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Soya • Making good use of food waste | B9





Juvenile abalone (right) from Republic Polytechnic's Aquaria lab were fed with the okara-based feed (abov They weighed about 25 per cent heavier than those or commercial feed. PHOTOS: REPUBLIC POLYTECHNIC



Soya pulp, also known as okara, is a by-product derived after tofu and soya milk is made. The NTU team used a week-long process that involved fermenting the okara with micro-organisms, heating and adding water, to extract a yellow liquid containing the hormones. PHOTOS: NANYANG TECHNOLOGICAL UNIVERSITY

(From foreground) Dr Jasmin Lim, Dr Susmita Bandyopadhyay, Dr Chiradip Chatterjee and Mr Yilong Ng from Republic Polytechnic have developed a cheaper and nutritious food for abalone, made from a soya and tofu by-product, called okara, or soya pulp. Compared with juvenile abalone fed with commercial feed, the abalone fed with soya pulp weighed more and had shells with a more vibrant colour. ST PHOTO: KHALID BABA





A bottle of the fermented okara extract that contains plant growth hormones, which help the cell grow and multiply to form tissue



## Using soya waste in new ways for food production

Two separate projects are under way to use okara for cell-cultured meat and abalone

## Shabana Begun

The white, mushy and unpleasant smelling waste that remains after making tofu and soya milk may rev-olutionise the novel food space and aquaculture. Researchers from Nanyang Tech-nological University (NTU) and Re-public Polytechnic (RP) are work-ing on separate projects to max-ing on separate projects to discu-se the observation of the separate vicientist have been able to derive a liquid extract that contains plant growth hormones that can spur an-imal cells to grow and multiply unot tissue, to form cell-cultured meat.

Imm tent to go with a many many finance in the local transform cell-cultured meat. Cell-cultured protein allows meat products to be manufactured without slaughtering animals. Currently, when producing cell-cultured meat, the chicken or cow cells are usually immersed in a pink nutrient broth containing a bit of serum that helps the cells grow and multiply. But the serum comes from the blood of unborn calves of pregnant cows that are later killed. The serum can cost up to \$2,000 per litre. Its use in cultivated meat that aims to be cruelty-free may also seem ironic, said Professor William Chen, director of NTU's food science and technology programme, who is leading the okara research. The process of harvest-

gramme, who is leading the okara research. "The process of harvest-ing the bovine serum causes pain and distress to the foetal calves." The team used a week-long process that involved fermenting the okara with micro-organisms, heating and adding water, to ex-tract a yellow liquid containing the hormones hormones. About 200g of okara can pro-

duce 300ml to 400ml of the liquid, said the NTU programme's PhD student Teng Ting Shien. The okara fermentation research is part of his food science and tech-

nology thesis. In the lab, Mr Teng found that the cultured mice muscle cells mul-

the cultured mice muscle cells mul-tiplied 70 per cent as much as an-other batch of cells that were treated with the bovine serum. Prof Chen said: "To find a bovine serum replacement, other labs have come up with growth media that are generally expensive and non food-grade. But okars is avail-able in large quantities from the food industry, is edible and safe, and is low cost."

The team's fermented okara ex-

The team's fermented okara ex-tract can cost 52 per litre. The main cost driver for this novel food is the growth serum. The research team is now reach-ing out to local cultivated meat start-ups to test the liquid extract. Singapore became the first coun-try to approve the sale of a cell-cul-ured product last December. Over at RP, researchers have con-coted a cheaper feed for abalone, using okara as the main ingredient, luvenile abalone fed on the okara-based food weighed about 25 per ent heavier than those sustained on commercial feed, and the abalone shells were a more vibrant purple.

on commercial feed, and the abalone shells were a more vibrant purple. Dr Chiradip Chatterjee, senior lecturer at the polytechnic's School of Applied Science, and his team developed the food pellets us-ing a technology that included pre-treating the okara under high tem-perature and mixing if with key nu-trients. "Abalone fed by commer-cial feed is less striking in their colour, more greyish... Their vi-brant shell colour can increase their sellingotential." Although soya pulp is used as food for livestock, the team be-lieves this is the first abalone feed that uses okara. Dr Chatterjee said the protein-rich pellets cost up to 30 per cent less than commercial feed, with okara replacing fishmeal, the costl-est ingredient in fish feed. In the market, feed costs be-mean is usually made from wild-caucht small fishes. and their num-

meal is usually made from wild-caught small fishes, and their num-

bers are depleting, he said. "There is potential for our okara-based feed to be used with com-mercially available feed to reduce

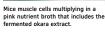
mercally available feed to reduce the cost of aquaculture." The research team sourced okara from a local soya beverage maker. A 2017 report by The Straits Times said 30,000kg of okara is discarded in Singapore each day. The RP team is reaching out to lo-cal and Catth act Ating belong

cal and South-east Asian abalone farms to trial the okara feed in the

industry. Although the high amount of fi-Although the high amount of h-bre in okara is most suitable for her-bivores like abalone, the pellets can be customised for omnivorous and carnivorous marine species such as shrimp, seabass and tuna, with more research.

"For the carnivorous species, the indigestible fibres in okara should be reduced before developing the feed," said Dr Chatterjee.

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(From far left) Professor William Chen, director of the food science and technology programme at Nanyang Technological University (NTU); Dr Jaslyn Lee, senior research fellow; Mr Teng Ting Shien, PhD student esearcher: and Dr Rita Mark, former

researcher with the NTU

programme.