Creating chitin from prawn and fruit waste

Monday, 11 May, 2020

Chitin and its derivatives have a variety of uses in the food industry, such as food thickeners and stabilisers, and as antimicrobial food packaging.

Now scientists at Nanyang Technological University, Singapore (NTU Singapore) have developed a more sustainable way to create chitin, by using two forms of food waste — prawn shells and discarded fruit — and fermenting them.

Currently, a chemical method is used to extract chitin from the six to eight million tons of crustacean waste that are generated annually around the world. But, according to Professor William Chen, Director of the Food Science and Technology program at NTU, this extraction method is both unsustainable and harmful to the environment.

"Our new method takes crustacean waste and discarded fruit waste and uses natural fermentation processes to extract chitin. This is not only cost-effective, but also environmentally friendly and sustainable, and helps to reduce overall waste," said Prof Chen, who led the research.

The team's findings were reported in the paper 'Microbial extraction of chitin from seafood waste using sugars derived from fruit waste-stream', which was published in peer-reviewed journal *AMB Express* in January 2020.

The NTU team tested 10 sources of common fruit waste such as white and red grape pomace, mango and apple peels, and pineapple cores, in various fermentation experiments. They found that fruit waste contained enough sugar content to power the fermentation process that breaks prawn shells down into chitin.

They used an 'X-ray diffraction' technique to determine the atomic and molecular structure of the chitin created using the new method and its level of purity was measured using a 'crystallinity index'. The extracted crude chitin samples from prawn shells fermented using fruit waste gave a crystallinity index of 98.16%, which compared to commercial chitin samples with an index of 87.56%. The fermentation process using the sugar content from the fruit waste produced higher quality chitin than the commercial one.

Mr Loo Yuen Meng, Managing Director of Integrated Aqua Singapore Pte. Ltd., who was not involved in the study, said, "The latest innovations developed by Prof William Chen from the Food Science and Technology program at NTU is an excellent example of how the expertise from an institute of higher learning can be applied to improve operational efficiency of the food industry while reducing food processing waste. Through a simple fermentation process, the high-value chitin and chitosan recovered from the prawn shells are environment friendly, and the products can be reconnected back to the food industry."

By leaving chitin to undergo further stages of fermentation, the NTU research team also found they could ferment it further into chitosan, which can be used as a growth enhancer in plant fertilisers, or as a controlled drug delivery system in pharmaceutical treatments.

The NTU team is now exploring ways to use chitosan to enhance previous research innovations such as food packaging created using soybean residue or Okara. This could potentially lead to the development of a more durable cellulose film with antimicrobial and antibacterial properties.

Prof Chen is also working with multiple companies to spur the adoption of greener industrial methods in producing chitin and chitosan.

Image credit: ©stock.adobe.com/au/Volodymyr Shcerbak