

Tofu ingredient yields formaldehyde-free glue for plywood and other wood products

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Wood composites used to make flooring, furniture, and other products could become more eco-friendly thanks to new adhesives made soy flour and a chemical used to make paper towels more water-resistant. Credit: Christian J. Stewart

In a real-life "back to the future" story, scientists today reported that the sustainable, environmentally-friendly process that gave birth to plywood a century ago is re-emerging as a "green" alternative to wood adhesives made from petroleum. Speaking at the 240th National Meeting of the American Chemical Society, they described development of new soy-based glues that use a substance in soy milk and tofu and could mean a new generation of more eco-friendly furniture, cabinets, flooring, and other wood products.

The new adhesive contains soy flour and an additive used to make paper towels resist water. It performs as well as conventional wood adhesives

for interior products, the scientists said, and does not produce the harmful [formaldehyde](#) vapors released from traditional plywood, particleboard, and other composite products.

"Protein adhesives allowed the development of composite wood products such as plywood in the early 20th century," said Charles Frihart, Ph.D., who participated in the research project. "Petrochemical-based adhesives replaced proteins in most applications based upon cost, production efficiencies, and better durability. However, several technologies and environmental factors have led to a resurgence of protein, especially soy flour, as an important adhesive for interior plywood and wood flooring."

Frihart, a research chemist with the U.S. Department of Agriculture (USDA) Forest Products Laboratory in Madison, Wisc., explained that many wood products today look as if made from solid pieces of wood. However, they actually are composites, consisting of wood pieces bonded together with petroleum-based adhesives.

Certain petroleum-based adhesives can release formaldehyde, a potential human carcinogen, or substance capable of causing cancer. Formaldehyde fumes from these materials also can cause short-term symptoms, especially in sensitive people. These include watery eyes; burning sensations in the eyes, nose, and throat; and skin irritation. Such problems, combined with high petroleum prices and concerns about sustainability, are spurring wood manufacturers to take another look at soy, Frihart said.

Academic, industrial, and government researchers have developed a wide variety of new soy adhesives in an effort to improve upon old formulas. In lab studies, they tested the glues on wood samples under harsh conditions, including water exposure and high temperatures.

The scientists identified a highly promising soy-based glue composed of soy flour, a special water-resistant additive, and other modifiers. Together these ingredients form a polymer glue for interior wood products that performs as well as the existing petroleum adhesives but does not contain formaldehyde, they said.

In the future, Frihart and his colleagues plan to develop soy adhesives that are even stronger than existing ones. Soy-based adhesives currently make up less than five percent of the wood adhesive market, but Frihart expects their use to increase. The Forest Service is developing the adhesives in partnership with Ashland Hercules and Heartland Resource Technologies.

Provided by American Chemical Society

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