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SmellStop – Odour reduction as a key technology for the use of recycled polyethylene

Resource-efficient Circular Economy – Plastic Recycling Technologies (KuRT)

The "SmellStop" joint project is pursuing a holistic approach to reducing the odour of polyethylene film recycles through process engineering. This is because the strong odour is one of the biggest obstacles to the widespread use of these post-consumer recycles in packaging films. The "SmellStop" innovation covers the entire material cycle – from pre-treatment through to film production. It also identifies odour-causing substances so that they can be avoided right from the packaging design stage.

The project is part of the funding initiative "Resource-efficient Circular Economy – Plastic Recycling Technologies (KuRT)". "KuRT" is part of the BMBF research concept "Resource-efficient Circular Economy" and is aimed at high-quality recycling of plastics.

Use of recyclates in new packaging

The packaging sector processes the largest amount of plastic of any industrial sector. Compared to durable products in the construction and automotive sectors, packaging such as films, cups and bottles have a short lifespan. Currently, most plastic packaging is made from fossil-based virgin materials. This linear use of plastic products leads to high greenhouse gas emissions and significant environmental pollution. New laws and regulations in Germany and the EU require increased use of recyclates in new packaging. Until now, the majority of recyclates have been used for lower value products or thermally utilised.

During the conception phase of the project, the "SmellStop" research team identified the strong odour of recyclates as a major obstacle to the widespread use of high levels of recyclates in packaging products, especially during processing. "SmellStop" aims to minimize the odour of PCR materials to increase product acceptance and achieve a sustainable, resource-efficient circular economy in the field of lightweight packaging.

Reducing odour via process engineering

The aim of the project is to reduce the odour activity of the recyclates via process engineering as well as preventing it in the long term by specifically adapting the printing inks. The odour reduction of the post-consumer polyethylene films is planned in several steps:

In "SmellStop" the use of recycled materials for films is to be increased.

thermal pre-treatment in the infrared rotary drum; targeted degassing in the twin-screw extruder; decontamination under the influence of temperature and water vapour, and optimised process parameters during film extrusion.

The odour is analysed at all stages of the process using gas chromatography-mass spectrometry (GC-MS) to identify the odour-causing substances and to avoid them in the production of the primary packaging. Targeted contamination of virgin material will also be used to draw conclusions about odour-active compounds in recycled materials. The focus is primarily on printing inks, adhesives, and biotic contaminants. The GC-MS analysis is further used to calibrate mobile sensors that can detect odours during production operations, and in the product.

Potential for a truly circular economy

The results have a major impact on the circular economy of lightweight packaging. By establishing the developed processes, recyclates can be used in a variety of products.

The Institute of Plastics Processing (IKV) at RWTH Aachen University will initially carry out laboratory-scale processing tests and GC-MS analyses of the odour-causing substances. In scale-up trials, the companies Coperion GmbH (regranulation), Kreyenborg GmbH & Co. KG (thermal pre-treatment in an infrared rotary kiln), Reifenhäuser Cast Sheet Coating GmbH & Co. KG (flat film production) and RKW SE (blown film production) validate the results on an industrial scale. Siegwerk Druckfarben AG & Co. KGaA supply contaminants in the form of printing inks and adhesives and continuously optimizes the formulations to achieve low odour levels in the recycling process. 3S GmbH optimizes and calibrate the sensors for the inline detection of odours in recyclate processing, enabling the quick and easy quantification of odours during processing and in the product.

In total, the entire odour reduction process will be performed twice, with the odour measurement and odour reduction strategies being further optimised in the second run.

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SmellStop: Odour reduction as a key technology for the use of recycled post-consumer polyethylene

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