# Study proposes profitable ways to repurpose industrial waste

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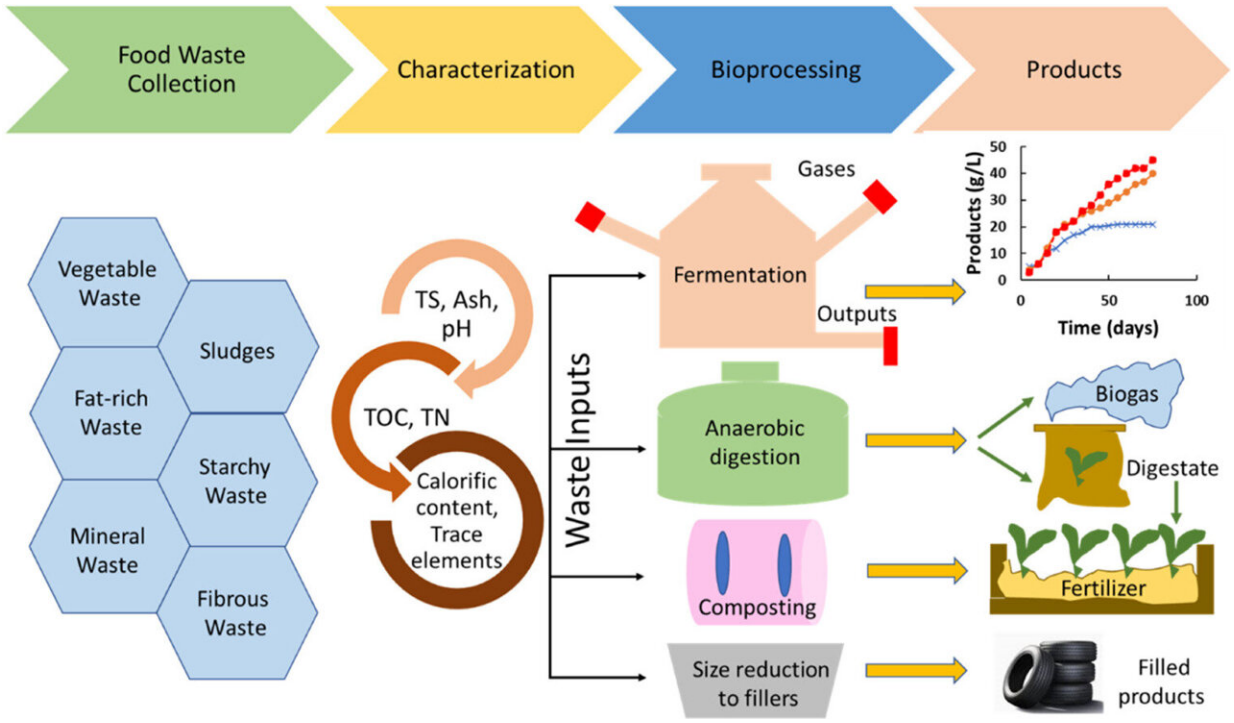


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There is money to be made—and potential to reduce greenhouse gas emissions—by finding a second life for the potato peels, fried dough particles, cheese whey and other industrial food-processing waste products that routinely end up in landfills, according to new research.

Scientists have taken the first step at estimating the best large-scale uses for food processing waste, first analyzing its contents and, based on those findings, proposing production opportunities ranging from sustainable fuels, biogas and electricity to useful chemicals and organic fertilizer.

This work is known as valorization, or determining the potential value of something "that is otherwise valueless or even a drain on resources for a company—when you have to spend money to get rid of it," said Katrina Cornish, senior author of the study and professor of horticulture and crop science and food, agricultural and biological engineering at The Ohio State University.

"The bioeconomy is becoming much more prevalent as a topic of conversation. In this case, don't get rid of food waste—make some money from it," said Cornish, also an Ohio Research Scholar of Bio-Emergent Materials. "Here, we're putting the base model in place for food manufacturers who are wondering, 'What can I do with this stuff?' Our flow chart guides them in a specific direction and prevents them from wasting time trying something we know won't work."

The study was published online recently in the journal *Science of the Total Environment*.

About 2% of the 80 billion pounds of food discarded annually in the United States is attributable to food manufacturing and processing—with food waste solids sent to landfills or composted, and liquids poured into sewers.

For the study, researchers collected a total of 46 waste samples, including 14 from large Ohio food processing companies, and divided them into four broad categories: vegetable, fat-rich, industrial sludge and starchy. They then characterized the sample contents' physical and

chemical properties and tested some starchy wastes they determined were good candidates for fermentation into the platform chemical acetone.

In the big picture, a waste type's energy density—based on calorific value—and carbon-to-nitrogen ratio were major determinants for its repurposing potential. For example, fatty waste and mineral-based waste can be digested anaerobically to generate biogas, and soybean waste has enough energy density to be used for biodiesel production.

Low-calorific vegetable wastes aren't great for energy production, but they are plentiful organic sources of flavonoids, antioxidants and pigments that could be extracted and used in health-promoting compounds.

Based on the analysis of fibrous and mineral-rich wastes, Cornish has practiced what she's preaching: Her lab developed a method for turning eggshells and tomato peels sourced from Ohio food producers into fillers in rubber products, partially replacing petroleum-based carbon black in tires, for example.

"We aligned this work with the Environmental Protection Agency goal to reduce 50% of food loss and waste by 2030," said first author Beenish Saba, a postdoctoral researcher in food, agricultural and biological engineering at Ohio State. "So, how can you reduce this waste? Valorization is one method.

"In Ohio, corn is being grown to convert into biofuel, acetone and butanol, and here we've identified other sources already available as wastes that you can also convert into those products."

The proposed conversion technologies require energy to operate and also yield some secondary waste, but the valorization modeling lays

groundwork for further "cradle to grave" analyses that would help quantify the environmental benefits of large-scale food—and other industry—waste reduction, Saba said.

While this study is a starting point, it ideally will offer incentive for food producers to consider the possibilities of making something out of waste products that are currently treated as trash, the researchers say.

"What we hope will happen is that food producers will actually look at their costs and their footprint, and see which of these approaches for their particular wastes will work best—which will be the least financially negative, and preferably profitable, and also minimize any carbon footprint," Cornish said. "In terms of global warming, any waste that can be valorized has a direct impact on global warming because it has a direct impact on emissions and on the ecosystem.

"This is all about improving energy security and lowering the financial and environmental impacts of food waste management," she said. "If your waste has enough value for you to do something with it that prevents it from going into the landfill, that's a really good thing."

**More information:** Beenish Saba et al, Characterization and potential valorization of industrial food processing wastes, *Science of The Total Environment* (2023). DOI: 10.1016/j.scitotenv.2023.161550

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