Sustainable route to ingredients from pulses

PhD candidate Qinhui Xing developed sustainable processes for producing protein-rich food ingredients from pulses.

Qinhui Xing graduated with a PhD on 9 February. Her supervisors were Professor Remko Boom and Maarten Schutyser of Food Process Engineering.

Previous research suggested that the most sustainable method to make protein-enriched flour from pulses is a process called dry fractionation. The dry process requires about four megajoules (MJ) in energy per kilo of protein, while the traditional method using water requires about 60 MJ. Xing therefore chose to use dry fractionation in her experiments with soya beans, peas, lentils and chickpeas.

The protein-rich mixtures she produced this way are less pure but are still nutritious and can have be used in the same ways, such as to bind water. We need sustainable plant-based proteins to feed the fast-growing world population.

After milling the pulses and in some cases, such as soya, extracting oil from them, Xing used two methods to increase the protein content. She used 'air classification' to separate the lighter starch from the heavier proteins. Then she used electrostatic separation to extract the fibre from the proteins. In this method, particles are electrically charged and can then be separated using a positive and negative electrode.

Less flatulence

Dry fractionation does have a drawback though, says Xing. 'Because we do not use water, the anti-nutritional factors are not removed,' she says, referring to certain carbohydrates such as raffinose and stachyose. These substances are broken down in the human intestinal tract by bacteria, releasing gas that causes flatulence.

'So we added a fermentation stage to break down those anti-nutritional factors.'

This 'solid-state fermentation' was applied to protein-rich chickpea flour, and with success. During spontaneous fermentation with lactic acid bacteria naturally found in the flour, the raffinose and stachyose content was reduced by 88 and 99 per cent respectively. These bacteria break down sugars. Moreover, the sourdough starter obtained can be used to enrich bread with proteins, Xing found from her baking experiments. She expects this new substance to also be a valuable ingredient in meat substitutes. Het supervisor, Maarten Schutyser of Food Process Engineering, aims to conduct further studies on fermentation as a way of improving the nutritional value and flavour of plant-based protein ingredients.

'It is also important to find out what the application potential is of the other fractions that come out of dry fractionation, such as the carbohydrate-rich fraction,' says Xing. Another PhD student is working on this topic. Xing herself has found a job as a scientist for a Chinese producer of plant-based meat substitutes. 'I see a bright future for these products.' AJ

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