

NTU scientists' plant-based emulsifier could replace egg in mayo

Protein-rich product could even improve plant-based meat, says prof who led project

Cheryl Tan

F finicky food lovers may soon not have to skip the mayo.

Mayonnaise made entirely from plant-based ingredients – but richer in protein and antioxidants compared with the conventional product – could become a reality here.

Scientists at Nanyang Technological University (NTU) have developed a plant-based emulsifier that has the necessary properties to replace egg or dairy ingredients in food staples like mayonnaise, salad dressings and whipped cream.

Emulsifiers are crucial in food production as they help to combine ingredients that usually do not mix well, such as oil and water.

For example, egg yolk is often used as the emulsifying agent in mayonnaise to ensure that the oil and water the mayonnaise contains do not separate.

To create the emulsifier, the NTU scientists used spent barley grains, a by-product of beer brewing and Milo production that is rich

in protein.

Professor William Chen, director of NTU's food science and technology programme, who led the project, said Singapore produces about 23,000 tonnes of spent barley grains that end up in landfills. They decompose and add to the nation's greenhouse gas emissions.

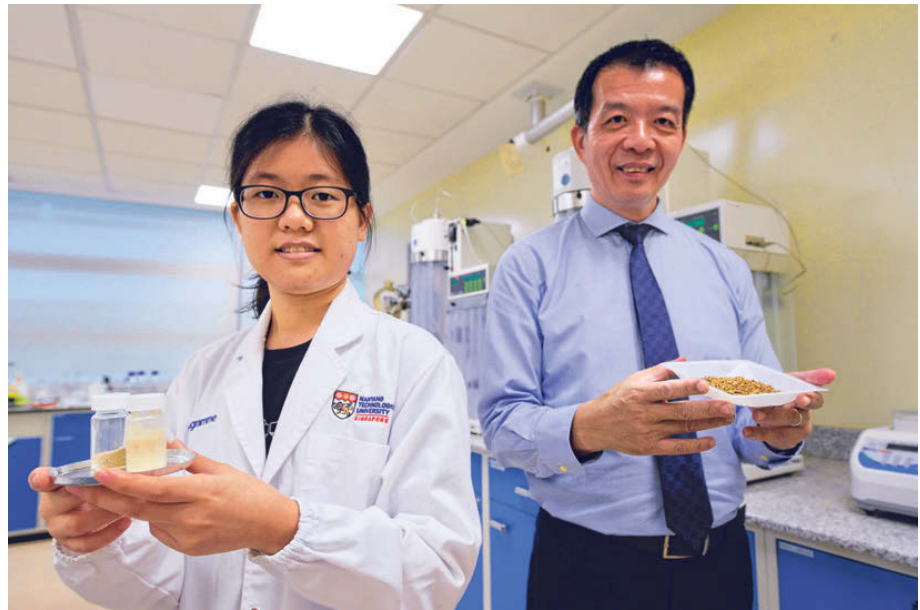
Globally, 39 million tonnes of spent grains are produced by the brewing industry.

"The spent grain, though rich in protein, is not widely used in food processing as the protein component is difficult to extract," said Prof Chen.

Although the spent grain can be used in cattle feed or solid fuel, the NTU team felt that more could be done to unlock its nutritional value for human consumption.

To produce the emulsifier, the spent grain is first fermented with a fungus, *Rhizopus oligosporus*, to make the nutrient extraction process easier.

The fungus secretes enzymes to break down the complex molecular structure of the spent grain, making it a simple and cost-effective way of extracting the proteins



and antioxidants.

Current commercial processes of nutrient extraction involve the use of chemicals or high temperatures, which make them costly and complicated, said Prof Chen.

Once the proteins are extracted, they are freeze-dried into a solid form so that they can be used for producing foods such as mayonnaise.

The residue from the fermented grain can be upcycled to create sustainable packaging materials, noted Prof Chen. "The idea behind this is that every part of the process truly achieves our zero-waste goal," he added.

Already, the NTU team has received interest from two companies about its plant-based emulsifiers. The first company is a start-up in the plant-based food space, while the second is a household brand looking to create a novel type of sauce.

In the meantime, the team is optimising its protein extraction methods to improve yield and quality.

"For instance, at present, for

every 1kg of spent barley grains, we can produce only 100g of emulsifier. However, we aim to maximise our output to 250g, as that is the maximum amount of protein that each kilogram of grain contains," said Prof Chen.

Being rich in protein, the emulsifier could be beneficial for the growth of the plant-based meat industry, he said.

"Some consumers have felt that the level of protein content is too low compared with animal meat, while others said that the taste is not yet up to par," said Prof Chen.

The emulsifier could not only boost the protein content in plant-based meat, but its taste – which resembles that of Marmite – could also improve the flavour, he said.

Marmite is a savoury food spread made from yeast extract.

As the emulsifier has spreadable properties, the team also hopes to explore pharmaceutical and cosmetic uses in products such as topical creams, lipsticks and more.

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Nutritional details

Compared with store-bought mayonnaise, Nanyang Technological University's plant-based version has a slightly higher caloric content as it has more protein and essential amino acids.

- Calorie content: 702kcal per 100g versus 680kcal per 100g for conventional mayo
- Protein: 6.6g per 100g versus 0.9g per 100g for conventional mayo
- The sugar and saturated fat content is similar for both types of mayo

Taste: (4.5/5)

The plant-based mayo has a more distinctive flavour compared with the conventional type, and has a slightly yeasty taste.

Resemblance to conventional mayo: (4/5)

The plant-based mayo is slightly pale orange in colour with a smoother texture, whereas the conventional product has a light cream colour and a fluffier texture.

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PhD student Chin Yi Ling with the plant-based emulsifier and mayonnaise made from spent barley grain, samples of which are seen in the tray held by Professor William Chen of Nanyang Technological University.

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