Fresno State research: Leftover food gets new life as bioplastic

By Hannah Furfaro

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Comparing Plastics

Plastic type	Price per pound	Material used
Traditional	$1.07-$1.25	Petroleum
Common bioplastic, polylactic acid	$1.10	Crops like corn or sugar
PHA bioplastic currently available	$1-$3	Crops like corn or sugar
Fresno State/Full Cycle Bioplastics PHA	$.90-$2	Any compostable waste material

Source: Full Cycle Bioplastics

Fresno State researcher Bill Wright pulls bags of frozen, mushy strawberries out of his lab freezer. He's converting the pink food waste into an unexpected consumer product: plastic.

In his small lab space in a campus engineering building, silvery trays filled with dark powder share cluttered space on tables with a spectrophotometer that measures light, a centrifuge and other equipment. Graduate student Michael Nunes, the lab manager, stirs fermented fruit stewing in buckets painted with the slogan "Let's do this" — a fitting message for the researchers, who have worked tirelessly to convert waste from fruit, nuts and other food into biodegradable plastic.

Feathery pieces of the stuff sit in glass test tubes. The opaque, delicate-looking plastic can be turned into water-resistant plastic pellets, melted down into molds, and shaped into forks and spoons, composting bags and plant pots.

It's a fresh take on the concept of reuse, recycle. And one that makes a lot of sense in the food-producing central San Joaquin Valley, Wright said.

"An incredible amount of food is grown in this fertile valley and not all of it makes it to the dinner table. There's quite a bit that ends up being a burden," Wright said. "We look at it as a resource."

For nearly two years Wright has led the research on behalf of a start-up called Full Cycle Bioplastics, an eco-friendly company started by two brothers that's looking to commercialize an affordable plastic made from food waste. The company has donated $112,000 to fund the project, Wright said.

In a year when plastic is being shunned in California — plastic shopping bags could disappear from many stores by summer — and floating islands of debris in the Pacific are catching international headlines, once-niche bioplastics are carving out a bigger corner of a market still dominated by petroleum-based plastic.

Commercial production of various bioplastics has been churning for decades. But Wright and his research team are taking a new approach. Instead of more popular methods, like growing corn or soybeans to use in the conversion process, they're using food scraps, like peach pits and fruit slurry.

"No one has been able to make this material from mixed waste. That's our innovation," said Brian Dawson, executive

chairman of Richmond-based Full Cycle Bioplastics. “You can dump everything into a bucket and make a consistent plastic resin.”

An innovative goal

The science behind the method is a lot more complicated than that, of course.

The process has everything to do with the carbon stored in the food waste, and how much of it can be fermented into volatile fatty acids — the same type of acids that animals like cattle and sheep use as energy.

In Wright’s lab, students in white lab coats are trying to find what organic material works best to boost the amount of acids produced.

After fermentation, the acids are fed to a special plastic-producing bacteria stored in large tanks. Wright controls the environmental conditions to get the best results, a process he compares to “fattening up turkeys right before Thanksgiving.”

The goal is to force the bacteria into producing and storing the plastic substitute — polyhydroxyalkanoate, or PHA — in large amounts. The plastic resin is then dried into a powder, which can be sold as-is or processed and formed into plastic products.

Wright is still experimenting with different types of organic waste. He’s looking for a mix that forms a plastic tough enough to replace the petroleum kind, but which still degrades quickly if it ends up in landfills or oceans.

The potential is big, Dawson said.

Although about 87 million tons of plastic are recycled in the United States each year — 34.5% of the 251 million tons the Environmental Protection Agency estimates is generated annually — it can take anywhere from hundreds to thousands of years for discarded plastic to decompose.

Dawson says the product Wright is developing answers these problems: The plastic degrades quickly in both land and sea and can easily be recycled back into the production process. It’s so efficient, Dawson said, that degradation of some products like composting bags takes only two weeks. It could be cheaper, too: company estimates show the product could cost as low as 90 cents per pound, several cents less than some traditional plastic and bioplastics on the market.

The team is revamping techniques that bioplastics companies have built their names on, like using corn and other field crops to create plastic. New tactics, like using methane waste, are also emerging.

Dawson calls Wright’s method “bioplastics 2.0.”

“You can imagine the environmental narrative of taking a food crop to make plastic is significantly less attractive than using waste,” he said.

A full cycle

It may be especially attractive to Valley food producers.

Bill Smittcamp, president and CEO at Wawona Frozen Foods, quickly realized the benefits of the project when Wright called him two years ago. At the time, Wright was looking for a steady supply of food waste he could use to experiment.

Smittcamp was more than happy to donate.

On a regular day, the fruit processor hauls out three to four truckloads of waste — pits, peels, stems and other scraps

“The trucking cost is a pretty big number and then there (are) times where we have to pay to have it disposed of,” Smittcamp said. “They’re going to take things that cost me money and turn it into something that will make me money.”

Smittcamp was one of the project’s first investors. He also converted an old carport at his Clovis facility into a research shed, giving Wright’s team a spot to run on-site tests. That’s where the first plastic was produced, Wright said.

Smittcamp, a longtime partner and donor to Fresno State, said these types of partnerships can prompt industry to ask tough questions about how they do business. In this case, he said, the research could mean real savings for both the environment and his pocketbook.

“It makes us think and we learn from the academia side of the world,” he said. “They learn with practicality with boots on the ground.”

It won’t be too long, Smittcamp imagines, before he’s transporting fruit on bioplastic pallets. Just another version of the food he produces every day, given new life by Wright’s innovation.

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