“Smart Sponge” Soaks Up Pollutants
Nanocellulose-Based Aerogel Takes on Oil and Chemical Spills

By Rebecca Wallace, Public Affairs Specialist

Pollutants beware! Nanotechnology researchers have developed a cellulose-based aerogel that’s thirsty for oil and chemicals while turning its nose up at water.

This collaborative effort between Forest Products Laboratory (FPL) and University of Wisconsin (UW) researchers offers the potential for a “green” method of cleaning up oil spills and heavy metal contamination using nanocellulose, or wood fiber broken down to the nanoscale.

“Initially we were looking to develop air or water filters made from nanocellulose,” explains Zhiyong Cai, FPL research engineer. “But the challenge there is that wood readily soaks up water. We were looking for ways to treat the fibers so they would repel water and be a suitable material for filter production.”

In his search for a solution, Cai reached out to Shaoqin “Sarah” Gong, who runs a biotechnology–nanotechnology lab at the UW’s Wisconsin Institutes for Discovery. There, researchers used a freeze-drying process to produce an aerogel made of cellulose nanofibrils. Aerogels are highly porous materials and the lightest solids in existence.

Working with the cellulose-based aerogel, UW graduate student Qifeng Zheng made an interesting discovery. By treating the material with specific types of silane, it acquired water-repelling and oil-absorbing properties.

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Wood You Believe: Insect and Marine Borer Edition

Termites invade more than 600,000 homes and cause over $1.5 billion in damage annually. Marine borers, small invertebrate sea animals that burrow into wood for food and shelter, destroy several hundred million dollars worth of waterfront structures each year. FPL is working to extend the life of wood products exposed to insects and marine borers.

Corrugated fiberboard is one of the termites’ preferred foods.

Marine borer shipworms destroyed this untreated pine 2-by-4 in about 5 months in Chesapeake Bay. The only external evidence of the borers are the tiny white protrusions. A pine specimen treated with CCA was still undamaged after 7 years.

Rachel Arango, Biological Science Pathways Student Trainee, and Frederick Green, Research Microbiologist, extract termites from corrugated fiberboard traps for a termite experiment.

68th Forest Products Society International Convention  
August 10–23, 2014, Québec City, Canada  
The use of wood in our daily lives has changed substantially over the past century. Today, wood competes with concrete, steel, and other materials for building construction and with oil, natural gas, hydropower, ethanol, and other resources for energy. Explore these and other forest products issues at the Forest Products Society’s 68th International Convention: Rediscovering Wood for Construction, the Economy and Environment, and Energy.

The annual International Convention brings together hundreds of scientists, design professionals, managers, and decision makers from academia, government, nonprofit, and private industry to discuss the state of forest products research and learn about innovations in the field.

For more conference information, visit www.forestprod.org/IC/about.php.

SmallWood 2014 Conference  
June 3–5, 2014, Rochester, Minnesota, USA  
Register now for SmallWood 2014 Forest Utilization and Management: From Working Woodlands to City Streets. Hear noted experts unveil the latest on forestry, stewardship, and invasive species; learn what’s new in emerging and value-added markets; network and grow your business with mobile apps and an online community; and visit mill and forestry sites in a hotbed of major primary and secondary wood manufacturing facilities.

For more conference information, visit www.woodsymposium.wsu.edu/.

The 57th SWST International Convention in conjunction with The 7th Wood Structure and Properties Conference and The 6th European Hardwood Conference  
June 23–27, 2014, Zvolen, Slovakia  
The Society of Wood Science and Technology (SWST) will hold its International Convention together with co-hosts Technical University, Zvolen, Slovakia, and University of West Hungary. Technical sessions include hardwood research and utilization; energy, fuels, and chemicals; products, design, and manufacturing technologies; forest products policy, global trade, and value chain management; wood construction and structures; sustainable forest management; lignocellulosic material science; and a poster session.

The final day will be a day-long tour of the UNESCO World Heritage Site city of Bansk tiavnica, old Mining/Forestry Academy and Botanical Gardens, and the wooden church in Hronsek.

For more conference information, visit www.swst.org/meetings/AM14/index.html.

Visit Lab Notes!  
Have you checked out Lab Notes, the FPL’s online news feed? Visit www.fpl.fs.fed.us/labnotes for unique and interesting stories about FPL research, scientists, and the greater forest products industry.

With Lab Notes, you can easily follow hyperlinks and get to know our researchers, their work, and how it all fits within a larger forestry-sector context.
“Wood may be one of the world’s oldest building materials, but it is now also one of the most advanced,” said Agriculture Secretary Tom Vilsack while announcing a new partnership to train architects, engineers, and builders about the benefits of advanced wood building materials.

The new training program will include a $1 million investment from the Forest Service and will be done in partnership with WoodWorks, an organization that provides technical support, education, and resources related to the design of modern wood buildings to architects, engineers, and developers.

“Building stronger markets for innovative new wood products supports sustainable forestry, helps buffer greenhouse gas emissions, and puts rural America at the forefront of an emerging industry,” Vilsack said. “Presently, the market for wood and other related forest products supports more than one million direct jobs, many in rural America. As these markets expand, so will these economic opportunities.”

These announcements were made during a “Building with Wood: Jobs and the Environment” workshop hosted by the White House Rural Council. They also are part of USDA’s overall strategy to promote the use of wood as a green building material. USDA’s Forest Products Laboratory has invested over $2 million in research and technical support for emerging wood technologies. The Lab has created additional opportunities for emerging wood technologies to be used in housing developments and other green building demonstration projects.

“This cooperative venture demonstrates the high value of ‘green’ building in terms of environmental sustainability and economic development,” said Michael T. Rains, Director of the Forest Service’s Northern Research Station and the Forest Products Laboratory. “Through research that connects the forest to the laboratory, where low-value wood is being converted into high-value materials such as engineered composites and nanocellulose products, the taxpayer is reaping the rewards of innovation like never before.”

Emerging engineered wood technologies can be used in industrial building projects such as tall buildings and skyscrapers. By some industry estimates, a three- to five-story building made from emerging wood technologies has the same emissions control as taking up to 550 cars off the road for one year. Wood-based designs are also far more efficient insulators than other building materials, thereby reducing energy consumption for heating and cooling.

The Secretary also announced plans to launch a prize competition later this year for developers, institutions, organizations, and design teams to demonstrate the

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architectural and commercial viability of using sustainable wood products in high-rise construction. The Department is planning to invest up to $1 million to launch the competition. One private partner, the Binational Softwood Lumber Council, has committed an additional $1.5 million for the competition and has agreed to match up to $3 million in support. The competition will help spur increased sustainability in construction and will give priority to applicants that source materials from rural domestic manufacturers and domestic, sustainably managed forests.

When President Obama signed the 2014 Farm Bill in February, he directed his Administration, working through the White House Rural Council, to lead a new “Made in Rural America” export and investment initiative. This initiative is charged with bringing together federal resources to help rural businesses and leaders take advantage of new investment opportunities and access new customers and markets both at home and abroad. White House Rural Council leadership on advanced wood products is an example of how the Administration is moving forward on dual goals of domestic production and sustainability. The Secretary’s announcement also supports President Obama’s Climate Action Plan goal of preserving the role of forests in mitigating climate change.

Distinguished Scientist Award Goes to FPL Researcher

By Rebecca Wallace, Public Affairs Specialist

JunYong (JY) Zhu, research general engineer at the Forest Products Laboratory, was recently presented with the Forest Service Deputy Chief’s Distinguished Science Award. Jimmy Reaves, Deputy Chief of Research and Development, awarded Zhu the honor for his “sustained productivity and scientific excellence in creating innovative market-based solutions for the utilization of low-value forest-based biomass.” Reaves went on to say Zhu is “a credit to the Forest Service and the larger research community.”

The award is a special honor for Zhu, a new immigrant to the United States and whose parents were farmers with little education. “I am very grateful for the education I received that equipped me with life learning skills,” said Zhu. “This can only happen in America.”

Zhu is also quick to thank those who helped him along the way. “I am grateful for the many great people, including collaborators, visiting scientists, and scholars, who diligently contributed to my research program,” Zhu added.

“We are proud of JY’s work and his great public service as we strive to make our forests healthy, sustainable and more resilient to disturbances,” said Michael T. Rains, Director of the Forest Products Laboratory and Northern Research Station.

Interestingly, Zhu’s education and background is not in wood science, but rather mechanical and aerospace engineering. He is now firmly rooted in the world of wood, however, with current research focusing on using undervalued materials, such as beetle-killed trees, for biofuel and nanocellulose production, as well as fundamental research on cell wall deconstruction.
Lights, Camera, Action! “Discover Wisconsin” Films at FPL

By Rebecca Wallace, Public Affairs Specialist

A film crew from “Discover Wisconsin”, a television program showcasing the many treasures of the Badger State, visited the Forest Products Laboratory as part of their America’s Dairyland series. This series takes a look at Wisconsin’s largest and most important industry, dairy.

So, what does this have to do with forest products?

A key component of the dairy industry is, well, cows. And cows produce a lot of milk, but they also produce a lot of waste. That’s right, good old fashioned manure. FPL engineer John Hunt has found a way to make composite panels from cow manure mixed with other materials, such as recycled paper or cardboard.

As you can see, the “Discover Wisconsin” crew dug right in, getting down and dirty with this research project.

But it’s really not so bad. The manure Hunt uses has gone through a process called anaerobic digestion, in which microorganisms break down biodegradable material in the absence of oxygen. The process reduces the manure to raw fiber, which is not unlike other natural fibers used in composite products.

The resulting product is strong, lightweight, recyclable, biodegradable, and incredibly versatile. A similar panel product (sans manure) has found considerable success through FPL partner Noble Environmental Technologies (NET). NET produces a recycled panel product based on Hunt’s research called ECOR, which was recently touted for its use in building the first 100% sustainable Hollywood studio set.

We here at FPL had a great time with the Discover Wisconsin crew, and are excited to see the results. The episode is scheduled to air in June, so stay tuned...
Excellence in Writing Award Goes to FPL-Authored Journal Article

By Rebecca Wallace, Public Affairs Specialist

The Society of Wood Science and Technology (SWST) awarded their First Place George Marra Award for Excellence in Writing to three Forest Products Laboratory (FPL) researchers and their project partners. The journal article—“Prediction of wood quality in small-diameter Douglas-fir using site and stand characteristics”—was written by FPL researchers James Evans, David Kretschmann, and Cherilyn Hatfield (retired), along with partners Carl Morrow and Tom Gorman from the University of Idaho.

The George Marra Award recognizes excellence in research and writing and is presented annually by the Marra family in memory of George’s devotion to excellence in writing. All articles published in the four quarterly issues of Wood and Fiber Science are considered for the award and are read and judged by a three-person committee—one each from academia, government, and industry.

This year’s award will be presented at the SWST 2014 International Convention in Zvolen, Slovakia, in June 2014.

A Winning Paper...on Paper

A journal article authored by Forest Products Laboratory researchers David Vahey (retired) and John Considine was selected as the TAPPI Journal Best Research Paper for 2013. Vahey and Considine, both materials research engineers, wrote “Influence of forming conditions on fiber tilt” with partner Michael MacGregor (retired) of MacGregor Paper Consulting. The research was assessed based on innovation, creativity, scientific merit, and clear and concise presentation of ideas.

“This paper is an example of high-quality, fundamental research that significantly improves the industry’s understanding of basic sheet properties and sheet structure and the model developed could also potentially be used to aid in troubleshooting paper performance,” said TAPPI Journal Editorial Board member Terry Bliss. The paper reported “highly valuable and innovative research work that expanded on earlier research by developing a simple model for fiber tilt.” In addition, Bliss said, results were written in a “clear, logical, and easy-to-follow manner. It’s a very thorough and well-written research paper.”

The paper and its authors were honored at the PaperCon 2014 Conference Awards Dinner on Tuesday, April 29, 2014, in Nashville, Tennessee, USA.
Cradle to Cradle Innovation Challenge Recognizes FPL-Developed Product

By Rebecca Wallace, Public Affairs Specialist

Noble Environmental Technologies (NET), a long-time partner of the Forest Products Laboratory (FPL), was recently recognized in the Cradle to Cradle Innovation Challenge featuring the next generation in green building materials.

The company placed third amongst 144 applicants competing to create a building product that is safe, healthy, affordable, effective, and designed to be returned safely to nature or industry after use. The winning product, ECOR®, was developed in cooperation with FPL.

ECOR® is a revolutionary design material that is 100% non-toxic, 100% recycled and recyclable, USDA-certified 100% biobased, and Cradle to Cradle certified. The material is manufactured through a clean technology conversion process that transforms virtually any natural cellulose fiber into high-density, compressed molded fiber panels. ECOR® gives architects and designers the freedom to create shapes and forms that would be impossible with traditional materials, and is recognized for its ability to be curved at almost any radii.

“Partnering with the researchers and inventors of the USDA’s Forest Products Laboratory to develop ECOR® has yielded unlimited opportunities,” said Robert Noble, CEO and Founder of Noble Environmental Technologies. “The partnership has garnered the issuance of a patent, many published articles, and an exclusive license agreement.”

FPL’s ongoing partnership with NET is an excellent example of how public research initiatives can benefit from collaboration by creating a gateway to get research results into the hands of the public.

“Partnering with industry, universities, and other organizations is very rewarding, as it brings the creative talents of multidisciplinary teams together and more rapidly moves new technologies into use,” says Ted Wegner, FPL Assistant Director. “Innovative partners such as NET excel at bringing creative new technologies and solutions to the marketplace.”

ECOR® gives architects and designers the freedom to create shapes and forms that would be impossible with traditional materials.

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When Zheng presented Cai with this phenomenon, his thoughts went back to the Gulf of Mexico oil spill in 2010. In the midst of that disaster, BP contacted the Forest Products Laboratory looking for help in cleaning up the spill. At the time, the only materials Cai could suggest would soak up water as readily as the oil, and would sink with the weight of the liquids.

“The cellulose aerogel can absorb 50–100 times its own weight, but is so low-density that it would still float for easy collection and clean-up,” says Cai. Additionally, the contaminants could be squeezed out of the aerogel and the material could be used again, albeit with somewhat less effectiveness.

The results of this study were published in the *Journal of Materials Chemistry A*. The aerogel technology has been patented, and researchers are now looking for paper or petroleum industry partners to scale-up and further develop the technology.

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**Smart Sponge** Soaks Up Pollutants

A piece of cellulose aerogel (left) was dipped into a beaker of water tainted with red-dyed diesel fuel. In just a few minutes, the diesel was absorbed by the aerogel (right), leaving the clear water behind.

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**Wood Wise—Terms from the World of Wood**

**Structural Composite Lumber (SCL):** Wood elements glued together to form products that are similar in size to solid-sawn lumber.

**Laminated Strand Lumber (LSL):** Similar to oriented strand lumber with somewhat longer strands.

**Laminated Veneer Lumber (LVL):** Structural composite lumber manufactured from veneers laminated into a panel with the grain of all veneer running parallel to each other. The resulting panel is ripped to common lumber dimensions.

**Oriented Strand Lumber (OSL):** Structural composite lumber made from wood strand elements similar to those used in oriented strand board. The strands are oriented primarily along the length of the member.

**Parallel Strand Lumber (PSL):** Structural composite lumber made from high aspect ratio wood strand elements manufactured from veneer oriented primarily along the length of the member. It is manufactured in billets and cut to lumber dimensions.

New Video Series: Engineered Wood Products in Residential Construction

By Rebecca Wallace, Public Affairs Specialist

The Forest Products Laboratory (with partners Home Innovation Research Labs, K Hovnanian Homes, and Weyerhaeuser) recently released a three-part video series on engineered wood products commonly used as structural components in residential construction.

The series was designed to provide the latest information on engineered wood in residential construction to assist in the development of building designs and specifications.

The first video provides an introduction to engineered wood products and presents best practices for residential design and installation.

The second video focuses on how to build a solid, high-performance floor assembly using engineered wood products, and is useful for builders as well as inspectors.

The third video details safety and construction precautions in constructing an engineered wood floor system, providing information on temporary safety bracing.

In addition to the details highlighted in this video series, all applicable local building code requirements and all specifications established by the licensed professional for the project must be followed. Safety first!


Several video series with the latest information on residential construction are available on FPL’s website.

View them for free at www.fpl.fs.fed.us/products/presentations/visuals
Science Serving Society: U.S. Forest Service R&D

By James T. Spartz, Public Affairs Specialist

The Research & Development arm of the U.S. Forest Service (USFS) pursues innovation nationwide to improve the health and use of America’s forests and grasslands. A recent Forest Service Research Overview explains how, why, and to what effect these 500-plus Forest Service researchers examine a spectrum of biological, physical, and social sciences to promote the sustainable management of our Nation’s diverse forests and rangelands.

Like those forests and rangelands, USFS R&D covers a lot of territory. Programs in all 50 states, U.S. territories, and commonwealths focus on informing policy and land-management decisions. Addressing invasive insects, urban forestry, trends in forest health, human dimensions of natural resources, climate change impacts, and sustainable forest products harvesting – among many other topics - a network of 82 experimental forests and rangelands extends from St. Croix in the U.S. Virgin Islands, up to Alaska, over to Hawaii, and deep into the South. This wide geographic purview includes nearly 50 degrees of latitude and the full range of temperature and precipitation conditions. Diverse ecosystems include Alaskan boreal forests, Puerto Rican a tropical forests, Pacific Northwest rainforests, and the arid ranges of Utah and the inter-mountain West.

Like all Forest Service research, the information and technology produced by the Forest Products Laboratory is available for public use. Pages 14 and 15 of the Overview identify how FPL research contributes to “the conservation and productivity of forest resources,” leading to “sustainability for forests, the economy, and quality of life.” Among the FPL focus areas highlighted in the Overview are advanced structures – using technology to change a building’s affordability, durability, quality, energy use, and disaster resilience – and nanotechnology – learning more about the fundamental components of wood at atomic and molecular scales.

Caring for the land and serving people
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