conduct BET<sup>1)</sup> and TGA<sup>2)</sup> on a monthly basis to identify optimal timing for the part replacement and maintenance of it.

Outdated low-efficiency equipment is being replaced with upgrades. The Geumsan plant increased its efficiency at removing odors and dust by 50% by installing diffraction-type wet scrubber. Moreover, the replacement facility is 30% smaller, which will reduce waste at the time of its disposal. Going forward, we will improve the work environment by upgrading local ventilation systems with lower dust-collection performance, shielding conveyor lines, and enhancing curved portions of ducts while increasing efficiency in removing pollutants.

1) BET: Brunauer Emmett Teller  
2) TGA: Thermogravimetric Analysis

**Achieving shared growth with local communities**

Since the establishment of the Donggrami consultation group in 2016, quarterly meetings have been held at the Daejeon plant with participants from local communities, universities, environmental organizations, and the city council. The plant describes the status of pollutant discharges and management and offers a factory tour. Opinions and advice from local residents and environmental experts at the meetings allow the plant to identify points for improvement. The group also serves as a communication channel to address any local misunderstandings about the company.

To prevent chemical accidents and ensure the safety and health of local residents, the Geumsan plant serves as a leader of the Chemical Safety Community consisting of six companies in Geumsan and Nonsan. At the Geumsan Environmental Management Committee, opinions from participants, including local residents, experts and government officers, are presented and collected based upon which the plant is working on key issues and formulating follow-up measures.