'With PLA, you create additional end-of-life options. You can compost it and recycle it.'

Thijs Rodenburg (left) and Niels L'Abée, "It is a unique development: an injection molding container that is transparent made of PLA."

Thin-walled injection molding with PLA

Biodegradable, recyclable, food safe and even transparent. Until now, it was an impossible combination for thin-walled PLA injection molding. Researchers from Wageningen Food & Biobased Research, a research institute within Wageningen University & Research, SFA Packaging and Rodenburg Biopolymers have succeeded and have developed a biodegradable material that meets all these requirements and is ready for production.

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“The thin-walled injection molding of PLA is difficult because it does not flow properly in the mold,” says Niels L'Abée of SFA Packaging. “PP turns into a very thin liquid under high injection speeds, whereas PLA retains almost the same viscosity. This so-called 'shear thinning effect', i.e. the thinness of the liquid under high injection speeds, is necessary to make injection molds with thin walls. The better a plastic flows, the thinner you can make a tray. We have developed and patented an additive that makes PLA just as fluid as PP and also retains the desired mechanical properties. This makes it possible to develop all kinds of packaging, such as tomato buckets, salad containers, butter tubs, and so on. It is even possible to make fully biobased IML (printed packaging).”

New possibilities PLA

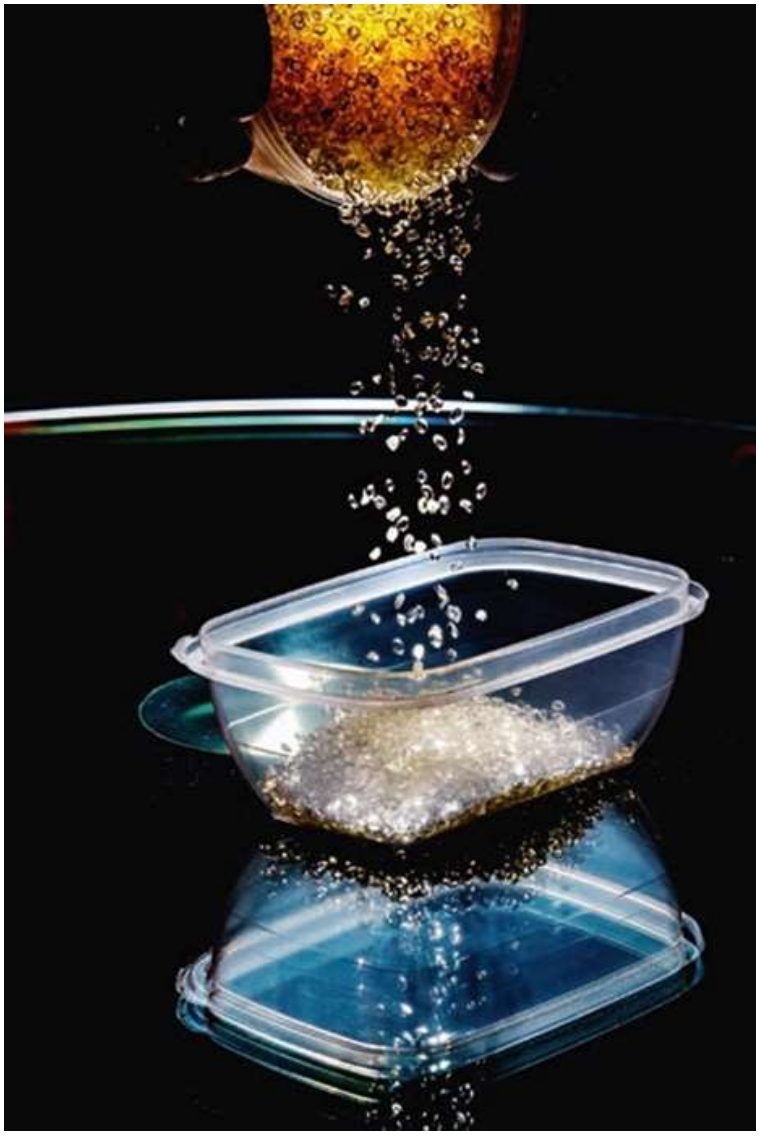
At a seminar in 2016, Niels L'Abée got into a conversation with researchers from Wageningen University & Research who were investigating the possibilities of PLA injection molded packaging. “They wanted to develop a biobased packaging that, at a competitive price, emits about half as much CO2 per unit to material and production as conventional plastics,” says L'Abée.

Besides SFA and Wageningen Food & Biobased Research, Rodenburg Biopolymers also became a partner in the project. “The research institute contributes its knowledge and expertise about biobased materials; we provide knowledge about the market and the production process.” The project is partly funded through Top Sector Agri&Food (TKI).

Search for new formula

The new PLA formula was discovered after searching and testing for a long time, says Gerald Schennink, Project Manager at Wageningen Food & Biobased Research. “It is a combination of the addition of two additives, which, as it turned out, worked. It involves a natural oil-based raw material together with a second biopolymer. Together, they ensure that the viscosity during injection molding decreases sharply. It wasn’t easy. The interaction between two additives often leads to negative results, but these two go together perfectly, even reinforcing each other.”

We are talking about some 10 to 30 percent additive that is, of course, also completely biodegradable. The PLA currently used for the research is made from corn starch. “The land used to grow raw materials for bioplastics is very low, but you could also get raw materials from side-streams.”



Ready for production

After various lab tests, the processing process is ready for large-scale production, says Thijs Rodenburg. “We tested the material for viscosity, strength, and transparency, and did various tensile, drop, and impact tests and research on food-contact approvals. The packaging passed them all with flying colors.”

The lab process has been scaled up to commercial production volumes. The first 1,000 kg of compound is ready for further processing in the injection molding machines. “The concept was tested on our own production line. Besides the flow of the material and the quality of the final product, strict criteria also apply to the production speed. Every five seconds new packaging has to roll out of the machine. We met that requirement.”

End-of-life routes

The new biobased packaging has two possible end-of-life routes, says L'Abée. “They are suitable for recycling and industrial composting.
The only problem in the Netherlands is that neither route is supported yet. In the case of industrial composting, you often hear the argument that PLA needs too much time to compost, but according to studies by Wageningen Research, PLA packaging breaks down faster in an industrial composting plant than an orange, for example.”

“To recycle PLA, recycling plants need to sort the material. That does not happen in the Netherlands yet, although it is technically possible. The technology is available, the quality of sorting has been demonstrated by Wageningen Research, and yet it is not implemented in the sorting installations. This is because the volume is still too low in the Netherlands. And if it were sorted, there would be no recycling capacity available. It is a chicken-and-egg story in which we hope the Waste Fund and large brand owners will take the lead. They should make long-term choices to stimulate the use of renewable raw materials.”

THIS ARTICLE WAS PRODUCED IN COLLABORATION WITH SFA PACKAGING, RODENBURG BIOPOLYMERS AND WAGENINGEN UNIVERSITY AND RESEARCH.