

MaReK – Improving Plastic Recycling with Fluorescent Markers

Plastics in the Environment – Sources · Sinks · Solutions

In Germany alone, about three million tons of packaging waste are generated each year and the number continues to grow. This waste is produced daily in every household, usually collected in yellow bags or bins, and then picked up. How can high-quality secondary raw materials be obtained from this waste? Is it possible to produce high-grade new packaging from used ones? Suitable technologies for sorting plastic waste are a prerequisite for such material recycling. The partners in the joint research project MareK are focusing on special fluorescent markers for this purpose. When integrated into packaging, these markers should enable the sorting of plastics from waste by type.

Markers Promote Material Recycling

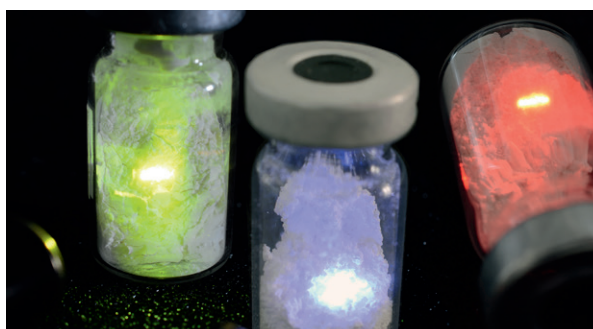
The collection, sorting and recycling of sales packaging from the household sector – also known as the post-consumer sector – has been regulated in Germany since 1991 by the Packaging Ordinance. Starting in 2019, a new packaging act will apply. Accordingly, 63% of plastic packaging must be recycled from 2022 onward so that it can be processed directly into new, high-quality products. At present, many packages are still being thermally recycled, i.e. they are being incinerated. From the perspective of climate policy, it would be desirable to expand the recycling of packaging plastics, as this can reduce CO₂ emissions. Additionally, it can help to secure raw materials.

The currently used sorting technologies are not able to keep up with the further development of packaging and materials technology in material recycling. The reason is that the quality requirements for secondary raw materials obtained from recycling – also known as recyclates – are increasing, for example to enable reuse in the packaging sector.

The joint research project MaReK is therefore pursuing a new approach: this should allow for sorting products or recyclable materials independently of their physical properties. The basis of this new sorting system is Tracer-Based Sorting (TBS). This technology uses inorganic phosphors or fluorescent markers to separate plastics much more accurately. This means that in future developments it will not only be possible to differentiate according to different types of plastic, but also according to other packaging properties such as contents or multilayer systems. Thus, with the current collection systems in Germany, even more waste could be separated and recycled to high-quality materials.

Technology Development for Pilot Use

The project consortium, which consists of five companies and research institutes, is initially examining marker materials for their suitability in plastic packaging and then further developing them. This is followed by the pilot application of the new system under technical conditions. The aim of the joint research project is to establish a marker-based sorting and recycling system that includes package labelling, an appropriate sorting process and high-quality material recycling to obtain secondary raw materials. In the first step, the project partners affix the marking material to the packaging – in the plastic itself or on the respective label. This marker has fluorescent properties and illuminates under a certain light when sorting. The sorting plant, which is being set up in Freiburg, reacts to this and sorts out the marked objects. Thus, regardless of shape, color or condition, plastics can be separated and recycled in a targeted manner.



Fluorescent markers should enable improved sorting of plastic packaging.

Thus, food packaging, for example, can be sorted and reused for the same purpose. It will also be possible, for the first time, to distinguish between different types of the same plastic. Secondary raw materials obtained by recycling will then also be suitable for applications and sales markets in which only new plastics have hitherto been used. In this way, TBS technology reduces the consumption of primary raw materials and protects the environment.

Focus on Entire Value Chain

MaReK not only focuses on the technical core, but on the entire value chain of the packaging life cycle. This means that investigations into suitable marking substances and application areas of the secondary raw materials take into account economic and ecological aspects. In order to assess the market opportunities for the marker-based sorting technology, the project partners are analyzing the associated energy and material flows and evaluating potential environmental impacts. Together with various stakeholders from business, associations, society and politics, approaches are being developed for new ways of dealing with packaging and improving waste management. The goal is to significantly increase the mechanical recycling of packaging in order to secure raw materials and protect the environment. Apart from the the packaging industry, additional sectors are being addressed for the reuse of recycled materials.



A specific IR laser pointer makes the fluorescence visible. The marker can be inserted in the label (left) or in the plastic itself (right).

Research Focus

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Contact

Hochschule Pforzheim, Institut für Industrial Ecology (INEC)
Prof. Dr.-Ing. Claus Lang-Koetz und
Prof. Dr.-Ing. Jörg Woidasky,
Tiefenbronner Straße 65
75175 Pforzheim
Phone: +49 (0) 7231/28-6427, -6489
E-mail: claus.lang-koetz@hs-pforzheim.de,
joerg.woidasky@hs-pforzheim.de

Project Partners

Der Grüne Punkt – Duales System Deutschland GmbH, Köln
Karlsruher Institut für Technologie (KIT), Institut für Mikrostrukturtechnologie, Karlsruhe
Polysecure GmbH, Freiburg
Werner & Mertz GmbH, Mainz

Website

www.hs-pforzheim.de/marek

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