TechLine

Forest Products Laboratory

Three-Dimensional Fiberboard: A New Structural Building Product

Many of our national forests contain an abundance of small, tightly spaced trees and underbrush that can substantially contribute to catastrophic forest fires. Existing stands of dead or dying trees can also add fuel to forest fires. Such forest material is often not economical to remove or the capacity to process it does not exist.

The Forest Products Laboratory has developed a process to produce a three-dimensional structural fiberboard product using a wide range of wood fibers. This new engineered wood product will help address sustainable forest management issues and promote economically viable utilization of this excess forest underbrush and small-diameter, unmerchantable material.

New Three-Dimensional Product

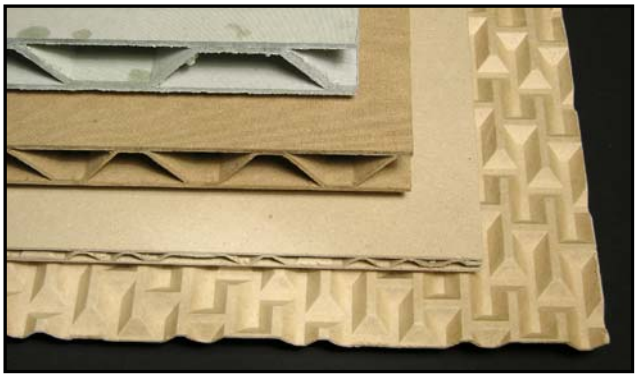
The newly developed three-dimensional engineered fiberboard product consists of a resin-free, pulp-molded core that is made from a wide range of inexpensive, underutilized fiber sources. This fiberboard is molded into a specially engineered form by hot-pressing the wood (lignocellulosic) fibers between rigid mold elements without supplemental adhesive. This hot-pressing produces strong inter-fiber bonds and a correspondingly strong core material, even when using relatively low-quality fiber. When the structural core is bonded to exterior skins, a novel three-dimensional sandwich panel is formed that exhibits a high level of strength and stiffness.

Most importantly, this new three-dimensional biobased composite can be made from virtually any virgin or recycled biofiber resource, including wood residues, agricultural biomass, recycled newsprint, small-diameter timber, and mixed wood and agricultural residue. As an engineered biocomposite, this product can be manufactured to provide a range of specific levels of structural performance, durability, moisture resistance, and insulation. This new product could have significant implications on resource sustainability and economic development for rural communities.

We recently built a pilot-plant-scale fiber former and hot-press system, giving us the capability to make 0.6- by 2.4-m (2- by 8-ft) three-dimensional engineered fiberboard panels. This capability allows us to produce and test larger three-dimensional engineered fiberboard panels to verify relationships between predicted and actual structural properties.

Our ultimate goal is to engineer a three-dimensional fiberboard that will (1) meet specific performance requirements, (2) provide maximum benefits in forest sustainability and forest fuel reduction, and (3) cause minimal environmental impact as determined by life-cycle analysis.

This new three-dimensional engineered fiberboard technology has a number of promising uses in construction, furniture, and packaging applications. The economic feasibility of constructing panels from these materials is currently being assessed as part of our ongoing research program.



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References

- Hunt, J.F.; Supan, K. 2006. Binderless fiberboard: comparison of fiber from recycled corrugated containers and refined small-diameter whole treetops. Forest Prod. J. 56(7/8): 69-74. www.fpl.fs.fed.us/documnts/pdf2006/fpl_2006_hunt001.pdf

- Winandy, J.E.; Hunt, J.F.; Turk, C.; Anderson, J.R. 2006. Emergency housing systems from three-dimensional engineered fiberboard: temporary building systems for lightweight, portable, easy-to-assemble, reusable, recyclable, and biodegradable structures. USDA Forest Service, Forest Products Laboratory, FPL-GTR-166. Madison, WI. www.fpl.fs.fed.us/documnts/fplgtr/fpl_gtr166.pdf

- Hunt, J.F.; Supan, K. 2005. Mechanical properties of a wet-processed fiberboard made from small-diameter lodgepole pine treetop material. Forest Prod. J. 55(5): 82-87. www.fpl.fs.fed.us/documnts/pdf2005/fpl_2005_hunt001.pdf

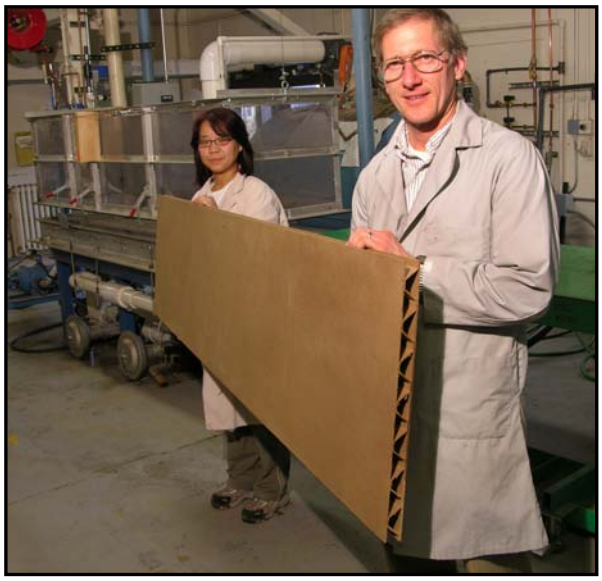
- Hunt, J.F. 2004. 3D engineered fiberboard: finite element analysis of a new building product. In: 2004 International ANSYS Conference. ANSYS, Inc. Pittsburg, PA. www.fpl.fs.fed.us/documnts/pdf2004/fpl_2004_hunt004.pdf

- Hunt, J.F. 2004. 3D structural panels: a literature review. In: 7th Pacific-rim Bio-based Composites Symposium. Nanjing Forestry University. Nanjing, China. Vol. 2: 272-281. www.fpl.fs.fed.us/documnts/pdf2004/fpl_2004_hunt005.pdf

- Hunt, J.F.; Vick C.B. 2004. Evaluation of coupling agents to manufacture hybrid hardboard made from industrial waste fiberglass and wood filler. Forest Prod. J. 54(7/8): 35-41. www.fpl.fs.fed.us/documnts/pdf2004/fpl_2004_hunt002.pdf

- Hunt, J.F.; Harper, D.P.; Friedrich, K.A. 2004. Three-dimensional engineered fiberboard: opportunities for the use of low valued timber and recycled material. In: 38th International Wood Composites Symposium. Washington State University Press. Pullman, WA. p. 207-216. www.fpl.fs.fed.us/documnts/pdf2004/fpl_2004_hunt003.pdf

- Mechanical Engineering Magazine. 2004. The mechanics of woods. Mechanical Engineering 126(7): 40-42. American Society of Mechanical Engineers. NY. www.memagazine.org/backissues/membersonly/july04/features/mechwood/mechwood.html



- Hunt, J.F.; Winandy, J.E. 2003. 3D engineered fiberboard: engineering analysis of an innovative new building product. In: 2nd Eco-Composites Conference, Paper 8.02. European Society for Composite Materials. London UK, Sept. 1-2, 2003. www.fpl.fs.fed.us/documnts/pdf2003/hunt03a.pdf

- Hunt, J.F.; Winandy, J.E. 2002. 3D engineered fiberboard: a new structural product. In: European Panel Products Symposium. Oct. 8-11, 2002. University of Wales, Bangor-Gwynedd, Wales. p. 106-117. www.fpl.fs.fed.us/documnts/pdf2002/hunt02a.pdf

- Hunt, J.F.; Winandy, J.E. 2002. Using wood-based structural products as forest management tools to improve forest health, sustainability and reduce forest fuel: a research program of the USDA Forest Service under the National Fire Plan. In: 6th Pacific Rim Bio-based Composites Symposium. Nov. 10-13, 2002. Portland OR; (1): 316-322. www.fpl.fs.fed.us/documnts/pdf2002/hunt02c.pdf

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