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## Could Asia's Passion for Soybeans Help Solve the Plastic Crisis?



A staple in the Asian diet, soybeans have been used to make tofu, miso soup and so hundreds of years. But now, the popular legumes are also being turned into an alternative plastic wrap.

William Chen, a professor of food science and technology at Singapore's Nanyang Technological University, invented the biodegradable food wrap. It's made of cellulose, extracted from waste generated by soybean product manufacturers.

Soybeans are crushed to squeeze out juice that's used to make bean curd and soy milk. Chen. What's left is a porridge residue, which is usually dumped. Chen takes the milk leftovers and puts them through a fermentation process. Microbes gobble up the milk leaving behind cellulose, a form of fiber.

Cellulose-based plastic wraps have been on the market for a few years but Chen says they are made from wood or corn, cultivated for that purpose. By contrast, his wrap is made from waste product -- so it doesn't compete with edible crops for land and is more sustainable. Chen's technology could help to solve two problems at once: cutting plastic production and reducing the amount of food waste deposited in landfill. "In Singapore, the amount of food waste we generate every year can fill up 15,000 Olympic-sized swimming pools," he says. That's because soy products are so popular in Singapore, 30 tons of soybean residue are generated there every day.

F&N, a soy-based drinks producer, has partnered with Chen's lab and provides the raw materials straight from the factory. The company is conducting a feasibility study to assess whether the food wrap could compete, commercially, with conventional products, says Chen. Scalability is sometimes an issue with bioplastics, which are typically more expensive than their petrochemical counterparts. The soy-based wrap costs "almost nothing" to produce at the lab, says Chen, because the raw materials are free of charge. Commercial scale

Soybeans are not the only natural product he's turning into bioplastic. Chen has also a method to transform the cellulose-rich husks of the durian -- a notoriously smelly fruit -- into plastic wrap. Despite the fruit's controversial odor, Singaporeans consume 12 million durians a year, he says, so there is an ample supply of discarded husks.

Biodegradability is another potential hurdle. Some bioplastics breakdown fully only when exposed to temperatures exceeding 50 degrees Celsius for prolonged periods. Concerns have been raised that if bioplastics are not disposed of in special facilities, they could add to the global plastic pollution problem.

However, Chen says his soybean-based plastic wrap is digested by microbes and disappears completely within a month when disposed of in general household waste, without the need for heat.

Chen is not the only inventor seeking to replace plastic with biodegradable alternatives. Other innovative products include MarinaTex, a plastic film made from fish waste that's used for making sandwich bags; sequins made from plant matter; and drinks containers and packaging made from seaweed.

Chen says he hopes neighboring soy-loving countries will be inspired by Singapore's innovation: "My dream is that our technology, which is cheap and simple to implement, will help reduce plastic and food waste and create a cleaner environment."

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