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Thermoset biocomposites for industrial applications

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World Congress on Industrial Biotechnology

July 19-22, 2015 Montréal

BioProducts AgSci Cluster
***Thermoset Biocomposites For
Industrial Applications***

Session 5: Generating More Value from
Canadian Biomass and Waste Streams

NRC: **Minh Tan Ton-That**, Nathalie Legros
AITF: Byron James, Jan Slaski
Stemia: Mike Duckett
AAF: Lori-Jo Graham



Introduction

- This project belongs to the BioProducts AgSci Cluster managed by Bioindustrial Innovation Canada (BIC)



- Initial budget: \$350k
- It is partly funded by Agriculture Agri-Food Canada (AAFC)



Agriculture and
Agri-Food Canada

Agriculture et
Agroalimentaire Canada

- Cash and in-kind contribution from Stemia and AITF
- Duration: Sep 2015 – March 2018



Project objective

Develop high performance and cost-effective thermoset biocomposites from Canadian hemp (or flax) fibre showing good mechanical properties and improved fire and humidity resistance for the industry such as transportation, construction and oil field.





Project partners

- NRC: Industrial Biomaterial Flagship Program

- Minh Tan Ton-That
 - Nathalie Legros



National Research
Council Canada

Conseil national
de recherches Canada

- Stemia Group Ltd, Alberta

- Mike Duckett, CEO



- Alberta Innovate-Technology Future (AITF), Alberta

- Jan Slaski
 - Byron James
 - Anthony Anyia



- Alberta Agriculture and Forestry (AAF), Alberta

- Lori-Jo Graham



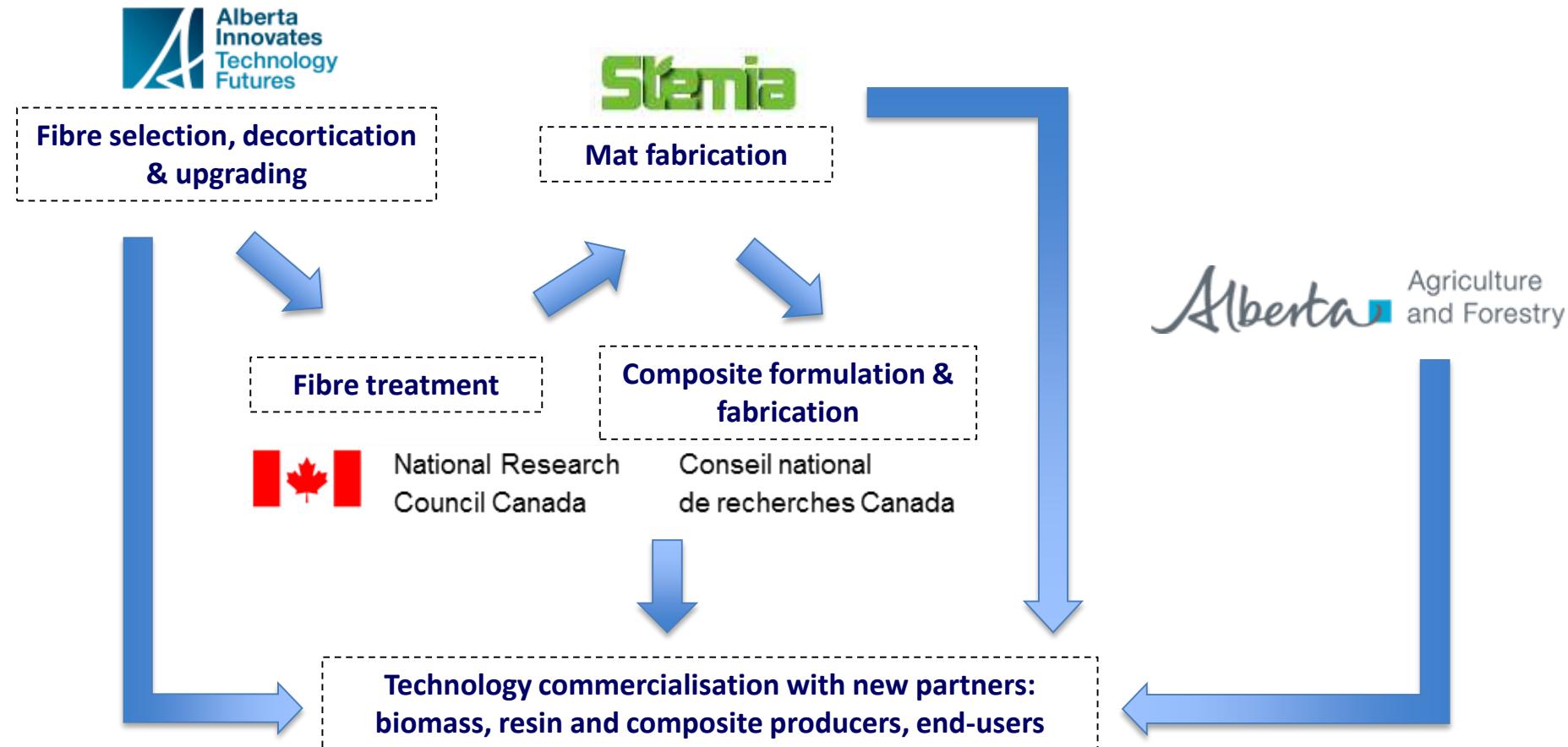


Project activities

- Process for flax fibre post-harvest handling and mat making (AITF, Stemia)
- Fibre treatment process to improve the fibre resistance to humidity and fire (NRC, AITF, Stemia)
- Biocomposite formulation with adequate processing performance (NRC)
- Preparation of technology commercialization (NRC, AITF, Stemia, AAF)



Project activities





AITF with unique expertise and facilities in flax and hemp production research and development

- AITF in Vegreville, Alberta runs agronomy and demonstration field trials of hemp and flax



AITF with unique expertise and facilities in cellulosic fibre decortication and upgrading

AITF pilot scale decortication system in Vegreville, AB

- Decorticate hemp or flax fiber using a hammer mill type decortication system
- Long bast fiber at the end of the process is >95% clean and is between 50 - 200 mm inches in length
- Short fiber (hurd or shiv) is also produced
- Dust is removed using this system

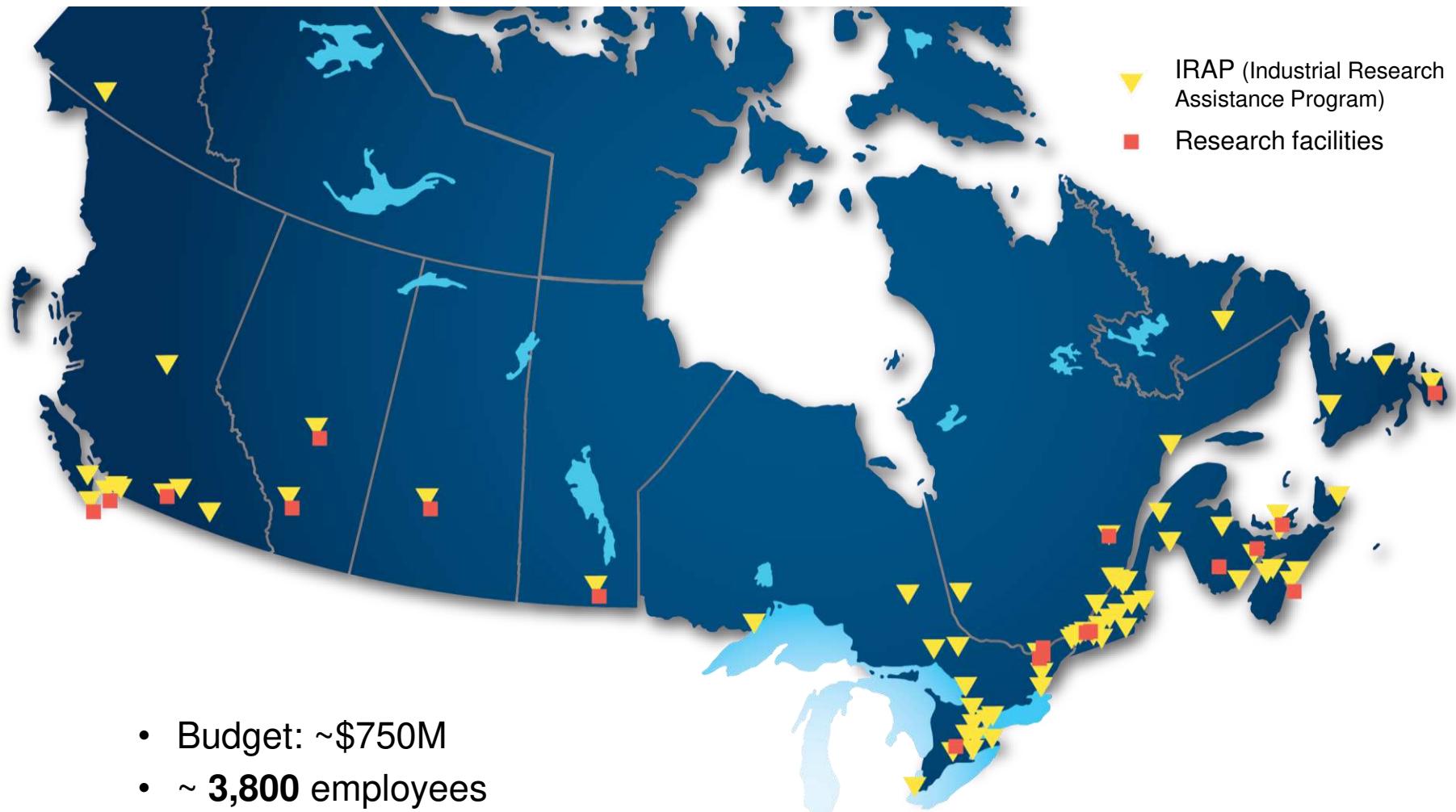




Stemia's use of unique patent protected state-of-the-art mat forming line

- Flexibility of production allows the manufacture of a wide range of products from 150 – 8000 g/m²
- Patented addition system allows efficient in line treatment of fibres
- Production capacity is maintained across the product range
- Cost effective process
- The ability to utilise a wide range of input fibres in the length range 1 – 100 mm

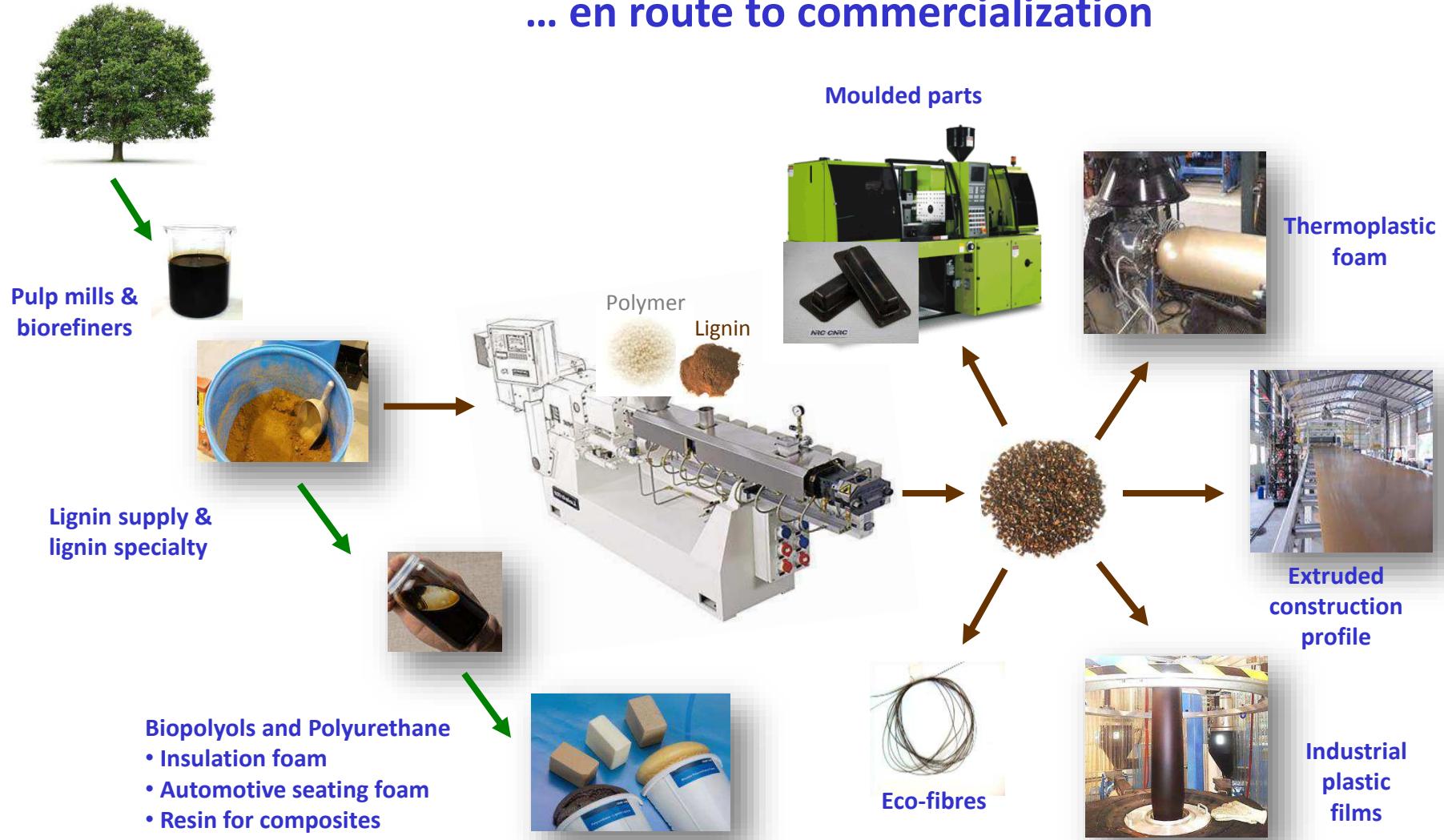
NRC: R&T organization



- Budget: ~\$750M
- ~ **3,800** employees
- Wide variety of disciplines and broad array of services and assistance for industry

Example of NRC's lignin technologies

... en route to commercialization





Example of NRC's biocomposites technologies

...from short to long and continuous fibres, mats and fabrics



1- Green and low cost compounding and processing



Extruded panels



2- Lightweight advanced composites and cost-efficient biocomposites for automotive products



Magna-NRC Composites Centre of Excellence

Bio-based C-Pillar Cover

Formulation: NRC, Acknowledgements: CRIBE, Alberta Innovates Bio-Solutions, Magna



3- Fire resistant and hydrophobic fibres for high performance biocomposites



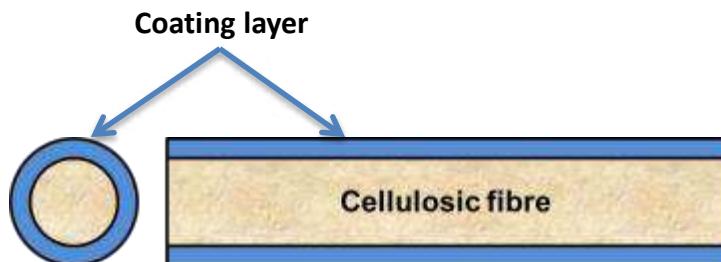
Self extinguished cellulosic fibre composites



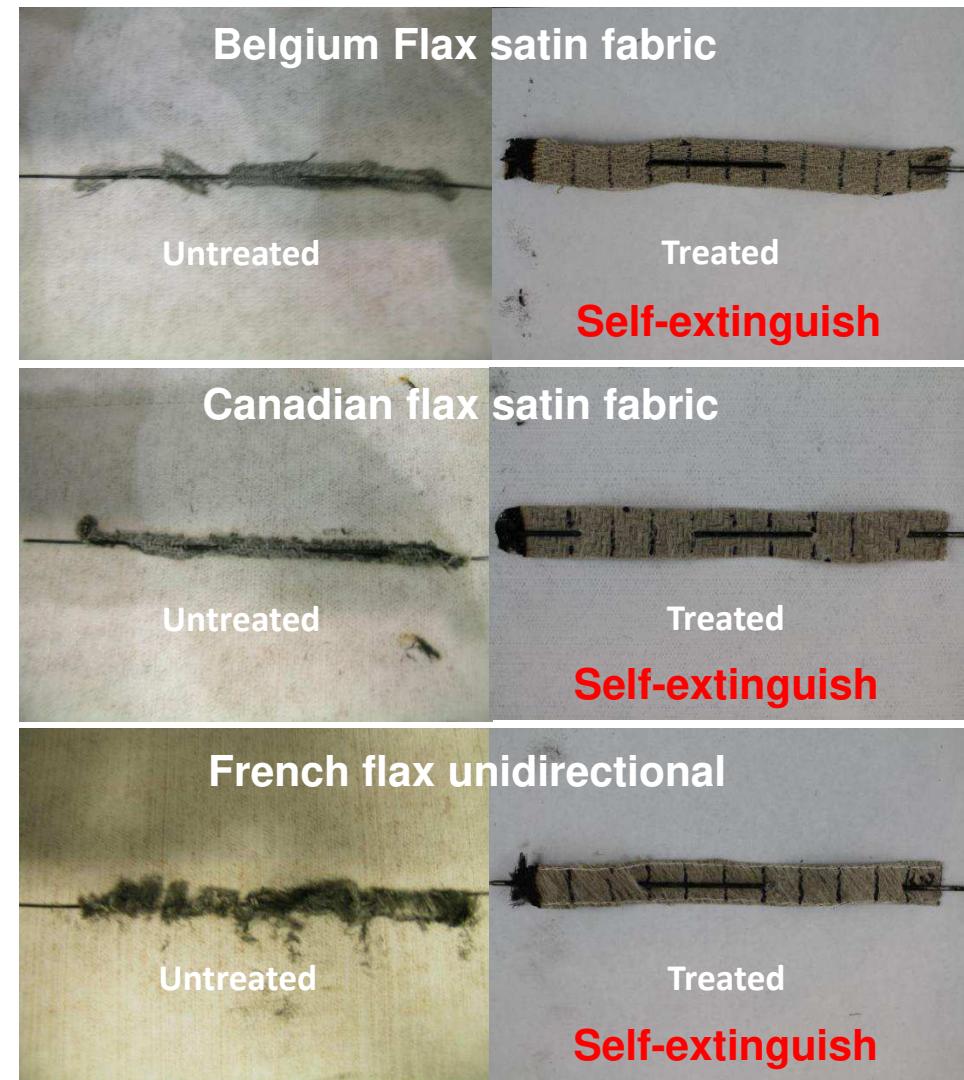


NRC's technology: self extinguish cellulosic fibres

- Coating the cellulosic surface by a layer of inexpensive, non-toxic and non-halogenated compounds to protect cellulosic fibres from fire or from moisture without affecting the mechanical properties



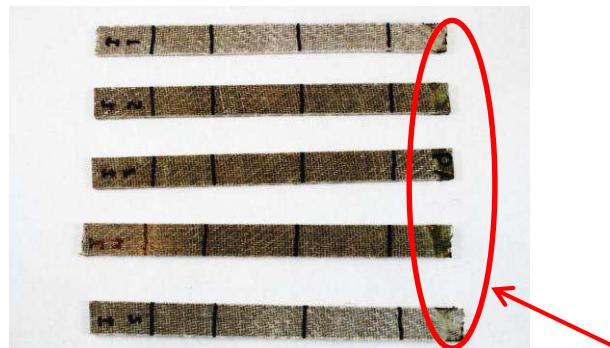
NRC patent pending
PCT/CA2012/000631





NRC's technology: self extinguish cellulosic fibres

Sample	Tensile stress (MPa)	Energy to break (J)
Epo-C2	117.7 ± 4.0	33.7±2.0
Epo-C2-34/P1	106.4 ± 1.0	36.7±2.6



UPE-flax fiber composite



PF-flax fiber composite



Ignition zone

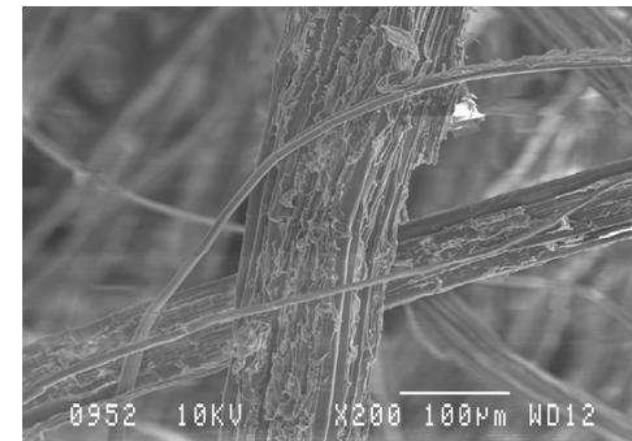
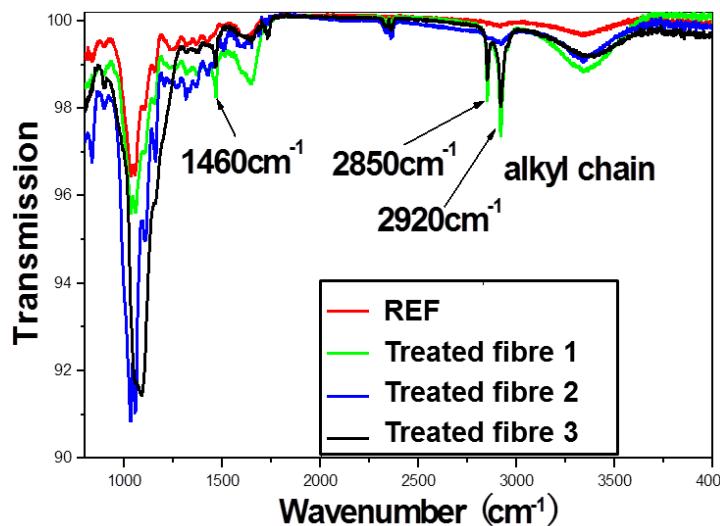


Epoxy-flax fiber composite



NRC's technology: hydrophobic cellulosic fibres

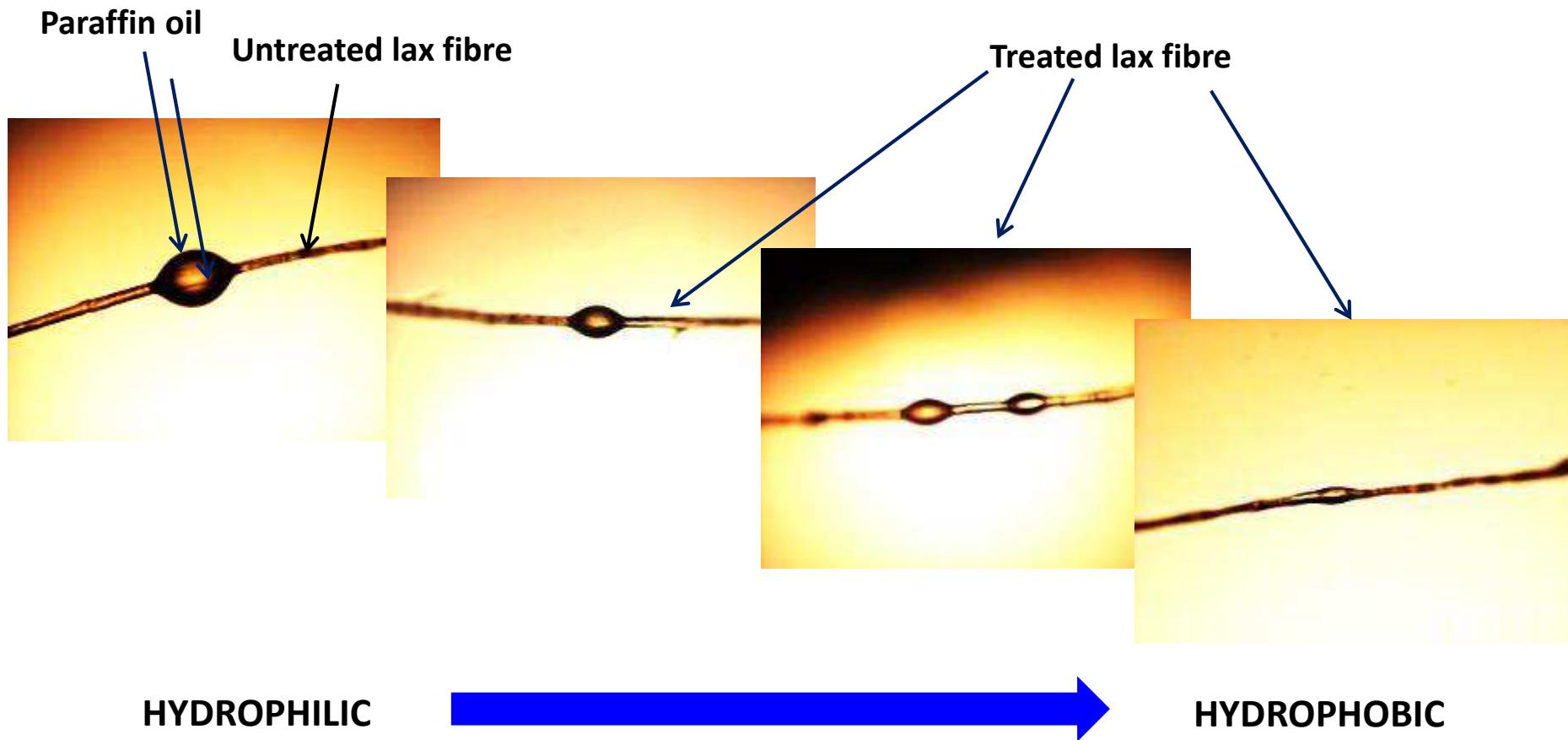
- Change the hydrophilic nature of natural fiber surface into hydrophobic using bio-based chemicals (fatty acid) for reducing moisture absorption



NRC invention



NRC's technology: hydrophobic cellulosic fibres



NRC invention



Preparation for commercialisation

- Open to collaborate with other companies who are biomass suppliers, resin and composite producers and end-users
 - Partnership can taken any time during the course of the project (2015-2018) and beyond
 - Different stages of product and application development: prototype, pilot scale, performance evaluation, technology transfer
 - Flexible business models: one-on-one or multipartners



Thank you!

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