An Initiative of the German Federal Ministry of Education and Research

Plastics in the Environment

sources • sinks • solutions

Tracer-Based Sorting with Fluorescent Tracers

Efficient and flexible sorting of plastic packaging

Dual systems collect lightweight packaging, primarily consisting of plastic, throughout Germany. Recycling rates for this kind of packaging will have to increase significantly in the next few years.

The German Packaging Regulation calls for a significant increase in recycling rates for plastics. Currently, plastics cannot usually be sorted satisfactorily by type. Therefore, the quality of the recyclates produced is often insufficient. In the sense of a circular economy, the detection, and subsequent sorting and recycling, of plastic packaging can be significantly improved by employing a fluorescent tracer (marker) system.

Fluorescent tracers enable high-quality plastics recycling and transparency of material flows

„Tracer-based sorting" (TBS) uses anorganic tracer substances that possess rapidly measurable fluorescent properties. Very small amounts of these fluorescent tracers are applied to packaging or labels.
One advantage of TBS over existing sorting techniques is that the tracers are independent of the packaging material. This means that when sorting plastics, not only the types of plastic (e.g. PE, PP, PS, PET) can be reliably differentiated, but also individual kinds of plastic (e.g. polymers for injection molding or blow molding). It is also possible to separate packages made of identical packaging materials according to their contents: TBS can be used, for example, to distinguish food from non-food packaging.

„The use of fluorescent tracers in waste management holds the potential for radical innovations in sorting and recycling technology."

Prof. Dr. Claus Lang-Koetz
Pforzheim University

Fluorescent tracers can be used without changing the manufacturing process of the packaging

Fluorescent tracers are inert anorganic materials that can be illuminated exclusively in technical environments (e.g. by infrared excitation). Similar to pigments and other additives, they can be used as a powdered material in packaging or label production with no need for process modification. When used packaging is sorted, the tracers provide allocation information for the appropriate recycling path.

TBS marking on packaging labels (in the square with the black border) is only visible with specific excitiation.

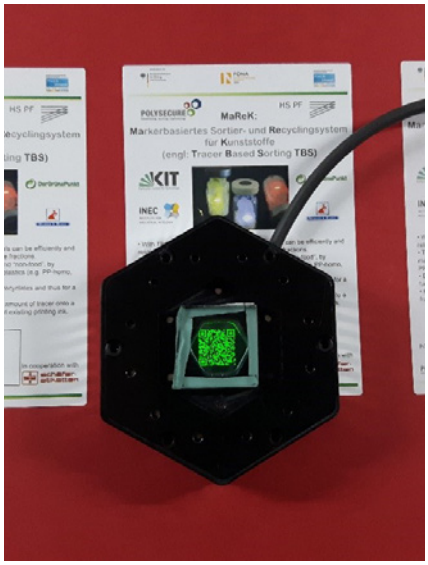

Photo: @ J. Woidasky / HS Pforzheim

MaReK – Marker-based Sorting and Recycling System for Plastic Packaging

In the BMBF project MaReK, the TBS approach was further developed for waste management applications and evaluated within the framework of a life cycle assessment. Further project results include validated labeling approaches for plastic packaging and a demonstration facility for TBS sorting.

In addition, several new marker substances and extensive sorting results for lightweight packaging (including a photo database of 27,000 individual packages) were prepared. On this basis, business models were developed and the implementation process for TBS as an environmentally-relevant innovation was investigated in detail and with a focus on transfer.

Fluorescence tracers are detectable in minute concentrations

Fluorescent tracers have been developed for waste management applications that can be quickly and reliably detected, even at very low concentrations. These multi-colored tracers are used both alone or in combination, thus making it possible to distinguish between different types of recycling options. The marking works independently of the shape, design and flexibility of the packaging material. For example, even problematic black flexible plastic packaging could be sorted with a high detection rate.

Plastic bales result from current sorting methods for plastic packaging. This is insufficient for the manufacture of higher-quality recyclates.

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Fluorescent tracers can be employed in different colors or color combinations, depending on the application.

Photo: Polysecure GmbH 2020

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Authors
Woidasky, Jörg; Lang-Koetz, Claus; Gasde, Johannes; Moesslein, Jochen

Institution
Pforzheim University, Institute for Industrial Ecology (INEC); Polysecure GmbH; Der Grüne Punkt – Duales System Deutschland GmbH; Werner & Mertz GmbH; Karlsruhe Institute of Technology, Institute for Microstructure Technology; Umwelttechnik BW GmbH (associated)

Contact
claus.lang-koetz@hs-pforzheim.de
joerg.woidasky@hs-pforzheim.de

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Lena Aebli, Ecologic Institute

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www.bmbf-plastik.de/en
@plastik_environment

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