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Bio-based polyols containing lignin Ton-That, Minh-Tan

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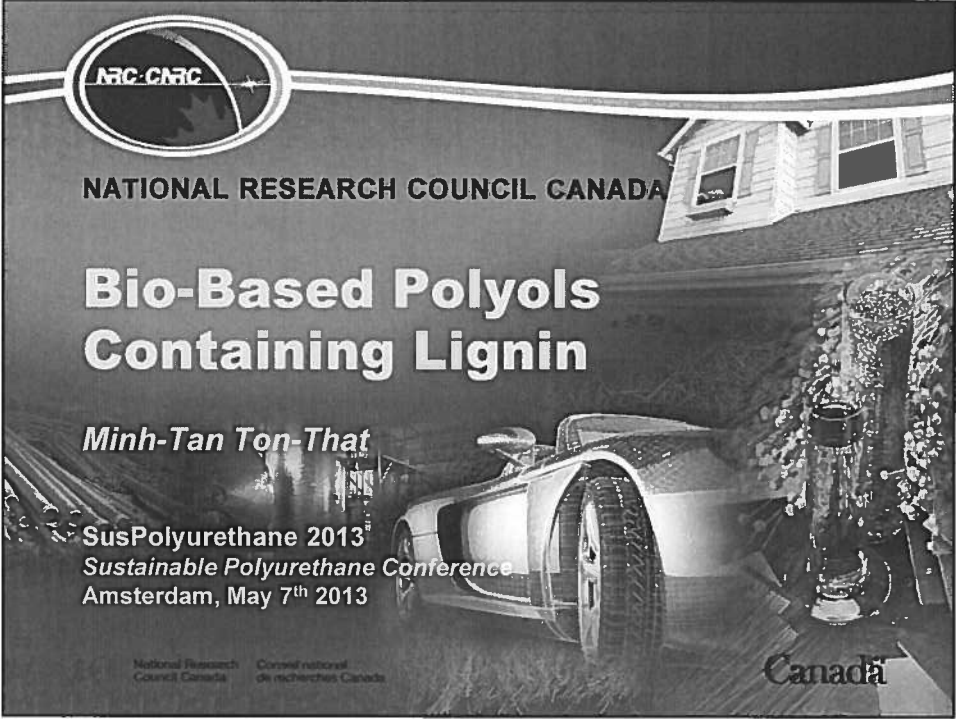


NATIONAL RESEARCH COUNCIL CANADA

Bio-Based Polyols Containing Lignin

Minh-Tan Ton-That

SusPolyurethane 2013
Sustainable Polyurethane Conference
Amsterdam, May 7th 2013



National Research Council Canada / Conseil national de recherches Canada

Canada



▼ IRAP
■ Research facilities

About NRC

- 2011-12 budget: \$700M
- Over **4,200** employees and **1,500** visiting workers
- Wide variety of disciplines and broad array of services and support to industry.

Naturally Resourceful



NRC's Industrial Biomaterials Vision

Seed-to-product: engage industry and support the development of the entire supply chain

BIOMASS

Supply, selection, harvesting, standards

RAW MATERIALS TREATMENT

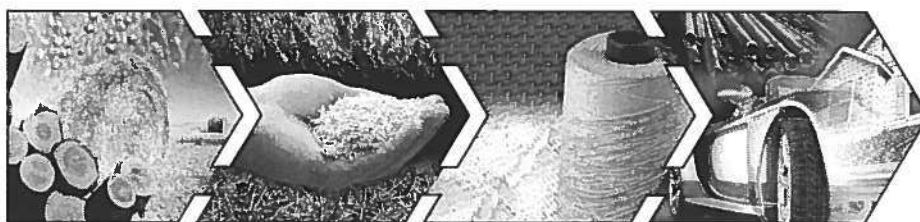
Characterization, fitness for use, handling

PROCESSING/ MANUFACTURING

Flexible platforms, high throughput, reliability, new markets

COMMERCIALIZATION

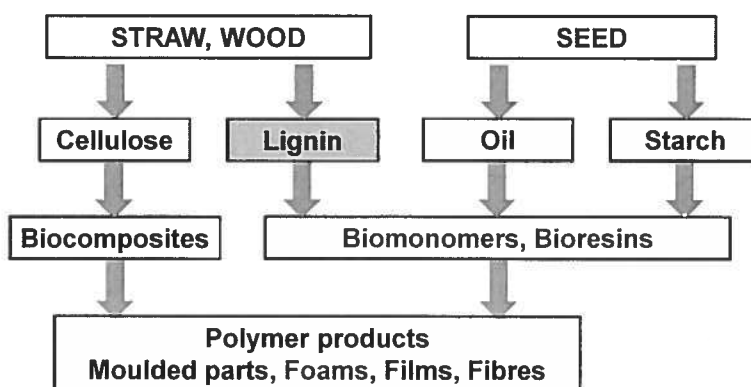
Cheaper, lighter, stronger materials for the construction and automotive industries



Naturally Resourceful

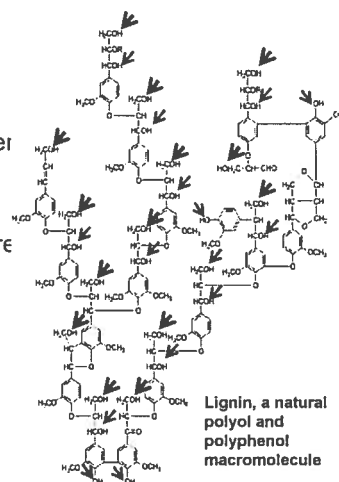


Valorisation of Canadian Biomass into High Value-Added Products



Lignin for Polymer Products

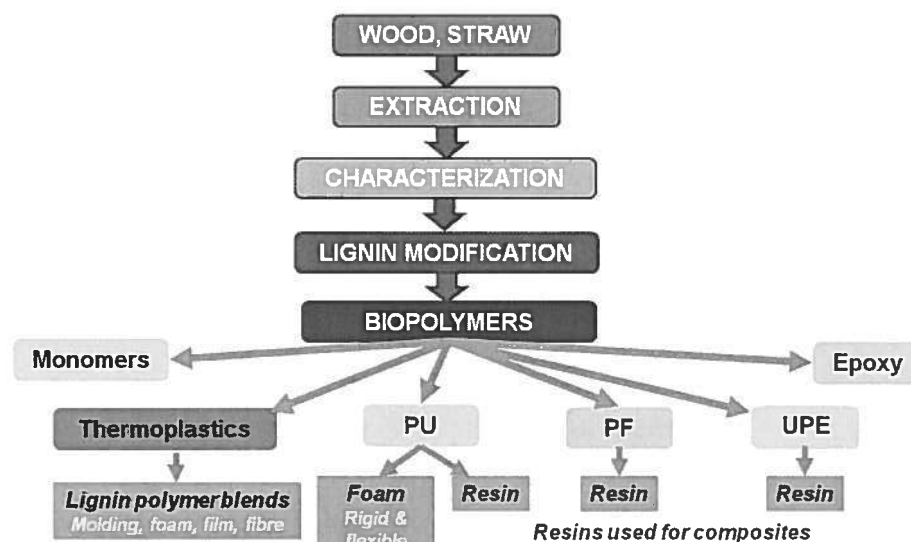
- Lignin: a by-product from the Pulp & Paper industry or recently from biofuel production
 - One of the most abundance biomass after cellulose (20-40% in wood and straw)
 - An attractive and cheap biomass for monomer production & polymer application
- A biopolymer itself with obstacles
 - Many hydroxyl and phenol groups but they are difficult to reach → difficult to react with
 - Inhomogeneous macromolecular thermoplastics with branch and hydrophilicity → incompatible with many common thermoplastic polymers
- Great potential but very limited applications



Naturally Resourceful

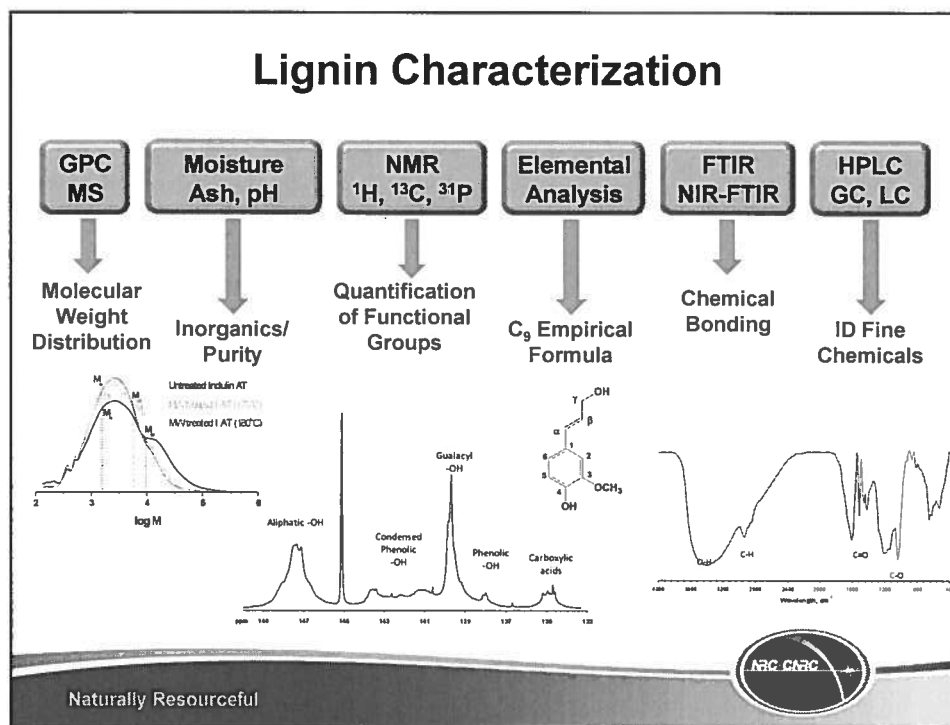


NRC's Technology Development Program on Lignin



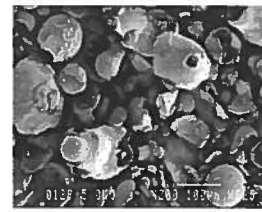
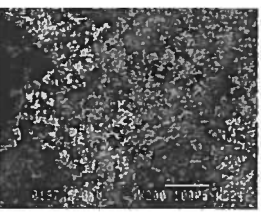
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Lignin Physical Modification

- ☐ Fractionation
 - pH
 - Temperature
 - Sequence
- ☐ Particle morphology (size/shape)
- ☐ Blending methods (discontinuous/continuous)

Lignin particles

NRC CNRC

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Lignin Chemical Modification

☐ Technologies

- Bulk processes
- Solid state processes
- Aqueous processes

☐ Benefits

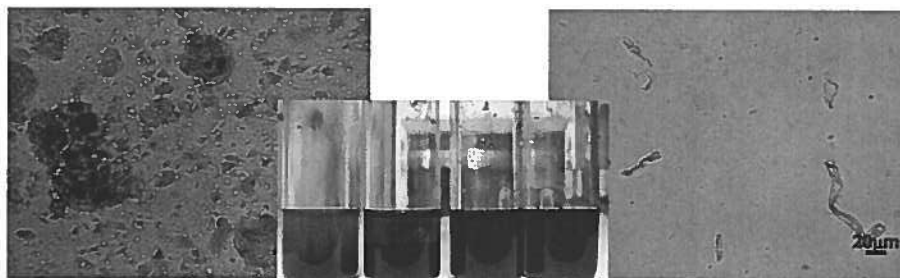
- High efficiency
- No solvent and toxic chemical
- Minimized energy and water consumption
- Ease to scale-up

Naturally Resourceful



Example of Lignin Functionalisation in Solid State - Hydrophylic

10wt% Lignin in polyol CAPA 4023, sonification at 60-80°C for 2 h



Ligno-polyol from
untreated lignin

Ligno-polyol with lignin
functionalized by NRC's invention

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