NTU Singapore scientists invent a protein-rich product made from plants that could replace dairy and eggs in certain foods

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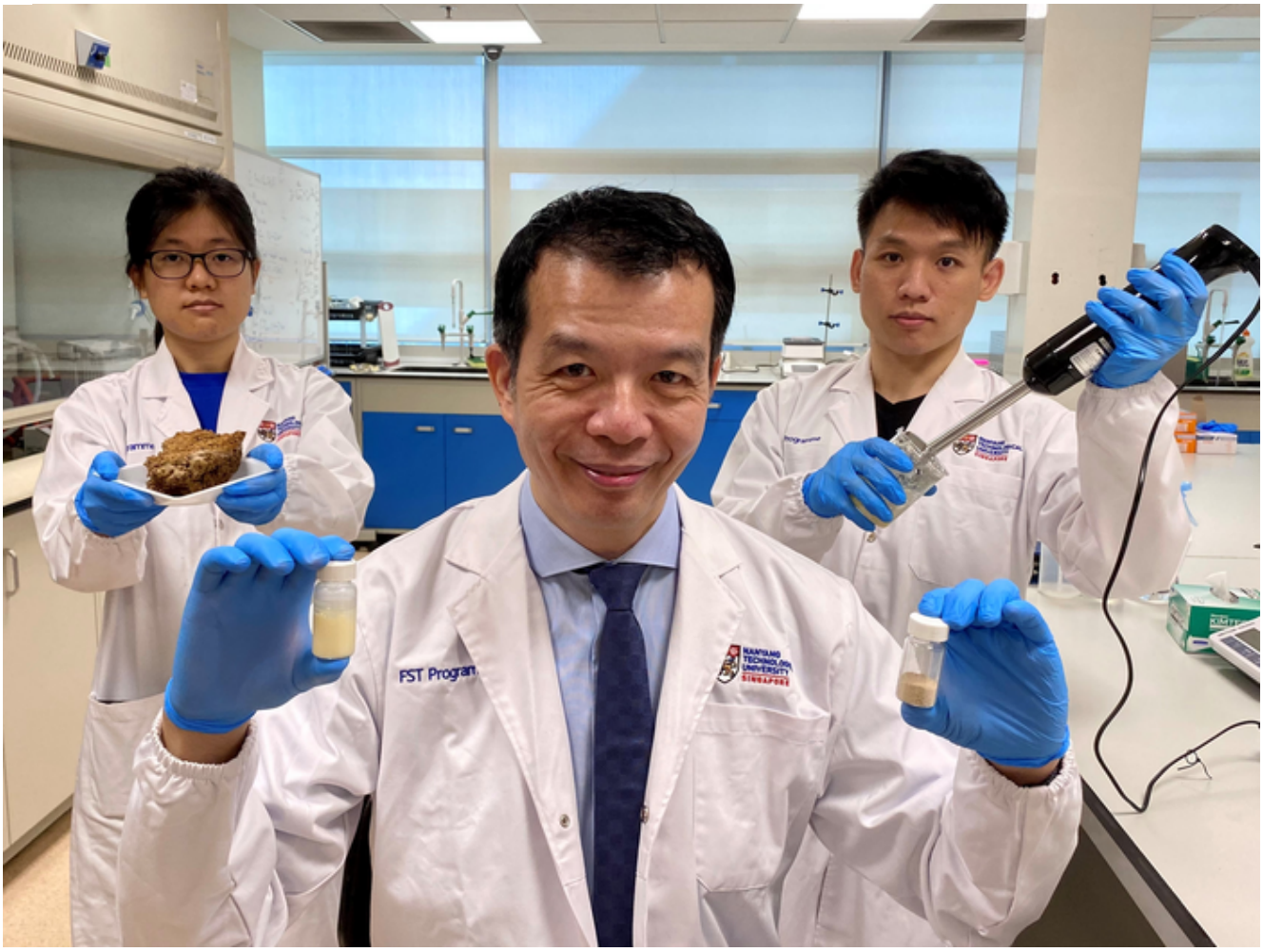

Credit: NTU Singapore

A team of scientists from **Nanyang Technological University, Singapore (NTU Singapore)** has developed a plant-based emulsifier that is not only rich in protein and antioxidants, but has the necessary properties to replace eggs or dairy in food staples such as mayonnaise, salad dressings, and whipped cream.

Emulsifiers are crucial for food production, as they help stabilise a combination of two liquids that do not mix easily, 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 it contains does not separate.

The NTU-made emulsifier also helps cut down on food waste, as it is made by fermenting brewers' spent grain, a by-product of the beer-making industry (see video). It is estimated that globally, around 39 million tons of such spent grains are thrown into landfills yearly, where it would decompose and add to greenhouse gas emissions.

The study, which presents an innovation that could help cut down on waste, reflects NTU's commitment to mitigate our impact on the environment, which is one of four humanity's grand challenges that the University seeks to address through its **NTU 2025 strategic plan**.

To produce the emulsifier, brewers' spent grain is fermented, before undergoing further processes to extract the proteins, which, once dried, are immediately viable for producing foods such as mayonnaise.

Compared to store brand mayonnaise, the mayonnaise produced with the NTU-plant-based emulsifier contained more protein, and higher amounts of certain essential amino acids. The fat and calorie contents were similar compared to typical store brand mayonnaise, but the NTU-made mayonnaise contained more nutrients and antioxidants.

Mayonnaise prepared with the NTU plant-based emulsifier also tasted identical to store-bought mayonnaise. A lab test by the researchers also showed that NTU-made mayonnaise also showed better texture and spreadability, compared to its off-the-shelf counterpart.

Professor William Chen, Director of NTU's Food Science and Technology (FST) programme, who led the project, said: "Our plant-based emulsifier is yet another triumph for NTU, as we look to find successful ways to find new uses for products that would otherwise be left to waste. Each year, approximately 39 million tons of brewers' spent grain is generated globally by the brewing industry and is sent to landfills. Upcycling this as a potential human food source is an opportunity for enhancing processing efficiency in the food supply chain, as well as potentially promoting a healthier plant-based protein alternative to enrich diets."

The NTU team behind the invention also includes **Dr Josh Chai, Research Fellow at NTU's FST programme** and **Ms Chin Yi Ling, a PhD student, also from FST.**

The results of the study were published in the peer-reviewed academic journal ***Food Chemistry: X*** in December.

Using nature as a solution

Currently, brewers' spent grain is not widely used in food processing, largely due to the difficulty in extracting proteins from it, say the NTU researchers. As the proteins are 'trapped' within its complex structure, current commercial processes, such as using chemicals or high temperature to release them are costly and complicated.

Although there have been other uses for brewers' spent grain, such as cattle feed and solid fuel, the NTU-made emulsifier focusses on its human nutritional aspect, as well as using natural solutions to add value to it.

The NTU team discovered that a cheaper and simpler alternative to unlock the protein potential of brewers' spent grain was to use a fungus, *Rhizopus oligosporus*, which is easily