

Laboratory Scale Production  
of Lignin-based Carbon Fiber  
isolated by Solvent  
Fractionation

October 5, 2011 12:20pm 160 Plant Biotech Building



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Special thanks to:

- Dr. Joe Clark
- Dr. Don Hodges
- Dr. Mark Fly
- Dr. Miriam Davis
- Dr. Siqun Wang

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<http://www.carbonfiberguru.com/what-exactly-is-carbon-fiber/>

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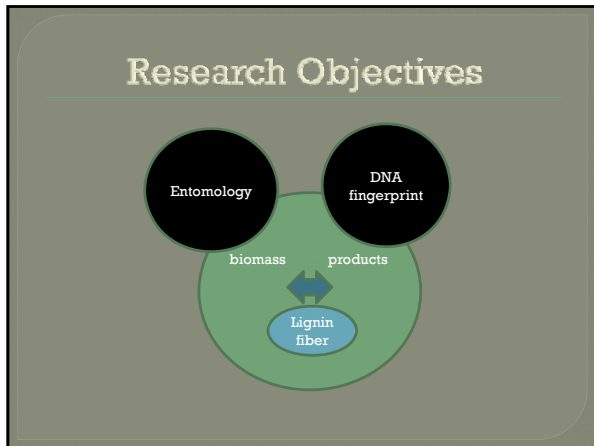
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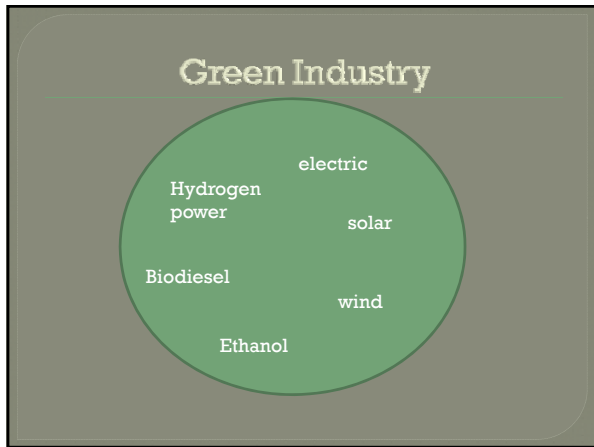
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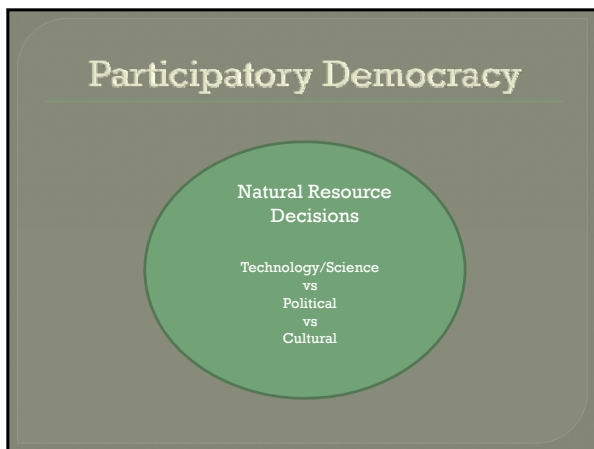
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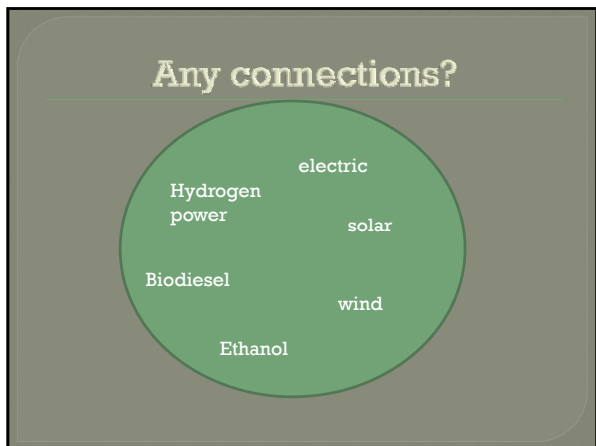
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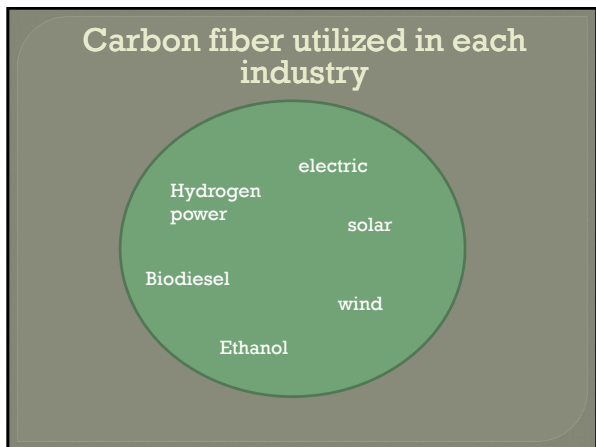
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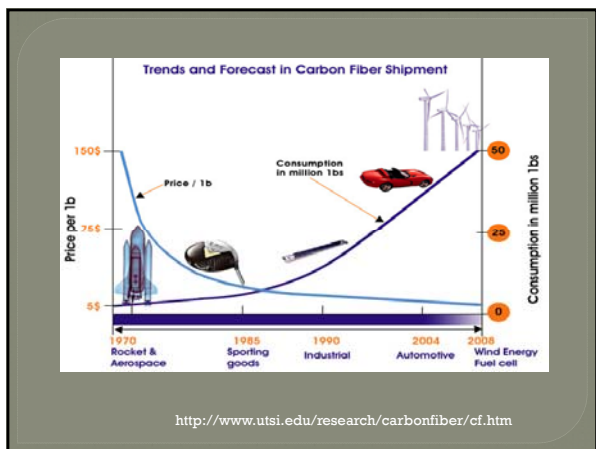
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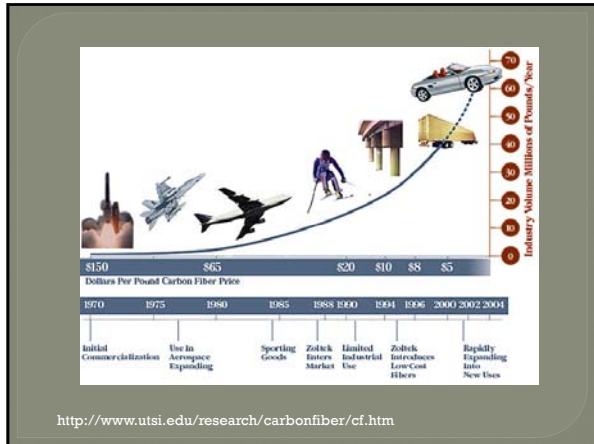
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### What is carbon fiber?

Carbon Fiber is a very strong, lightweight, synthetic fiber often bound together in a matrix with epoxy or plastic resin by heat, vacuum, and pressure.

<http://www.carbonfiberguru.com/what-exactly-is-carbon-fiber>

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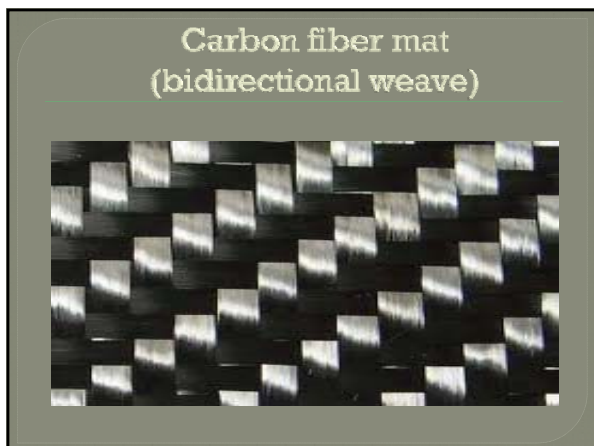
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### Isolate lignin via solvent fractionation

**Solignifera**

**Xylem cell:** dead and its thick walls and the thick, many of these cells fit a long narrow pipe for water to conduct.

**Xylem:** the tissue that conducts water from roots to leaves.

**The components of the rigid cell wall in xylem:**

- Lignin:** about 20% of the material in the xylem cell wall. It is a complex polymer and is converted into an alternative fuel.
- Cellulose:** material that can be digested into fermentable sugars, which can be converted into bioethanol.

**Plant Cell Wall Structure:**

- Middle Lamella
- Primary Cell Wall
- Pectin
- Cross-Linking Glycan
- Cellulose Microfibrils
- Plasma Membrane

Figure 1

[http://www.nsf.gov/news/news\\_summ.jsp?cntn\\_id=111897](http://www.nsf.gov/news/news_summ.jsp?cntn_id=111897)

<http://news.moogsbay.com/bioenergy/2007/10/green-roads-engineers-investigate.html>

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### Organosolv Solvent Fractionation

Similar to the paper industry

Black liquor is recovered and processed to separate lignin component from the hemi-cellulose component

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### Black Liquor

The black liquor is split by a phase separation caused by adding NaCl

Each phase is drained from a separatory funnel and dried

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### Lignin as the Precursor

1. The precursor is drawn into long strands and then heated in an anaerobic environment.
2. Most non-carbon atoms are expelled during the process leaving a carbon fiber .
3. After spinning, the fibers are stabilized and carbonized.
4. Surface treatment and sizing

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Polyacrylonitrile is currently the major source of precursor used in carbon fiber production. It is a synthetic resin created by the polymerization of acrylonitrile.

<http://pslc.ws/macrog/pan.htm>

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### Entomological impacts

Goal: To study the possible affects of insects on biomass

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## DNA Fingerprinting

Goal: To utilize PCR and other technologies to create a DNA profile of the biomass samples

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## PCR

Polymerase Chain Reaction-

Technique used to quickly amplify regions of DNA

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## Special thanks to:

Dr. Max Cheng	Tree physiology	Summer 2007
Dr. Tom Mueller	Weed science	Summer 2008
Dr. Neal Stewart	Plant genomics	Fall 2008
Dr. Joe Bozell	Organic chemistry	2009-present
Dr. Darren Baker	Material science	present
Dr. David Harper	Wood science	present

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