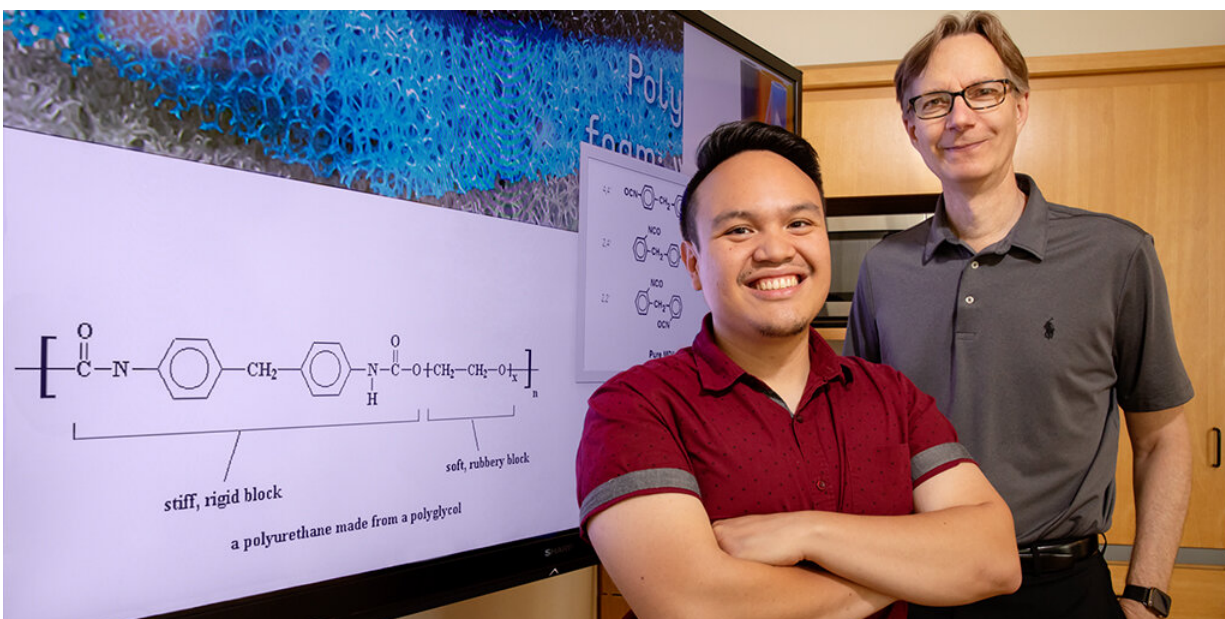


New technique gives polyurethane waste a second life

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U. of I. chemistry professor Steven Zimmerman, right, graduate student Ephraim Morado and their colleagues are inventing new ways to degrade polyurethane and reuse the waste. Credit: L. Brian Stauffer

Polyurethane is used in a wide range of materials, including paints, foam mattresses, seat cushions and insulation. These diverse applications generate large amounts of waste. A team at the University of Illinois has developed a method to break down polyurethane waste and turn it into other useful products.

The researchers will report their findings at the American Chemical Society National Meeting and Exposition.

In the U.S. alone, 1.3 million tons of [polyurethane waste](#) is generated each year. The waste usually ends up in landfills or is incinerated, a process that requires a large energy input and generates toxic byproducts.

"We want to solve the waste problem by repurposing polyurethane," said Ephraim Morado, a [graduate student](#) in the laboratory of chemistry professor Steven Zimmerman, who led the research.

Polyurethanes are made of two components that are hard to break down: isocyanates, which are composed of nitrogen, carbon and oxygen; and alcohol groups called polyols.

"The polyol is usually petroleum-based and is not degradable," Morado said. To address this difficulty, the team incorporated a more easily degraded chemical unit, an acetal, to the polyol. And because polyurethanes are water-resistant, the researchers invented an acetal unit that degrades in solvents other than water.

"When we add a combination of trichloroacetic acid and dichloromethane, the material swells and rapidly degrades at [room temperature](#)," Morado said.

The degradation products that are formed can then be repurposed to new materials. For example, the researchers were able to convert elastomers—a type of polyurethane used in rubber bands, packaging and car parts—into an adhesive glue.

"One of the challenges with our approach is that the starting material is costly," Zimmerman said. "We are trying to find a better, cheaper way to accomplish this. Our second hurdle will be to get a patent and find

someone who is interested in commercializing it."

The researchers are testing the same technique on other polyurethane materials. They also hope to use milder solvents, such as vinegar, to carry out the degradation.

"The polyurethane materials have different properties based on the chemical structure of the isocyanate," Zimmerman said. "We can change the structure of the acetal accordingly."

Provided by University of Illinois at Urbana-Champaign

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