

# Biorefinery

Forest Resource Association – Sappi NA

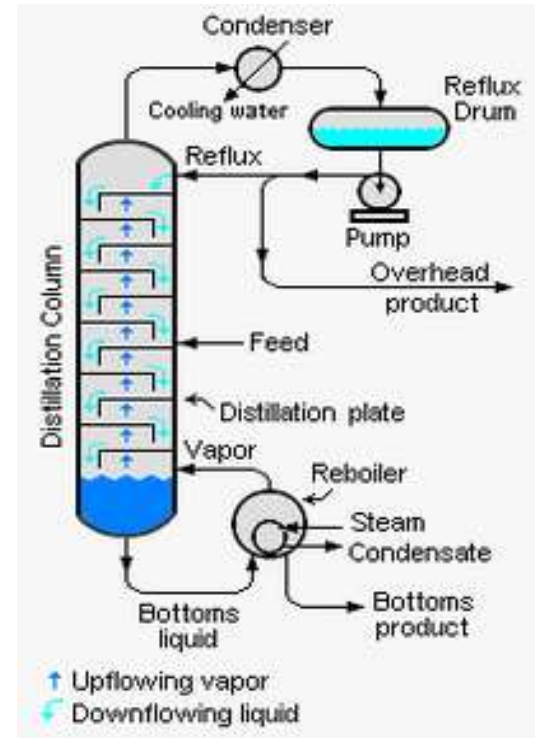
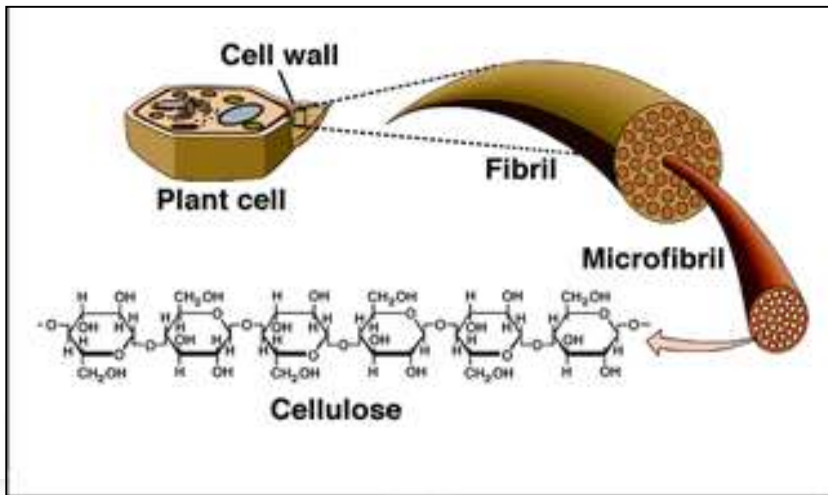
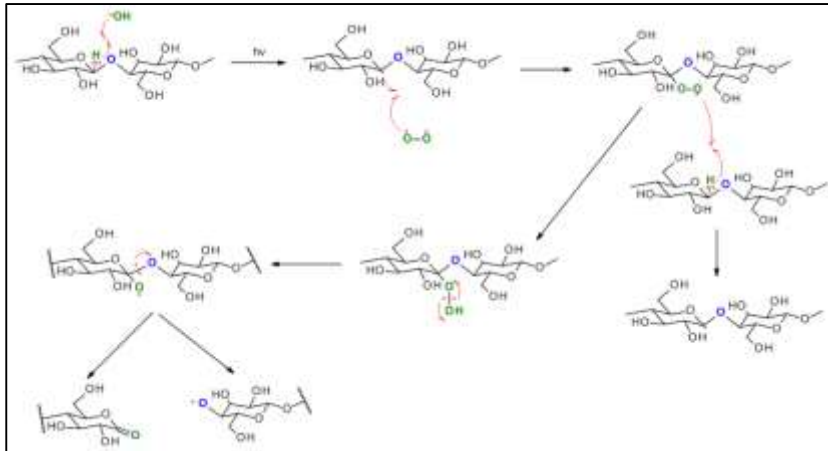
October 18, 2016



Jeff Brungardt  
Director, Fiber Sales  
Sappi North America

**sappi**  
Inspired by life

# Just what is a Bio-refinery?



# Bio-refinery

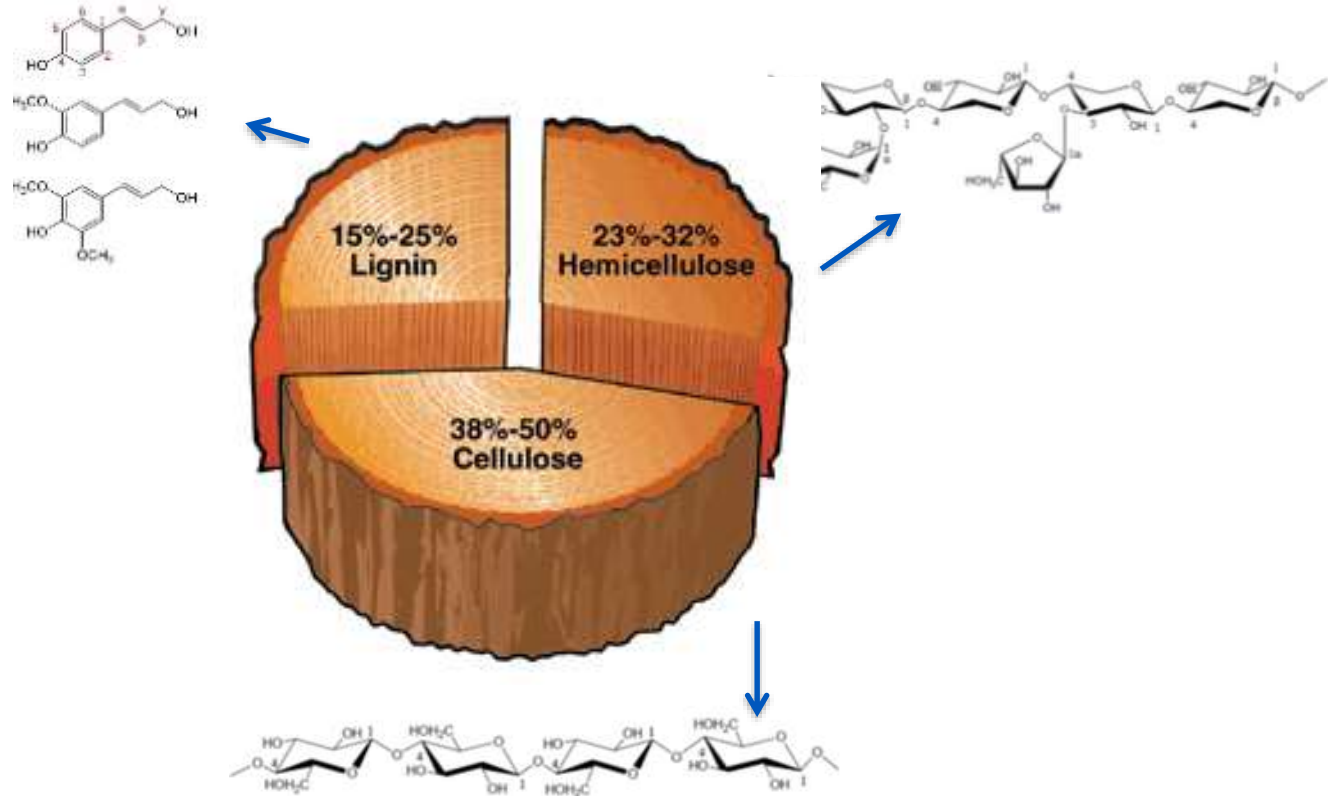
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A facility that utilizes plants (biomass) to produce fuels, power, heat, as well as value-added chemicals

Cellulose is the most abundant polymer on earth

- Naturally occurring
- Sustainable
- Renewable
- Biodegradable

# Wood Composition



# Uses for Wood components

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- Cellulose is an extremely versatile polymer which can be chemically converted into numerous products
  - Paper pulp                      Nano-cellulose                      Dissolving pulp
- Lignin
  - Cement and asphalt
  - Dust Control
  - Emulsifiers
  - Potential applications to replace many petroleum feed stocks
    - More development needed to improve economics
- Hemicellulose is extracted as wood sugars
  - Fuels
  - Chemical feed stock

# Where Does Dissolving Pulp End Up?



Food &  
Beverage



Clothing



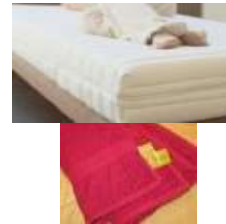
Wrap



Cosmetics



Wash & Wipe



Rest &  
Relaxation



Medical



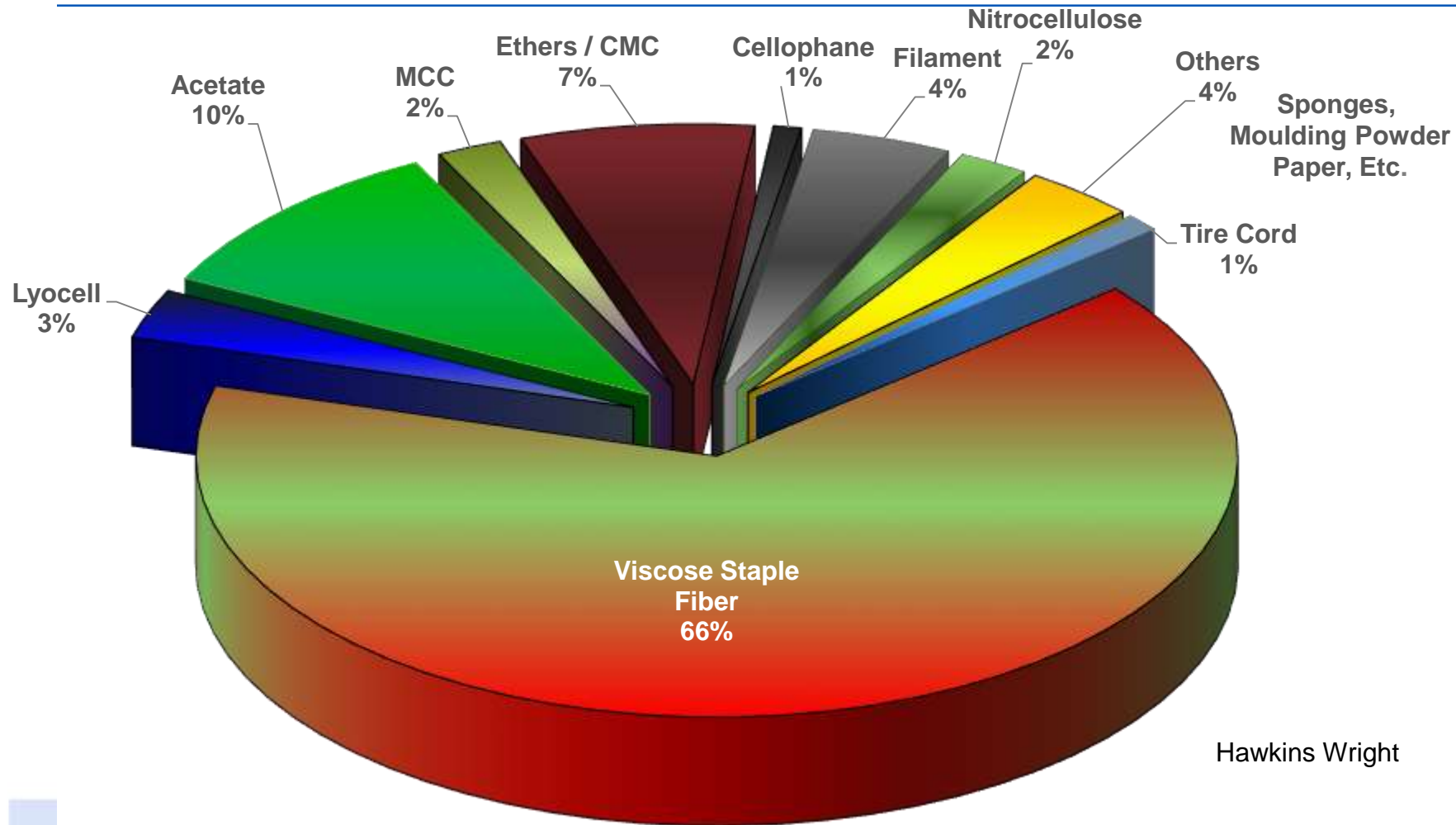
Communications



Cigarette  
Filters



# Global Dissolving Pulp Segments



Hawkins Wright

Total Demand 2016 (e) = 6.9mtpa growing at 3-5% p.a. Sappi Share of Demand = 16%



# Dissolving Pulp -- Textiles



- Familiar names
  - Rayon      Viscose      Modal      Lyocell
  - Dresses      Undergarments      Denim
  - Suits      Slacks      Shirts
  - Furniture      Drapes      Bedding
- Very soft, breathable, vivid colors
- Wipes and hygiene products
- Largest market 5M tons/y
- 3-4% growth





# Dissolving pulp -- Acetates

- Plastics – toothbrushes, handles
- Screens for HD TV's, Monitors, Phones
- 800k ton/y market
- 0% growth



# Dissolving Pulps - Ethers



- A product that is used in many fields
  - Construction
  - Adhesives
  - Coatings
  - Oil drilling fluids
  - Food additives
- 700k ton/y market
- 4-6% growth

# Dissolving pulp – Specialty products



- Wide range of products
  - Food additives, film, lacquers, sponge, casings, explosives, smokeless gunpowder, cosmetics
- 150k tons/y
- 3-5% growth





# Lignin

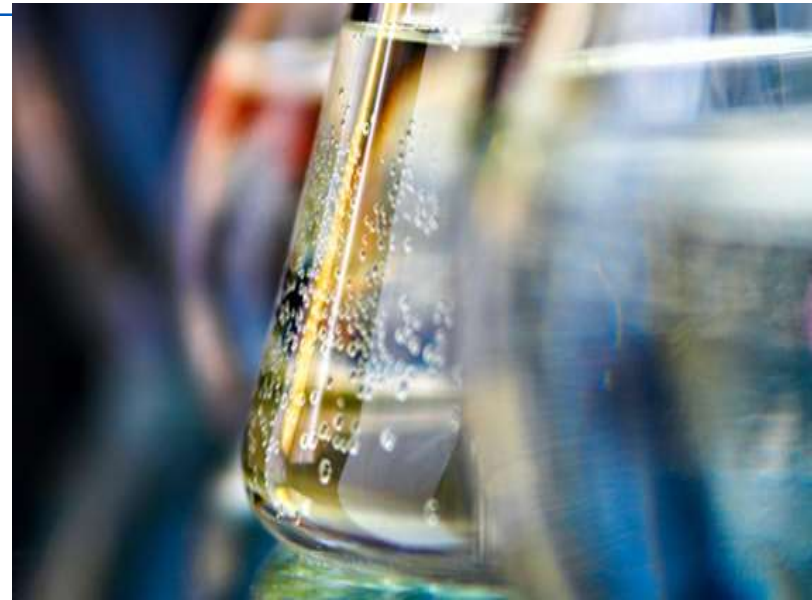


- Developed technology
- Wide application
  - Dust control
  - Pellets, Briquettes
  - Chipboard manufacture
  - Dispersant for coatings
  - Concrete, ceramics
  - Leather tanning .....



# Hemicellulose sugars

- Recovering purifying and converting to other products
  - Xylitol – Low energy sugar substitute
  - PLA – Renewable plastics
  - Glycols – target for use in polyester manufacture
  - Fuels
- Second generation sugars don't compete with food production like first generation sugars



# Nano-cellulose

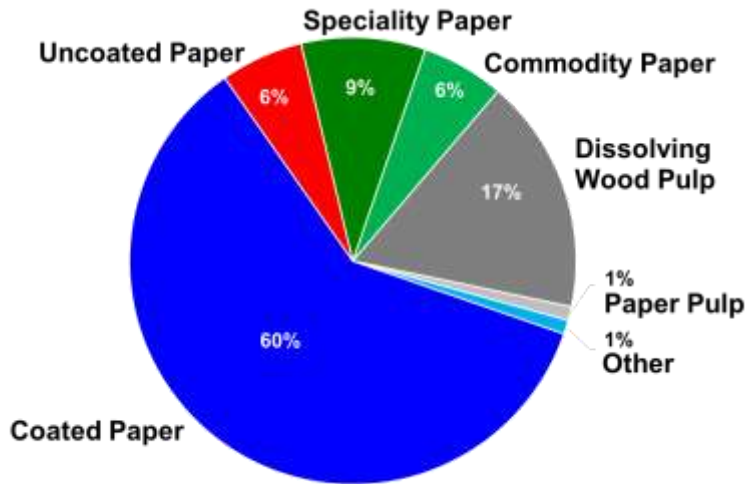


Newer technology – 1980's

- 8x tensile strength of steel
- Stiff and lightweight
- Potential uses in plastics, paper, concrete, construction, medical, electronics, renewable energy.....



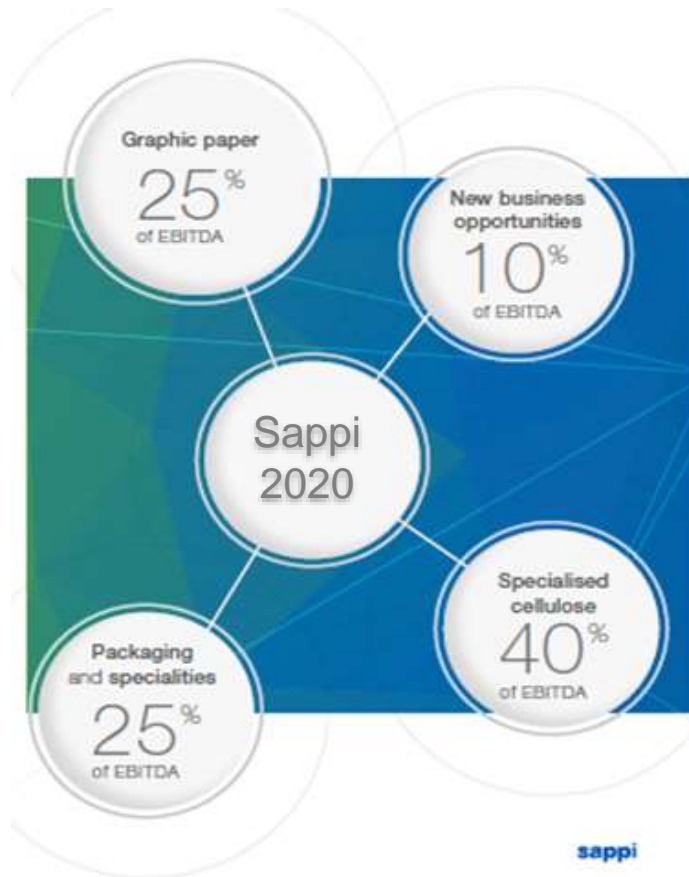
# Who is Sappi



2015 Sales – US\$ 5,390 million 12,800 employees on 5 continents

**sappi**  
Inspired by life

# Our 2020 Vision



- Investing in research and development for tomorrows products
- Adapting to the changing marketplace
- We are growing our cellulose business

# Thank you

Questions??

