Joint News Release

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Collaboration project shows: multi-layer packaging can be separated and recycled on an industrial scale

- **Collaboration project gives proof of concept for closed recycling loop for PET-based multi-layer packaging**
- **Recycling process can be implemented directly using the existing infrastructure**
- **Multi-layer packaging meets requirements for the recyclability of packaging according to the Packaging and Packaging Waste Regulation (PPWR)**

Multi-layer films are used for a wide range of packaging materials, particularly in the food industry. The European Green Deal stipulates that packaging must be recyclable to a large extent by 2030. In the future, the details will be regulated by the Packaging and Packaging Waste Regulation (PPWR). A draft regulation was presented in November 2022. However, up until this point, the recycling of multi-layer film has proven difficult because the film is made of different materials.

A collaboration project involving the companies BASF, Krones, SÜDPACK, and TOMRA has now demonstrated that it is possible to separate PET/PE multi-layer packaging into its individual components and return them to the materials cycle as raw materials. During the first industrial trial conducted at a Krones pilot plant in Flensburg, the partners were able to completely separate as much as 69 percent of the PET/PE components and partially separate another twelve percent. This approach is special as it uses the existing infrastructure only to recycle the multi-layer packaging.

BASF SE
67056 Ludwigshafen
www.basf.com
presse.kontakt@basf.com

The basis for success: a partnership involving all members of the value-added chain

Decisive for the success of the project team were the collaborative efforts of the partners BASF, Krones, SÜDPACK, and TOMRA. The companies combined their know-how in order to close the loop.

The first phase of the project was initiated in early 2021 when TOMRA conducted the first sorting trials with PET/PE trays. These trays had been manufactured by SÜDPACK using a “debonding adhesive” developed by BASF. SÜDPACK, a leading manufacturer of high-performance films for the packaging of food, non-food and medical products, has committed to becoming a zero-waste company. “Our contribution to the collaboration project was our long-standing expertise in lamination. Using our expert know-how in water-based lamination, we were able to develop multi-layer films that can be separated by caustic hot washing,” says Carolin Grimbacher, Managing Partner at SÜDPACK who is also responsible for R&D.

To close the materials cycle, the recyclable multi-layer films first have to be sorted out of the waste stream. The main determinant of success for this step was the ability of the AUTOSORT™ technology of TOMRA to separate the recyclable PET/PE trays from non-recyclable trays. “Our NIR technology made this possible because it is able to detect the multi-layer PET trays containing the adhesive of BASF. With this it’s possible to sort the trays out of the waste stream and add them to the recyclables,” David Rüßmann, Manager Special Projects, explains.

Krones, a company that, among other things, develops plastics recycling systems, joined the project team in July 2022. At one of the company’s pilot plants, trials were carried out to test whether it’s possible to separate laminated PET/PE films to their single layers in an industrial scale. A standard hot washing process commonly used for PET recycling was applied sucessfully and as a result, the separated PET and PE can be re-used as monomaterials. “At our facility, we proved that the delamination of multi-layer films works. However, the separation of the films can still be improved by optimizing individual process parameters as well as, for example, the particle size of the flakes,” Thore Lucks, Head of Techology Recycling Solutions at Krones, explains.

The process of separating the PET and PE components of the film is based on adhesives that were specifically developed for this purpose. These adhesives are

used during the lamination of multi-layer films to join different functional materials. The lamination adhesive must have the best possible adhesive strength when required, but still makes it possible to easily separate the two films when it comes time to recycle. “Our water-based Epotal® adhesives already yielded very good results when separating multi-layer packaging in the laboratory. We consider it a huge success that we were able to completely separate 69 percent of the packaging during our very first industrial trial. We are confident that we will be able to further increase this figure by optimizing our debonding adhesive,” Kresimir Cule, Commercial Marketing Industrial Adhesives, BASF SE, states.

Outlook: Further development of the lamination adhesive used

The project is still ongoing. By adjusting various parameters of the recycling process and by further developing the lamination adhesive used, the project partners see additional opportunities for improving the recycling rate for plastics. The quality of the recycled materials is a major focus. The aim is to be able to re-use the PET for the manufacture of food packaging, while the PE fraction will be used as a raw material to make new packaging for the non-food industry. Studies on this will be carried out shortly.

Press contact

BASF
Friederike Stausberg
Mobil: +49 174 3493641
E-mail: friederike.stausberg@basf.com

KRONES
Peter Moertl
Telephone: +49 9401 70-5924
Mobile: +49 151 74303736
E-mail: peter.moertl@krones.com

SÜDPACK
Cordula Schmidt
Telephone: +49 7352 925 1869
Mobile: + 49 151 640 697 13
E-mail: Cordula.Schmidt@suedpack.com

TOMRA
Michèle Wiemer
Telephone: +49 2630 9150453
Mobile: +49 172 4549309
E-mail: michele.wiemer@tomra.com

About BASF

At BASF, we create chemistry for a sustainable future. We combine economic success with environmental protection and social responsibility. More than 111,000 employees in the BASF Group contribute to the success of our customers in nearly all sectors and almost every country in the world. Our portfolio comprises six segments: Chemicals, Materials, Industrial Solutions, Surface Technologies, Nutrition & Care and Agricultural Solutions. BASF generated sales of €87.3 billion in 2022. BASF shares are traded on the stock exchange in Frankfurt (BAS) and as American Depositary Receipts (BASFY) in the United States. Further information at www.basf.com.

About Krones

The Krones Group, headquartered in Neutraubling, Germany, plans, develops and manufactures machines and complete lines for the fields of process, filling and packaging technology. And Krones also offers a fit-for-purpose solution for bottle-to-bottle recycling of PET containers. The product portfolio is rounded off by numerous products and services from Krones' subsidiaries, themed around digitalisation, for example, digital container decoration and intralogistics. Every day, millions of bottles, cans, and special-shaped containers are handled on lines from Krones, particularly in breweries, the soft-drinks sector and at producers of still or sparkling wines, and spirits, but also in the food and luxury-goods industries, plus the chemical, cosmetics and pharmaceutical sectors. Worldwide, Krones employs around 17,200 people. Consolidated sales in 2022 totalled 4.209 billion euros. Around 90 per cent of its products are sold abroad. The group includes not only Krones AG (listed on the stock exchange), but also more than 100 subsidiaries and further sales and service companies worldwide. Further information at www.krones.com.

About SÜDPACK

SÜDPACK is a leading manufacturer of high-performance films and packaging materials for the food, non-food and medical goods industries. Our solutions ensure maximum product protection as well as additional pioneering functionality with minimum material input. The family business, which was founded by Alfred Remmele in 1964, is head-quartered in Ochsenhausen. The production sites in Germany, France, Poland, Switzerland, the Netherlands and the USA are equipped with the latest plant technology and manufacture to the highest standards, including the capacity to operate under clean room conditions. The global sales and service network ensures a high degree of proximity to the customer and comprehensive application technology support in more than 70 countries.

With its state-of-the-art Development and Application Center at its headquarters in Ochsenhausen, the innovation-oriented company offers its customers an optimal platform for carrying out application tests and for developing individual and tailor-made solutions. SÜDPACK is committed to sustainable development and fulfills its responsibility as an employer and towards society, the environment, and its customers by developing packaging solutions that are highly efficient and sustainable. Further information at www.suedpack.com.

About TOMRA Recycling Sorting

TOMRA Recycling Sorting designs and manufactures sensor-based sorting technologies for the recycling and waste management industry. More than 8,000 systems are installed in 100 countries around the world. Responsible for the development of the world's first infrared sensor for waste recycling applications, TOMRA Recycling Sorting is a pioneer in the field and through its sensors recovers high-purity fractions from the waste stream that maximize yield and customer benefits.

TOMRA Recycling Sorting is part of TOMRA Recycling, which develops sensor-based sorting and process control systems for the food, mining and other industries. TOMRA Recycling is owned by Norway's TOMRA Systems ASA, which was founded in 1972 and is publicly listed on the Oslo Stock Exchange. The Group employs ~4,600 people globally and had total revenues of ~1.1B Euro in 2021. Further information at www.tomra.com/recycling.