Science devises ways to recycle crustacean shells

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Credit: AI-generated image (disclaimer)

It was only a matter of time before scientists found a way to recycle the 750 000 tonnes of crustacean shells which are disposed of in the EU every year.

Asia has successfully managed to extract polymer chitosan (used to

make filters, foils and wound dressings) produced from shrimp shells. But in Europe crustaceans contain more lime, so processing is more complex and not economical. Also, the high content of calcium carbonate (known as CaCO3) of EU crab shell waste has prevented cost effective conversions to chitosan so far.

However, a solution has come from the ChiBio Project, which is developing an integrated biorefinery for processing chitin rich biowaste, to specialty and fine chemicals. ChiBio is led by the Straubing Project Group BioCat of the Fraunhofer Institute for Interfacial Engineering and Biotechnology IGB, with a consortium of 11 European partners and has been awarded EU funding of nearly EUR 3 million.

The consortium is working on an integrated approach in developing new methods to produce specialty and fine chemicals from chitin-rich fishing-industry waste. Chitin is a biopolymer occurring in insects and fungi that consists of nitrogenous sugar molecules strung together in a polymer chain.

The project aims to transform the chemical constituents of EU, African and Asian crustacean shell waste into chemical intermediates to produce high performance bio-based polymers at high atom efficiencies.

Professor Volker Sieber, coordinator of ChiBio and head of the BioCat Project Group says, 'In the manner of a biorefinery we want to develop or optimise various material and energetic uses for the waste material of crustacean shells, and thus utilise the residual material as efficiently and completely as possible.'

Researchers are also looking at ways to separate biomass residues (which consist of proteins and fats) and ferment them directly so they can be used for energetic purposes.

Professor Sieber adds, 'We are not opting for the production of chitosan but for polyamides and other polymers to be used as biobased plastics. Such products have a huge market potential. Within the project we therefore also analyse whether the process we are developing for European waste could well be applied for the shell waste from Asia. We aim to combine chemical steps with biotechnological processes. The intention is to ferment all the bio-based by-products generated in the process chain together with the initially separated proteins and fats to produce biogas as a regenerative energy carrier.'

In addition, recycling crustacean shell waste, which is usually disposed of in landfills, will be kinder to the environment. The project intends to evaluate the environmental impact of the process chain with a cradle-to-product life cycle analysis, as well as modelling and optimisation studies to demonstrate the economic viability.

More information: CHIBIO www.chibiofp7.fraunhofer.de/index.html

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