Researchers develop a toxin-free adhesive system inspired by underwater creatures

September 11 2018

Purdue University researchers have developed a unique, toxin-free adhesive system inspired from underwater creatures. Credit: Purdue University

Purdue University researchers have developed a unique, toxin-free adhesive system developed from underwater creatures. They hope it will

make plywood, cardboard boxes and other packaging – combined $100 billion industries – both safer and easier to use.

"We want to be able to reduce the daily exposure we all have to common toxins, and this type of materials development could lead to a giant leap in sustainability," said Amelia Putnam, a doctoral research chemist, who serves as a senior member of the research team.

The technology aligns with Purdue's giant leaps celebration, acknowledging the university's global advancements made in health, space, artificial intelligence and sustainability as part of Purdue's 150th anniversary. Those are the four themes of the yearlong celebration's Ideas Festival, designed to showcase Purdue as an intellectual center solving real-world issues.

The Purdue team's adhesive is inspired from underwater creatures and does not contain formaldehyde, a major component of common glues used in the manufacturing of composite wood products such as plywood and fiberboard and linked to some types of cancers. These materials are common in the construction of houses and furniture.

The Environmental Protection Agency is working to put additional regulations in place to set limits on how much formaldehyde can be released from those products.

"Our adhesives mimic some of those found in the seas and might be able to solve two problems that we are facing currently – creating bonds using less toxic materials as well as having improved functions such as degradability," said Jonathan Wilker, a Purdue professor of chemistry and materials engineering, who helps lead the research team. "We have been able to make progress here by first learning how marine mussels stick themselves to rocks."

The Purdue team has hundreds of mussels growing in their laboratory for studying the release of proteins when the creatures attach. The researchers then generate different synthetic versions of the adhesive, which produces materials that can generate strong bonds and also work underwater.

The Purdue team's adhesive may also work for food packaging, where the glue would provide an effective non-toxic alternative to the current adhesives being used now.

"Another potential advantage of our adhesives is that they may be broken down, allowing bonded components to be separated for recycling," Putnam said.

Current prevalent paper products such as cardboard cannot be composted. Most boxes are assembled using glues that are not easily degradable, according to Putnam. Strong yet degradable adhesives might change the packaging industry by enabling large scale composting of cardboard boxes.

More information: Gudrun Schmidt et al. High Strength Adhesives from Catechol Cross-Linking of Zein Protein and Plant Phenolics, *Advanced Sustainable Systems* (2018). DOI: 10.1002/adsu.201700159

Provided by Purdue University