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Circular economy for plastics

Fraunhofer, SABIC, and Procter & Gamble join forces in closed-loop recycling pilot project for single-use facemasks

The Fraunhofer Cluster of Excellence Circular Plastics Economy CCPE and its Institute for Environmental, Safety and Energy Technology UMSICHT have developed an advanced recycling process for used plastics. The pilot project with SABIC and Procter & Gamble serves to demonstrate the feasibility of closed-loop recycling for single-use facemasks.

Fraunhofer Institute UMSICHT, SABIC and Procter & Gamble (P&G) today announced their collaboration in an innovative circular economy pilot project which aimed to demonstrate the feasibility of closed-loop recycling of single-use facemasks.

Due to COVID-19, use of billions of disposable facemasks is raising environmental concerns especially when they are thoughtlessly discarded in public spaces, including - parks, open-air venues and beaches. Apart from the challenge of dealing with such huge volumes of essential personal healthcare items in a sustainable way, simply throwing the used masks away for disposal on landfill sites or in incineration plants represents a loss of valuable feedstock for new material.

“Recognizing the challenge, we set out to explore how used facemasks could potentially be returned into the value chain of new facemask production,” says Dr. Peter Dziezok, Director R&D Open Innovation at P&G. “But creating a true circular solution from both a sustainable and an economically feasible perspective takes partners. Therefore, we teamed up with Fraunhofer CCPE and Fraunhofer UMSICHT’s expert scientists and SABIC’s T&I specialists to investigate potential solutions.”

As part of the pilot, P&G collected used facemasks worn by employees or given to visitors at its manufacturing and research sites in Germany. Although those masks are always disposed of responsibly, there was no ideal route in place to recycle them efficiently. To help demonstrate a potential step change in this scenario, special collection bins were set up, and the collected used masks were sent to Fraunhofer for further processing in a dedicated research pyrolysis plant.

Editorial Notes

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“A single-use medical product such as a face mask has high hygiene requirements, both in terms of disposal and production. Mechanical recycling, would have not done the job” explains Dr. Alexander Hofmann, Head of Department Recycling Management at Fraunhofer UMSICHT. “In our solution, therefore, the masks were first automatically shredded and then thermochemically converted to pyrolysis oil. Pyrolysis breaks the plastic down into molecular fragments under pressure and heat, which will also destroy any residual pollutants or pathogens, such as the Coronavirus. In this way it is possible to produce feedstock for new plastics in virgin quality that can also meet the requirements for medical products” adds Hofmann, who is also Head of Research Department “Advanced Recycling” at Fraunhofer CCPE.

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The pyrolysis oil was then sent to SABIC to be used as feedstock for the production of new PP resin. The resins were produced using the widely recognized principle of mass balance to combine the alternative feedstock with fossil-based feedstock in the production process. Mass balance is considered a crucial bridge between today’s linear economy and the more sustainable circular economy of the future.

“The high-quality circular PP polymer obtained in this pilot clearly demonstrates that closed-loop recycling is achievable through active collaboration of players from across the value chain,” emphasizes Mark Vester, Global Circular Economy Leader at SABIC. “The circular material is part of our TRUCIRCLE™ portfolio, aimed at preventing valuable used plastic from becoming waste and at mitigating the depletion of fossil resources.”

Finally, to close the loop, the PP polymer was supplied to P&G, where it was processed into non-woven fibers material. “This pilot project has helped us to assess if the close loop approach could work for hygienic and medical grade plastics.” says Hansjörg Reick, P&G Senior Director Open Innovation. “Of course, further work is needed but the results so far have been very encouraging” . .

The entire closed loop pilot project from facemask collection to production was developed and implemented within only seven months. The transferability of advanced recycling to other feedstocks and chemical products is being further researched at Fraunhofer CCPE.

About Fraunhofer CCPE and Fraunhofer UMSICHT

The transformation from a linear to a circular plastics economy can only succeed with a multi-stakeholder approach. The Fraunhofer Cluster of Excellence Circular Plastics Economy CCPE combines the competencies of six institutes of the Fraunhofer-Gesellschaft and cooperates closely with partners from industry. Together, we work on systemic, technical and social innovations and keep an eye on the entire life cycle of plastic products. Read more about CCPE: www.ccpe.fraunhofer.de.

Fraunhofer Institute for Environmental, Safety and Energy Technology UMSICHT is a pioneer in sustainable energy and raw materials management by supplying and transferring scientific results into companies, society and politics. Together with partners, the dedicated UMSICHT team researches and develops sustainable products, processes and services which inspire. Learn more at www.umsicht.fraunhofer.de.

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About SABIC

SABIC is a global diversified chemicals company, headquartered in Riyadh, Saudi Arabia. It manufactures on a global scale in the Americas, Europe, Middle East and Asia Pacific, making distinctly different kinds of products: chemicals, commodity and high performance plastics, agri-nutrients and metals.

SABIC supports its customers by identifying and developing opportunities in key end-use applications such as construction, medical devices, packaging, agri-nutrients, electrical and electronics, transportation and clean energy. Production in 2020 was 60.8 million metric tons.

The company has more than 32,000 employees worldwide and operates in around 50 countries. Fostering innovation and a spirit of ingenuity, SABIC has 9,946 global patent filings, and has significant research resources with innovation hubs in five key geographies – USA, Europe, Middle East, South Asia and North Asia.

SABIC's continuing TRUCIRCLE program comprises design for recyclability services, mechanically recycled materials, certified circular products from chemical recycling of used plastics, and certified renewable polymers from bio-based feedstock. Read more [here](#).

About Procter & Gamble

P&G serves consumers around the world with one of the strongest portfolios of trusted, quality, leadership brands, including Always®, Ambi Pur®, Ariel®, Bounty®, Charmin®, Crest®, Dawn®, Downy®, Fairy®, Febreze®, Gain®, Gillette®, Head & Shoulders®, Lenor®, Olay®, Oral-B®, Pampers®, Pantene®, SK-II®, Tide®, Vicks®, and Whisper®. The P&G community includes operations in approximately 70 countries worldwide. Please visit <http://www.pg.com> for the latest news and information about P&G and its brands.



Picture 1: In an innovative circular economy pilot project, Fraunhofer, SABIC and Procter & Gamble have demonstrated the feasibility of closing the loop on facemasks to help reduce plastic waste and mitigate fossil resources depletion.

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