CIRCPACK tests the sortability and recyclability of packaging under real-world conditions using RFID – a milestone for the data-driven circular economy

Track. Trace. Recycle.

CIRCPACK by Veolia and TURCK use RFID technology to make the sortability of packaging measurable – and provide manufacturers with valuable data for sustainable packaging development

"It all ends up in the incinerator anyway." This and similar statements are often heard when it comes to waste separation. First of all, let's be clear: No, it doesn't – at least not all of it. Packaging waste, which has been collected by the Dual Systems in Germany since 1993, ends up in waste sorting plants such as the one in Ochtendung near Koblenz. The waste management company Veolia sorts 90,000 tons of packaging waste every year in this highly automated sorting plant. Packaging that citizens dispose of in yellow bags and bins is separated into a total of 13 different material streams, including main streams of polypropylene (PP) polyethylene (PE) and polyethylenterephthalat (PET) in the form of film and rigid packaging, as well as metals, and paper.

Automated precision: How packaging is sorted in Ochtendung

Some people may be surprised to learn that a lot of high-tech is involved in this process. Only a few people are needed to operate the plant. In the first sorting step, rotating drum screens separate packaging components from the main stream according to their size. At the end, all material that falls through the last

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David Wardle | CIRCPACK by Veolia

three-by-three-centimeter screen openings is not sorted further and is sent for thermal recycling, i.e., incinerated. However, this is only a small fraction of the total packaging waste. In the further sorting process, near-infrared sensors (NIR) recognize different types of plastic and fiber based packaging. Magnets and Eddy Current remove ferrous and non-ferrous metals, and so-called windsifters remove light films by suction.

CIRCPACK by Veolia aims to steadily increase the proportion of recyclable packaging. Legislation and regulation, particularly at EU level, are following a similar path. The Packaging and Packaging Waste Regulation (PPWR) has been in force since February 2025 and aims to reduce waste generation through various measures – on the one hand through recyclable materials and on the other through waste prevention by means of a reusable obligation in certain areas.

Legislative tailwind: EU makes recycling mandatory
To achieve these goals, waste management companies such as CIRCPACK are testing the recyclability of packaging for packaging manufacturers. This is because the PPWR stipulates that from 2030, only packaging that meets certain recyclability criteria may be placed on the market. The exact details of these criteria still need to be defined in guidelines. Veolia already offers packaging manufacturers and other customers the opportunity to test new packaging for automatic sortability through its subsidiary CIRCPACK.

CIRCPACK tests and certifies packaging
David Wardle is one of the people responsible for these tests. The Environmental engineer has been part of the team at CIRCPACK that carries out these tests since 2021. "Brand owners and packaging manufacturers come to us because they want to have their existing and new packaging tested for sortability. After testing, we can verify sortability and recyclability and couple this with a certification. The packaging manufacturers can then in turn prove to their customers, such as

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At Veolia's highly automated sorting plant in Ochtendung, Germany, around 90,000 tons of packaging waste are separated into 13 different waste streams. To test the sortability of new packaging under real-life conditions, CIRCPACK by Veolia relies on an RFID-based track-and-trace system from Turck Vilant Systems. The solution tracks RFID-tagged test packaging in the regular waste stream – from input to final sorting. The technology provides objective, reliable data on sortability and supports manufacturers in designing recyclable packaging. The project is considered a pioneer in the digitalization of the circular economy and could be expanded to other plants and countries in the future.

Robust and versatile: Up to four external antennas can be connected to TURCK's IP67 UHF RFID reader Q180

The external antenna of the TURCK RFID system reliably detects the test packaging on the conveyor belt

consumer goods manufacturers, that their packaging is recyclable. That's a strong argument," explains David Wardle.

Manual tests very time-consuming

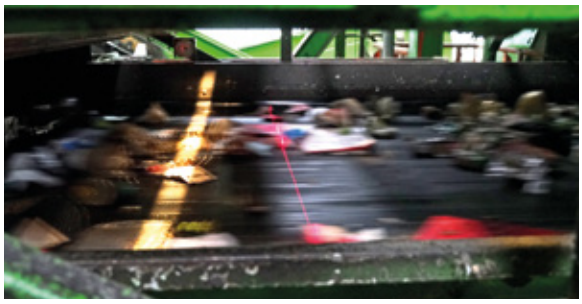
Before RFID was introduced, complete packaging sorting tests were very time-consuming. While packaging can be tested statically and dynamically, the complete sorting test proves more difficult in operation. The final conveyor belt for the sorted waste streams is operated by manual sorters before the waste enters the bunker to be pressed into bales. These employees manually sort out unwanted or incorrectly sorted packaging from the respective stream. Before conducting a complete sorting test, Wardle showed the manual sorters the packaging so that they could remove it from the respective conveyor belt if it was identified as faulty. To avoid confusion among employees and ensure high-quality results, this could only be done for one piece of packaging at a time. Due to the high demand for sorting tests at CIRCPACK, this process was very time-consuming and required the involvement of many employees.

Automated RFID-based tests improve accuracy

David Wardle was looking for a solution that would automatically track the path of the packages through the sorting system, thereby providing increasingly reliable data. His idea was to use RFID. "I had the idea, but not the technology," recalls Wardle. "So we looked for a partner who not only knew RFID, but could also make this technology work reliably in a harsh environment like a sorting plant." In his search for the right RFID solution, he turned to tag manufacturer Avery Dennison.

TURCK as technology partner

Through its contact with Avery Dennison, CIRCPACK came into contact with TURCK Vilant Systems – and was



Sorting machines also use near-field infrared sensors to distinguish between different packaging materials

quickly convinced. "TURCK not only had the experience, but also the professionalism we needed," says Wardle. "TURCK was able to provide us with a system that works – and that we can continue to develop." Together, they developed a setup that now consists of 9 readers and 32 antennas distributed throughout the entire sorting plant. The packaging to be tested is tagged with RFID tags, fed into the normal waste stream, and goes through the process like any other packaging, simulating real-world conditions as intended.

Test system under real conditions

"We didn't want a laboratory situation," emphasizes David Wardle. "We wanted real conditions – with wet, dirty, mixed waste." That's exactly what the system offers. The RFID tags make it possible to track every package tested – from the moment it enters the sorting process to the moment it ends up in one of the many material waste streams. "With strategically positioned antennas, we can see exactly which path a piece of packaging takes through the plant, whether it has been detected by the appropriate detection units, whether it has been sorted out – and if so, into which stream. That's a huge step forward."

ID technology meets reality

"RFID read accuracy has helped us gain a very accurate understanding of the actual sortability of a test

Search image: Test packaging with an orange banderole and RFID tag is hidden in the waste stream

Thanks to its high IP67 protection rating, TURCK's robust Q180 RFID reader performs reliably even in the harshest environments

package," says Wardle. " While there are certain specifics of packaging waste that were challenging for testing, we have improved the process step by step. We are always learning; sometimes we have to adjust the antenna effectiveness, sometimes change the position. The weather also plays a role, for example when the waste is wet. But that's part of it. It's a learning system." And TURCK Vilant Systems can also still learn in the plant.

Transparency that builds trust

For CIRCPACK's customers – mainly large brand manufacturers – the system is a groundbreaking innovation. It demonstrates their commitment to improving the recyclability of packaging. By introducing such a system, they can maintain high standards while meeting increased demand more efficiently and with even greater accuracy. The results of the tests are incorporated into certifications, for example from RecyClass. They help manufacturers improve their packaging and meet legal requirements. "The system creates trust and shows where improvements can still be made in packaging design."

Scaling and further development

The system in Ochtendung is unique so far – but that is set to change. "We want to roll it out to other plants and other countries," says the environmental engineer. "And we want to develop it further with optimized tags, higher reading accuracy, and more automation. In the future, manufacturers will have to prove that their packaging is recyclable and, in particular, sortable. Our system provides this proof – objectively, comprehensively, and reliably."

Conclusion: A project with appeal – and technological foresight

What began as an idea is now a functioning test system under real conditions – and a showcase project for the entire industry. "We have proven that technological innovations can pave the way for a more circular economy," summarizes CIRCPACK's test specialist David Wardle. "With TURCK, we have found a partner who not only delivers, but also thinks along with us – and makes real change possible with technology."

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