

Bonding with the Industry

Columbia Forest Products¹, Oregon State University and Hercules, Inc. stick together to create the low-cost Formaldehyde-free wood adhesive, PureBond.

by Mark Evertz

The process of taking thin slices of wood and gluing them together to increase strength and stability dates back to the tombs of ancient Egypt, with archeologists discovering traces of laminated wood in the resting places of pharaohs.

The Engineered Wood Association suggests on its Web site that the Chinese began the practice for furniture production more than 1,000 years ago, with Russians advancing the craft during the 17th and 18th centuries. The association notes, however, that it was an Oregon-based small wooden box manufacturer that essentially launched the plywood industry in 1905 by showing its wares at the World's Fair held in Portland that year.

It was there that Gustav Carlson of Portland Manufacturing introduced a series of laminated softwood panels from the Pacific Northwest that he made using paint brushes to apply the adhesive to thin slices of wood, employing the necessary pressure using house jacks until the glue dried. After he modified the gluing process by introducing an automated glue spreader in 1907, the plywood industry as we know it was born.

Now, nearly 100 years later, another Portland, Oregon-based manufacturer is about to bring the city back to the world stage by doing something few in the plywood world believed was possible.

In the present-day innovation, Portland-based Columbia Forest Products brought to market PureBond—an adhesive with a strong bond that repels water and doesn't emit potentially harmful chemicals into the air.

¹ Founded in 1957, Columbia Forest Products is North America's largest manufacturer of hardwood plywood and hardwood veneer. The company also markets and produces engineered and solid wood flooring products. Columbia's decorative interior veneers and panels are used in high-end cabinetry, fine furniture, architectural millwork and commercial fixtures. Employee-owned and based in Portland, Oregon, Columbia employs more than 3,000 and operates facilities in locations throughout the United States and Canada.

For Steve Pung, Columbia Forest Products' director of technology, the light bulb went on about 3 years ago at a conference in Seattle where a professor was speaking to a group of attendees about wood adhesives.

On its face, a presentation on wood adhesives would appear to be about as exciting as watching glue dry, but Pung was riveted.

It is plywood adhesives, after all, that have generated the lion's share of the controversy for plywood manufacturers over the last century, dating back to the first few decades of the 20th century when adhesives consisted mainly of powdered animal blood mixed with water to create a sticky glue-like substance. That was replaced by soy proteins in the 1950s and evolved into the current practice of using Urea Formaldehyde.

But the controversy still stuck to the glues—to soy proteins for their inability to hold up under water; and to Urea Formaldehyde, the low-cost synthetic replacement, because of its potential for creating residual health effects for producers and consumers.

One major concern with Urea Formaldehyde, also known as UF, is the release of the free Formaldehyde in the compound into the air over time. Going from its solid form in the adhesive to a gaseous form and becoming airborne during its lifetime, this free Formaldehyde is responsible for what those in manufacturing sectors call “off-gassing.” This ability to go from solid to airborne and therefore become ingestible by humans classifies Formaldehyde as a Volatile Organic Compound (VOC). In addition, Formaldehyde was recently branded as a known cancer-causing agent by the International Agency for Research on Cancer.

What Pung was hearing could revolutionize the way Columbia Forest Products — the largest hardwood plywood manufacturer in the North America—produced its plywood.

Dr. Kaichang Li of Oregon State University told the crowd attending the annual Forest Products Society Meeting in Seattle about his trip to the Oregon Coast, his fascination with mussels and their ability to adhere to rocks despite the continuous pounding of the ocean.

After tinkering in the lab, Li found that the power grip of mussels was due to the secretion of proteins called byssal threads. If he could find a

similar protein, he could mimic the natural wonder and make it available to the world at large.

Li professed to the group that he had perfected a compound that was as strong if not stronger, cheaper to make and more water resistant than any other adhesive on the wood market today. What's more, it was made almost entirely of soy flour.

"Without giving you any trade secrets," Li would say later, "if I told you the recipe you could take it home, go into your kitchen and make it, pretty easily."

If Li could create a cost-effective and environmentally friendly alternative to UF it would be a home run, for the industry and the end-users of hardwood plywood seeking cleaner and greener products.

"There has always been a lot of controversy around Urea Formaldehyde, particularly since it has been listed as carcinogenic to humans," Li said. "Despite all the fighting about 'Is it toxic? Is it not toxic?' most are willing to concede that it's certainly not good for you.

"The release into the air of UF vapors is really so slow that you don't realize it but it comes out, particularly in hotter climates. In mobile homes they use it all the time, and in other indoor construction the concentration can really be quite high," he added.

Pung and Dr. Li both knew that if this soy-based glue could be perfected, this compound would actually be the first Formaldehyde-free product produced at roughly the same cost as the traditional UF adhesives. Consider it a value-add for customers without the additional cost.

It also stood to virtually eliminate all VOCs that impact air quality and any potential carcinogenic materials from the company's product line, Pung added.

"It's roughly the same durability, but its resistance to moisture is much better," Pung said. "The great thing for us from a company perspective and an environmental perspective is that it eliminates air emissions at the plant level and the product level. The fact that it is more water resistant is really a bonus."

That water resistance is thanks to a connection of Li's: Hercules, Inc., a global chemical manufacturing company that worked with him previously on eliminating chlorine from the pulp and paper bleaching process. Li knew that Hercules specialized in wood and paper chemicals and was developing a curing agent that could essentially serve as a water protecting shell to the adhesive. Pung described the agent as a non-VOC resin that essentially "plasticizes" the bonding agent.

No stranger to the forest products industry, Li is known as an authority on the subject of wood and paper chemistry, pollution control in the wood and paper making process, and general wood science and engineering as an associate professor in Oregon State's College of Forestry.

The result is PureBond, a cost-effective compound the industry has been pursuing for decades. As a reward for their hard work, Columbia currently holds an exclusive license on the adhesive for hardwood-plywood and other forest product applications. "I was a little overwhelmed by the reaction at first," Pung said. "For me it's probably the biggest single accomplishment in the 10 years that I've been here at Columbia Forest Products."

This was particularly good news to Columbia Forest Products' CEO Harry Demorest, a former executive at Arthur Andersen who not only understood the financial value of the discovery, but its inherent impact on the forest product industry, Columbia Forest Products customers and the company's environmental impact.

"It's my sense that this is really something special," said Demorest. "The industry has been talking about this type of product for decades, with people trying and failing to make it happen, and finally deciding that it just couldn't be done.

"But when people say it can't be done, just like anything else you can't help but get inspired," he added.

Getting it done at Columbia Forest Products meant essentially revamping its plywood plants to incorporate this adhesive into the wood gluing process. For Demorest and company, this required an investment of \$250,000 per plant to make it possible. Currently 3 of the company's 6 plywood plants are using PureBond. Company officials added that they

hope to bring all plywood production facilities on line in 2006, with the rest of its 18 plants for flooring and veneer applications some time thereafter.

For Demorest, the cost for implementing the PureBond into company operations was the cost of doing business as an industry leader.

“It’s important that we as a company provide leadership in the industry as the largest hardwood plywood manufacturer in the United States,” he said. “I’ve only been here for 10 years but when I was with Arthur Andersen, who has a lot of forest products company clients, what I always saw was companies that would rebel against environmental issues imposed on them.”

It has been Columbia Forest Products’ ability to see market opportunity in environmental stewardship that has helped differentiate the company from its competitors and help them align with like-minded vendors, according to Paul Davis, the company’s marketing analyst.

He pointed to Columbia’s association with the Forest Stewardship Council since 1999 as a way to position itself into the green building market, its membership with the U.S. Green Building Council and Columbia’s pursuit to be the go-to company for a growing market of vendors and consumers seeking environmentally friendly and sustainably produced products.

“These baby-boomers and post-boomers are making a lot of decisions about the kitchen cabinets and flooring going into their homes,” said Davis. “It’s important that we as a business understand green building and this emerging demographic. It makes sense for Columbia not just on how it treats the environment but how it positions the Columbia brand in the market.”

According to a fact sheet on the PureBond adhesive, by switching to this compound, Columbia plywood manufacturing facilities also will reduce the employee and community exposure to VOCs by as much as 90 percent.

Demorest concurred with Davis, adding that the decision to invest in the research and implementation of this new adhesive wasn’t purely a “be good to the world” decision. His building customers were calling for UF-

free products without the added mark-ups, and end customers wanted environmentally friendly products that minimized health risks.

“Years ago, I figured this out when my wife had me hauling down the recycling to the curb that this type of environmentally conscious behavior was really important to people,” he said. “Then in food stores, I started seeing produce with no pesticides used and those food stores got bigger.

“So sure, it’s the right thing to do, but really, it’s part altruism and partly market driven,” he admitted.

Neil Kelly Cabinets, one of a handful of Columbia Forest Products’ customers who got in on the ground floor and tested the product before wide release, recognizes that growing market demand. Based on its history of environmental vision leading to market opportunities, Neil Kelly made a perfect testing partner for Columbia Forest Products.

“We are always interested in better, healthier building materials, and in my opinion this (PureBond) is huge for our industry... bigger than Columbia Forest Products even realizes,” said Rick Fields, president and CEO of Neil Kelly Cabinets. “In my opinion we’re only a couple of years away from the mothers of America standing up and demanding this type of a product in their homes because of things like Formaldehyde off-gassing and other VOCs affecting the health of their children.

“It’s stronger, it’s water-resistant and it’s natural,” he added. “You really can’t beat it...and it’s the right thing to do.”

Is it market-driven enough to be worth the more than \$4 million it will cost to retrofit Columbia Forest Products facilities with PureBond? Columbia Forest Products’ CEO Demorest recognized the gamble but charged ahead.

“To a certain degree this is a roll of the dice,” he admitted. “The research, the spending, the staff time...it is the right thing to do for our employees, our customers and our communities and I really think we can drive more business.”

He was quick to add however, “but the truth is you never know. But what I do know is that I’d rather do something like this rather than a few years down the road say ‘Wow, we really missed a great opportunity.’”

For Columbia Forest Products' technology steward, he was just glad to be in the audience, and later in collaboration with the group of innovators who helped move the process forward.

“When we first began working on this technology, I gave it a 50 percent chance of turning into anything of value,” said Pung. “As our chances for success grew so did support from customers.

We feel that in the end, OSU, Hercules, Columbia Forest Products and hardwood plywood users all benefit,” he continued. “It isn't often that we get to work on a project that can affect this many different people, companies and organizations.”

And Li was glad Pung was paying attention to his rather technical speech.

“I am very appreciative of Steve Pung and the fact that he trusted me and saw this as an opportunity,” said Dr. Li. “There were a lot of other people there (at the conference in Seattle) who liked it...they nodded and smiled, but did nothing about it. Steve and Columbia Forest Products did.”

Key Observations:

Other businesses can draw important lessons from Columbia Forest Products' approach to innovation, leadership and environmental stewardship.

1. Change is catalyzed by leadership. Columbia Forest Products' CEO Harry Demorest and Technology Director Steve Pung moved forward despite industry skepticism and they succeeded.
2. There is a company-wide recognition that sector leadership can translate to market advantage.
3. Businesses can find an alignment between environmental and financial outcomes by viewing environmental and social issues as potential market opportunities. Columbia Forest Products has a history of unearthing opportunity through environmental leadership.
4. Collaboration across sectors can be highly effective when there is an alignment of desired outcomes. Columbia Forest Products worked with many of its vendors prior to the product's release and

has worked with them since to ensure PureBond met expectations. Company representatives acknowledged that they could not have made progress toward this goal alone. They needed like-minded companies in their supply chain to make it happen.

This case study was authored by [Metafore](#), a non-profit environmental organization that specializes in working with businesses to implement innovations relating to evaluating, selecting and manufacturing environmentally preferable wood and paper products.

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