

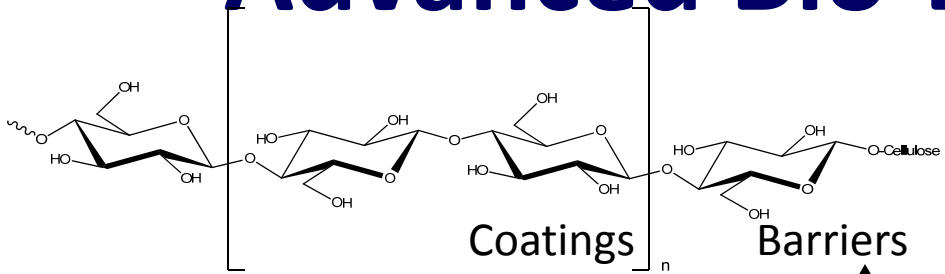
Advanced Bio-Based Materials



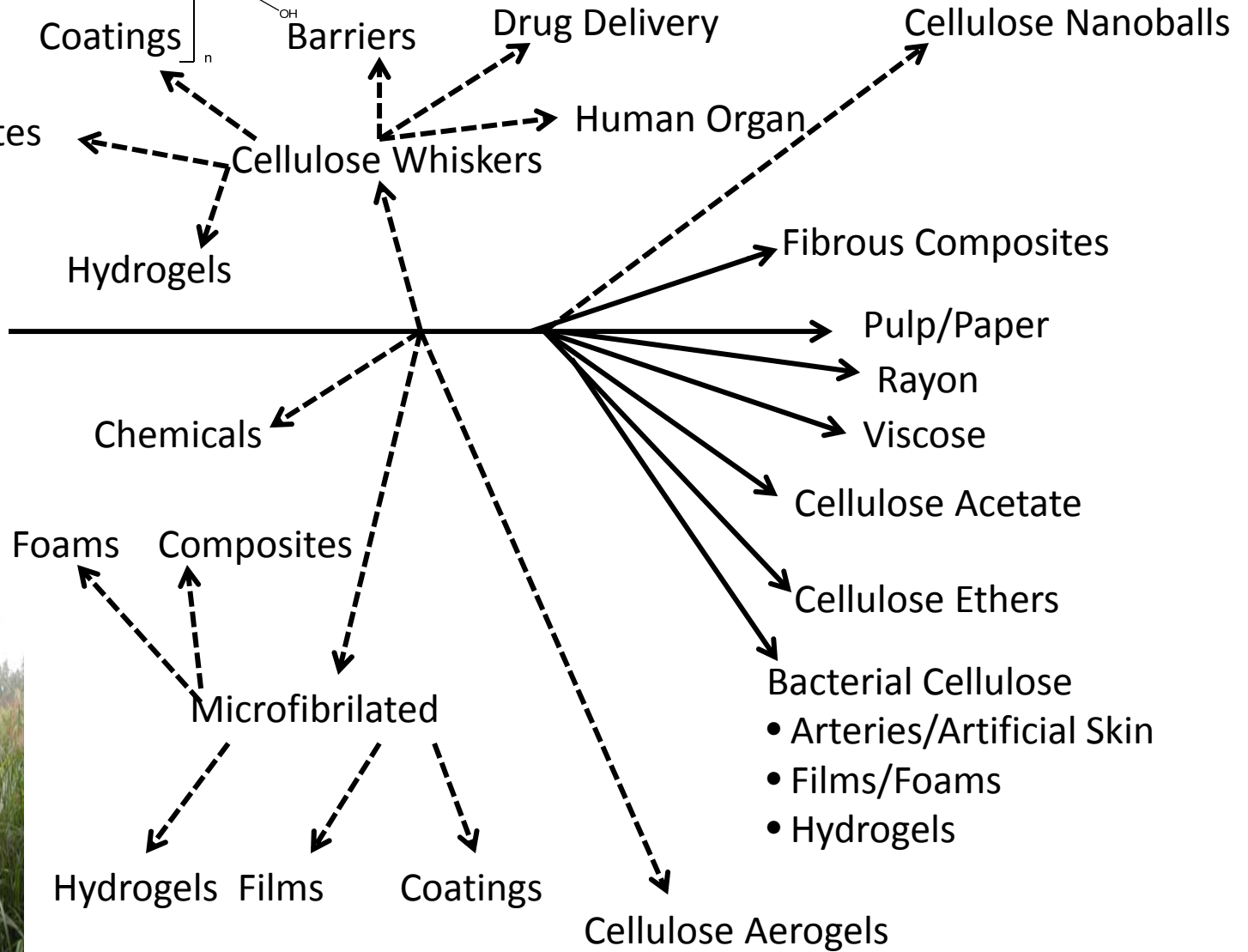
Resources:

- Extractives
- Hemicelluloses
- Cellulose
- Lignin
- Tannins

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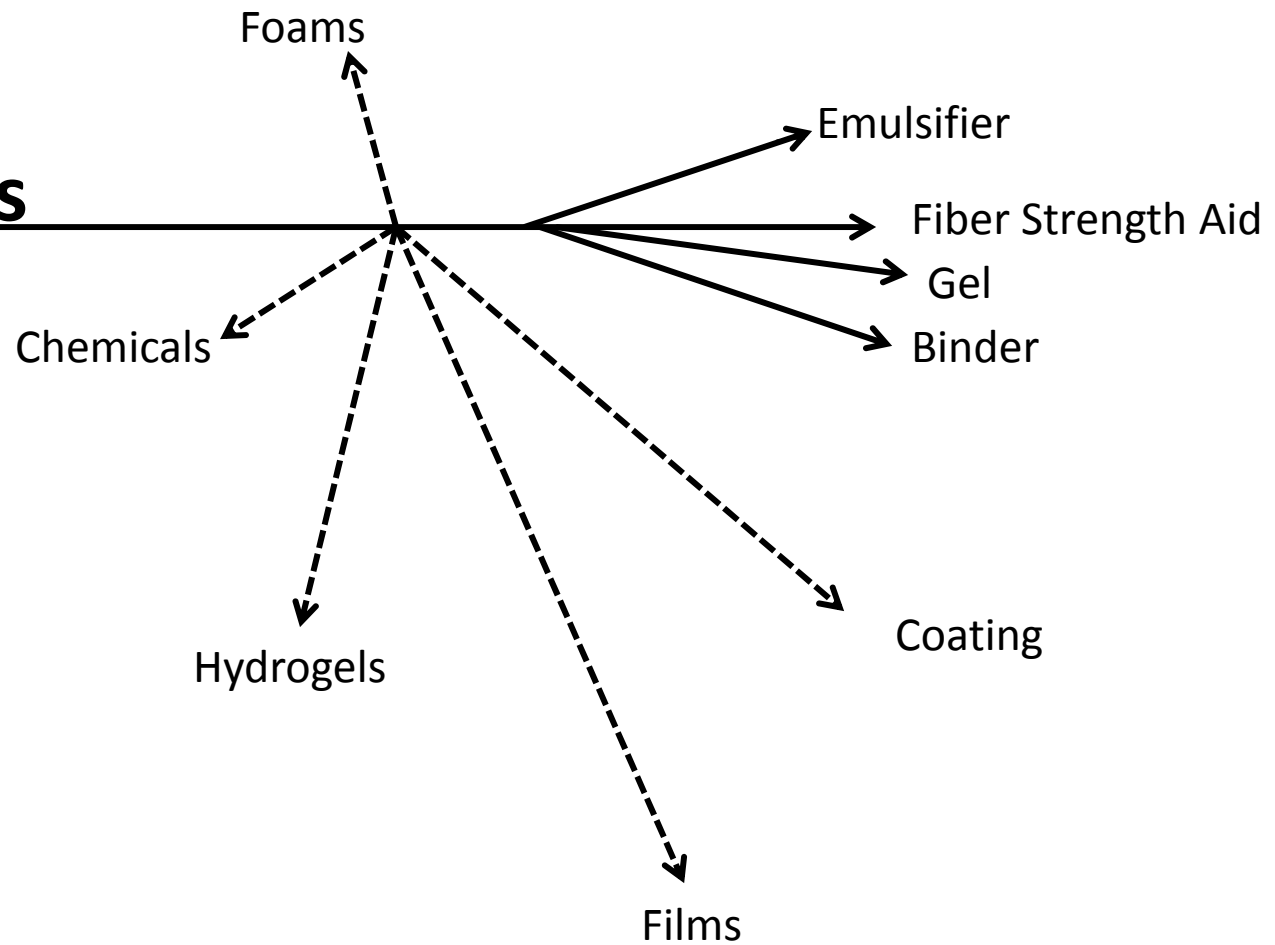


Cellulose

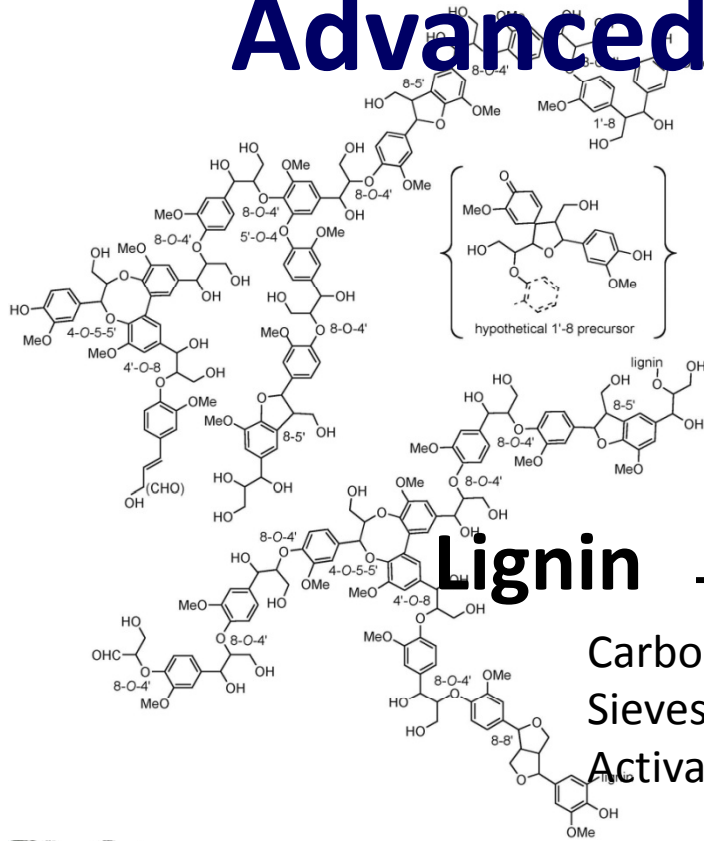


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HemiCelluloses



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Lignin



BTX-Naptha<<Chemical-Hydro Cracking> Biofuels

Phenols<<Pyrolysis> Biofuels

Pellets> Combustion> Power

Combustion> Power

Dust Control

Concert Additive

Wood adhesive

Surfactants - Dispersants

Asphalt Additives

Phenols

Anti-Oxidants & Slow Release Agent

Battery, tires

Cosmetics

Carbon Sieves/
Activated

Carbon Fibers

Polyurethane Foams

Co-Polymer Resin/Binder

Epoxies, Polyesters

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Bark Tannins:

- **Concert additive**
- **Adhesives**
- **dispersants**
- **Binders**
- **Deflocculants**
- **Antioxidants**
- **Sequestering agents**
- **Flotation agents**
- **Stabilizers in asphalt emulsions,**

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Extractives

- *Non-cell wall components that can be removed using solvents, steam, kraft pulping*
- *Typically small molecular weights, < C40*
- *Usually 1-5% of the biomass*
- *Numerous components that vary from species to species*
- *Applications include resource for production of lubricants, adhesives, rubbers, inks, emulsifier. And drilling fluids. The pitch is used as a binder in cement, an adhesive, and an emulsifier for asphalt.*