Novel technology to boost the European Bioeconomy: reducing the production costs of PHA biopolymer and expanding its applications as 100% compostable food packaging bioplastic

Results in Brief

Towards more sustainable food packaging

Researchers with the EU-funded EUROPHA project have developed 100 % natural and biodegradable bioplastic formulations for food packaging applications.

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As consumers, we take for granted that the food we buy at the grocery store is preserved by packaging that maintains both quality and safety. However, in order to provide this level of protection, the packaging must offer both high thermal stability and robust barrier properties – which is often accomplished using materials (e.g. plastic) that are not environmentally friendly.

Today's consumer is more environmentally aware than ever and, as such, is demanding the use of renewable and sustainable packaging materials. The EU-funded EUROPHA project is answering this demand by developing 100 % natural and biodegradable, polyhydroxyalkanoates-based

bioplastic formulations for food packaging applications.

‘Bioplastics like polyhydroxyalkanoates (PHA) are long-term sustainable alternatives because they show equal performance to conventional petrochemical plastics, originate from renewable non-food resources and are 100 % bio-degradable,’ says project coordinator Pedro Sanchez. ‘However, one of the main obstacles for the market uptake of PHA is its higher price compared to other bioplastics.’

EUROPHA overcame this obstacle by taking advantage of the waste generated by the Agri-food industry. The result is the production of bio-degradable polymers that can be used in the films and foams that will soon replace the petroleum-derived materials used by the food packaging industry.

A new PHA bioproduction process

Project researchers set out to create a PHA bioproduction process capable of reducing the production cost of the final plastic at an industrial scale. To do this, the project covered the entire PHA production chain. ‘The packaging industry can re-use their surplus streams as low-value feedstock as starting material in the synthesis of an added-value product, which also saves on treatment cost,’ explains Sanchez.

Instead of the conventional food-stuff currently used in producing PHA, the EUROPHA process uses mixed microbial cultures from the sugar-enriched waste created by the Agri-food industry. This process consists of four stages: acid fermentation, selection of cultures, accumulation of PHA, and extracting the PHA. Once extracted, the PHA is then formulated to a compound. This ensures its flexibility and is accomplished by using several additives, such as plasticisers, processing aids, UV-stabilisers and nucleating agents. ‘All of these additives are bio-based products and have food contact approval,’ says Sanchez.

Once the formulation is complete, the PHA can then be used for the industrial production of film and foam, which will then be used as the basis for creating sustainable food packaging.

Sustainable, cost-effective food packaging materials

The EUROPHA project has led to several innovative breakthroughs. For example, its PHA production process using mixed microbial cultures makes it possible to use the low-cost feedstock that is currently considered agro-food waste, has no market value, doesn’t compete with food and is not affected by price volatility. ‘This alone transforms what was once an expense into a revenue,’ says Sanchez.

Furthermore, the 100 % compostable bioplastics developed by the project will form the basis for the development of high quality food-grade bioplastics. ‘These

bioplastics can be disposed of together with food and managed as organic waste by industrial composting and anaerobic digestion that meets EU standards,' adds Sanchez.

Together, these results demonstrate the potential of PHA-based compounds derived from PHA-generated waste for sustainable, cost-effective food packaging materials.

Keywords

EUROPHA, food packaging, bioplastics, polyhydroxyalkanoates, PHA

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