

## NRC Publications Archive Archives des publications du CNRC

### Production of wood-based low-carbon and environment-friendly materials

Ton-That, Minh-Tan; Li, Hongbo; Faye, Adrien; Saeidlou, Sajjad; Maillard, Damien

**NRC Publications Archive Record / Notice des Archives des publications du CNRC :**  
<https://nrc-publications.canada.ca/eng/view/object/?id=a0b2a8b9-0b3a-4f80-adee-99b94f301a06>  
<https://publications-cnrc.canada.ca/fra/voir/objet/?id=a0b2a8b9-0b3a-4f80-adee-99b94f301a06>

Access and use of this website and the material on it are subject to the Terms and Conditions set forth at  
<https://nrc-publications.canada.ca/eng/copyright>

READ THESE TERMS AND CONDITIONS CAREFULLY BEFORE USING THIS WEBSITE.

L'accès à ce site Web et l'utilisation de son contenu sont assujettis aux conditions présentées dans le site  
<https://publications-cnrc.canada.ca/fra/droits>

LISEZ CES CONDITIONS ATTENTIVEMENT AVANT D'UTILISER CE SITE WEB.

**Questions?** Contact the NRC Publications Archive team at  
PublicationsArchive-ArchivesPublications@nrc-cnrc.gc.ca. If you wish to email the authors directly, please see the first page of the publication for their contact information.

**Vous avez des questions?** Nous pouvons vous aider. Pour communiquer directement avec un auteur, consultez la première page de la revue dans laquelle son article a été publié afin de trouver ses coordonnées. Si vous n'arrivez pas à les repérer, communiquez avec nous à PublicationsArchive-ArchivesPublications@nrc-cnrc.gc.ca.

# ***Production of Wood-Based Low-Carbon and Environment-Friendly Materials***

***Minh Tan Ton-That, Hongbo Li, Adrien Faye, Sajjad Saeidlou and Damien Maillard***

***Climate and clean tech policies: opportunities and challenges for the transformation of  
the Canadian forest sector***

***Biofor 2023 Conference  
February 6, 2023***

# Plastic Waste in Canada

- Plastic industry is an important sector in Canada: \$35 billion/yr sales, 1,932 establishments & 93,000 jobs
- Plastics production: **energy & chemical intensive**
- **Total volume: 4.7 MT/yr**
- **Recycling: 0.8 MT/yr (9%)**
- **Landfills: 2.8 MT/yr (86%)**
- The main plastic waste generators
  - **Packaging: 47%**
  - Automotive: 9%
  - Textiles: 7%
  - Electrical & electronic equipment: 7%



<https://www.cbc.ca/news/business/plastic-waste-grocery-stores-recycling-1.4969379>

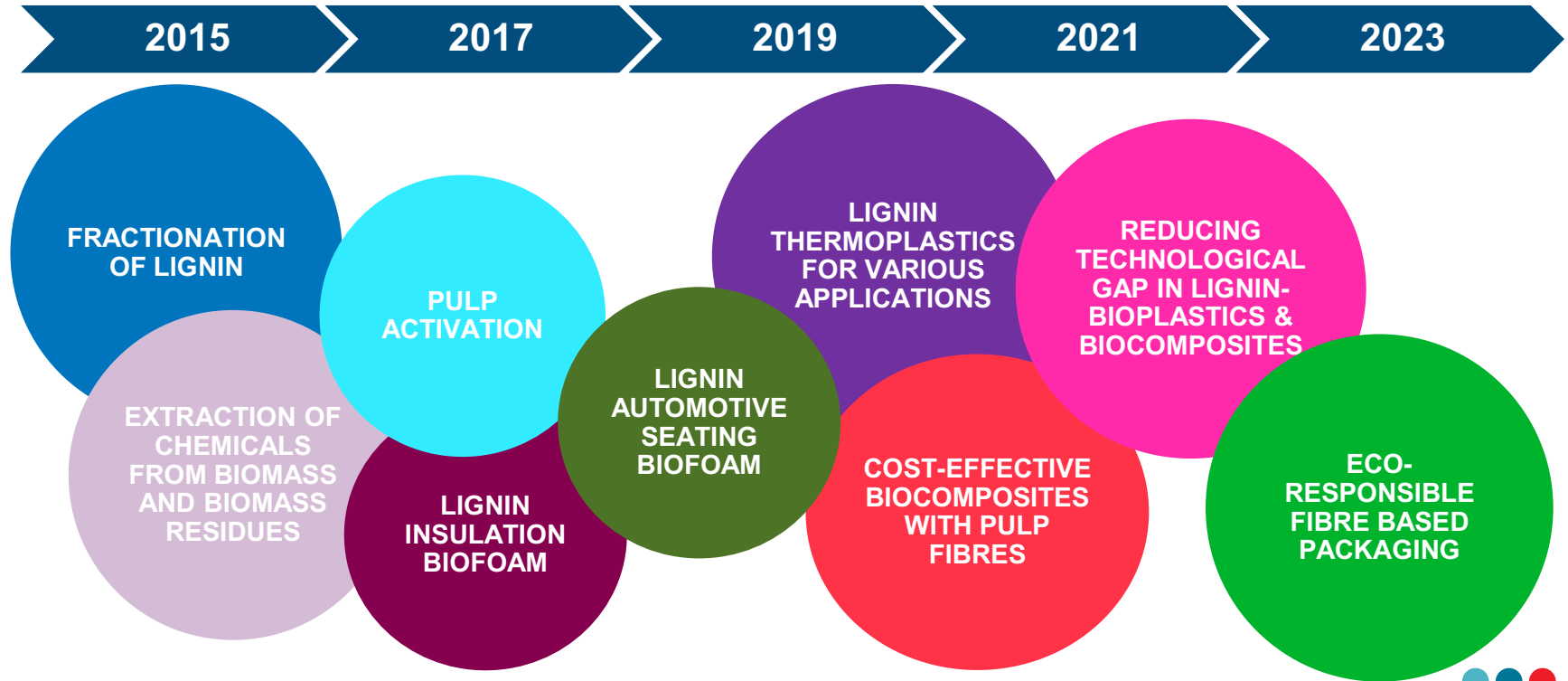
***Forest biomass could be used to reduce plastic pollutions and plastic waste crisis while opening new markets for pulp products***

# Forest Bioeconomy & NRC Contributions



Source: Anne-Helene Mathey, Room to grow: The forest bioeconomy in Canada, NRCan-CFS, 2019

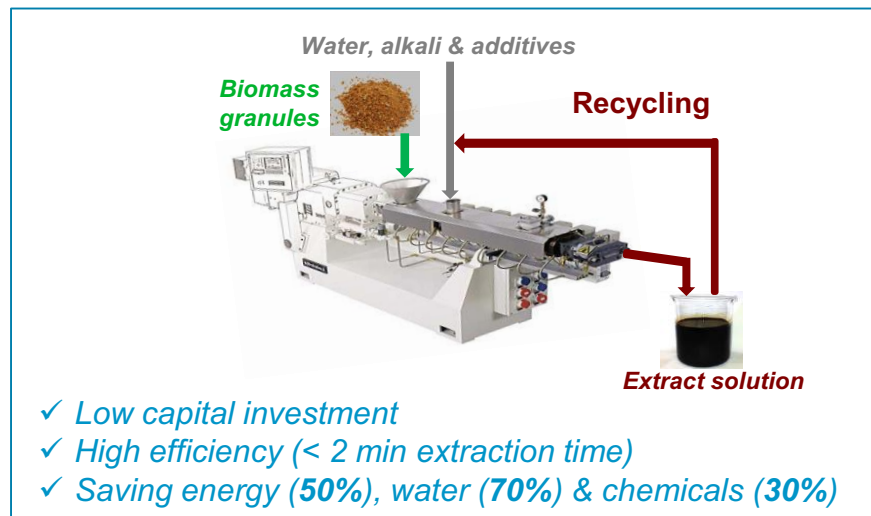
# Main Activities Ton Support Forest Innovations





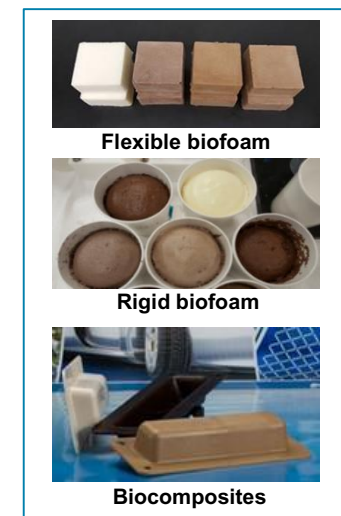
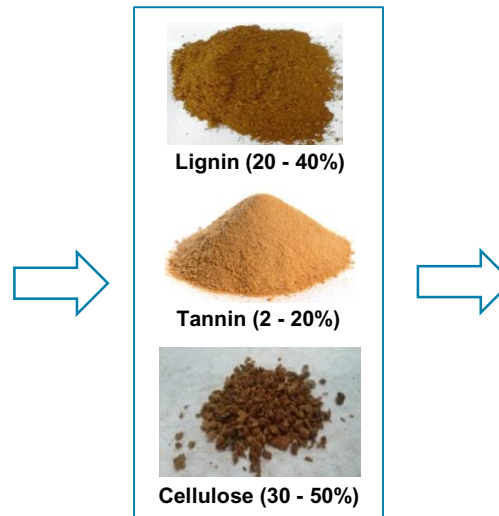
# Lignocellulosic Biomass Extraction

Continuous extraction of biomass and its residues to produce renewable materials



Value added materials

Industrial applications



# Cost-effective Biocomposites from Wood Fibres

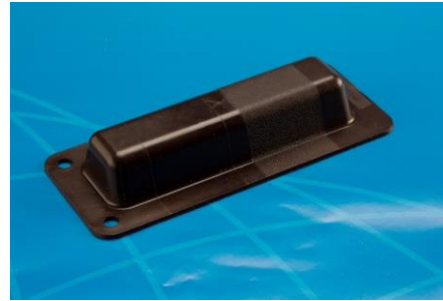
*Fibre treatment integrated into pulp mill for biocomposites production*



Fibre treatment



Pulp sheet making

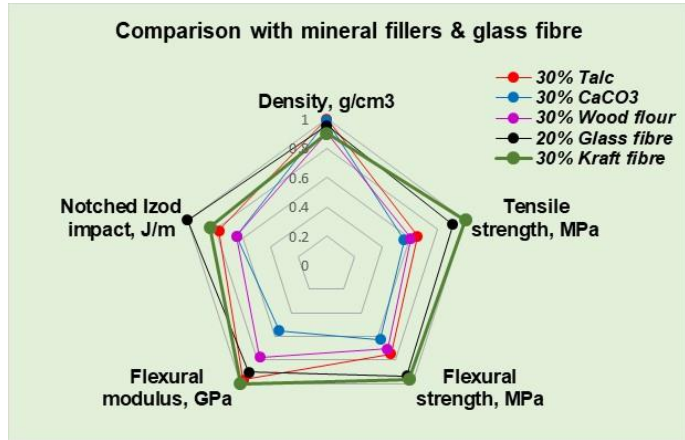


Molded biocomposites

- ✓ *NRC-Domtar Joint IP WO2019110868A1*
- ✓ *No additional step*
- ✓ *No capital investment*
- ✓ *Highly efficient*

# Cost-effective Biocomposites from Wood Fibres

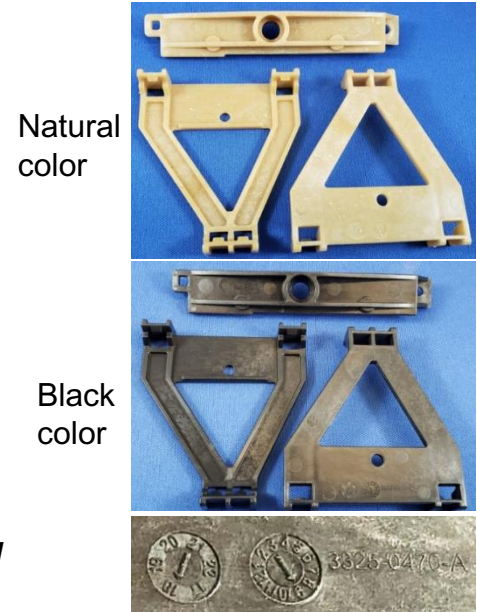
## Automotive Prototypes



**Potential savings: 6% in weight and 4% in cost as compared to 20 wt% glass fibre composite**



**Similar cycle time as conventional 30% talc filled PP**





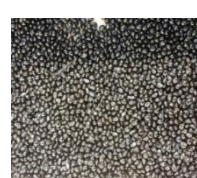
# Lignin Thermoplastics

From concept development to demonstration plant for the transformation into lignin pellets and thermoplastic products

- *NRC-Domtar Joint IP WO 2018/035598 A1*
- *Up to 40% lignin in final products*



Profile extrusion at Canplex  
TRL1 >> TRL7



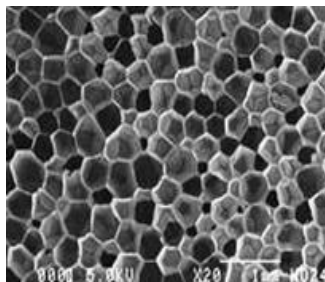
Lignin/PE agriculture film performs  
superior than commercial film



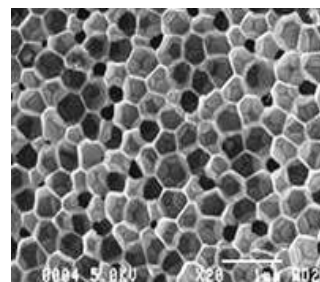
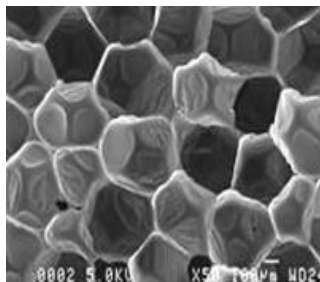
# Rigid Biofoam from Lignin for Insulation

## *Rigid PU Biofoam from Lignin*

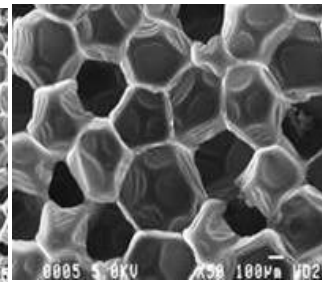
Lignin incorporated as filler or multifunctional polyol for PU rigid foam fabrication



Reference foam



Biofoam with 20% lignin in polyol



- ✓ *Renewable content up to 30%*
- ✓ *Cost competitive*
- ✓ *Maintain insulation performance*
- ✓ *Enhance mechanical properties*

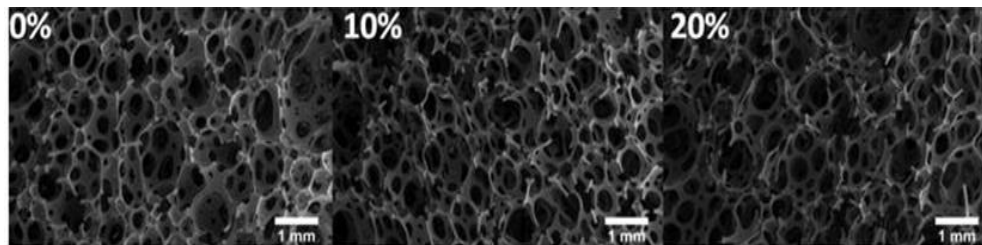


# Flexible Biofoam from Lignin for Automotive Seating

## *Flexible PU Biofoam from Lignin*

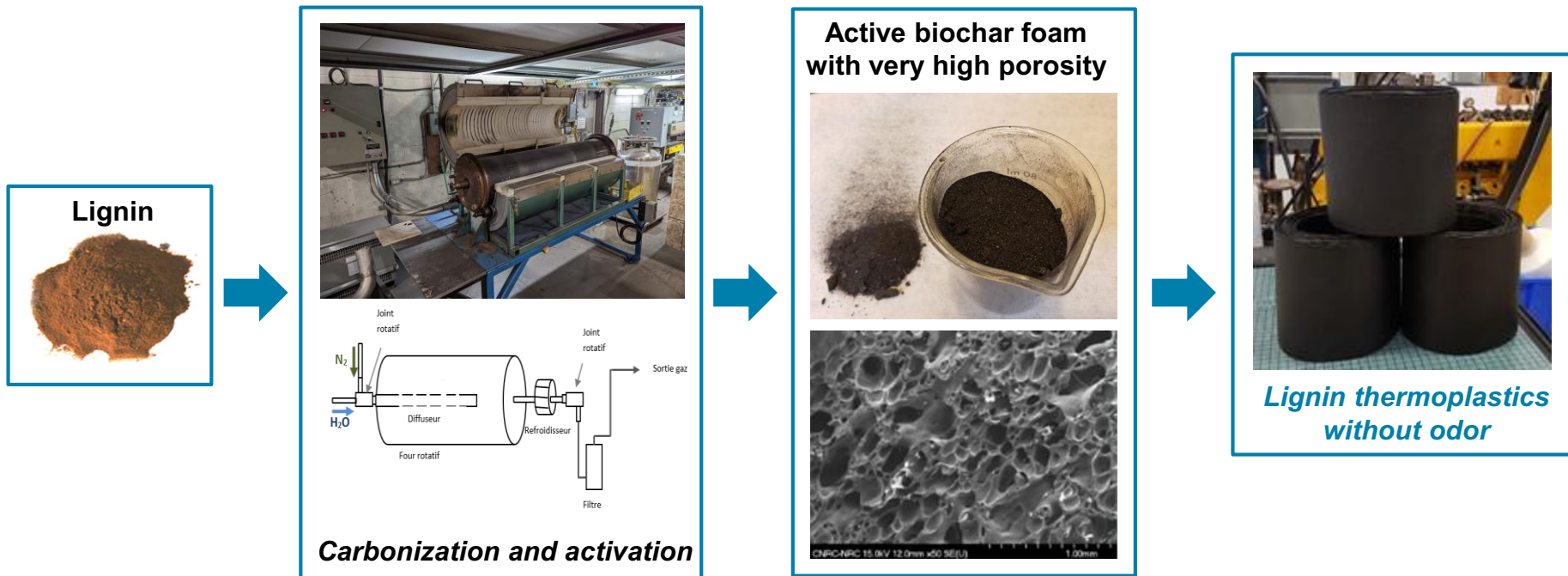
Lignin incorporated as filler or multifunctional polyol for PU flexible foam fabrication

- ✓ *Up to 20% lignin*
- ✓ *Cost competitive*
- ✓ *Improved elastic properties*



# Active Biochar Foam from Lignin

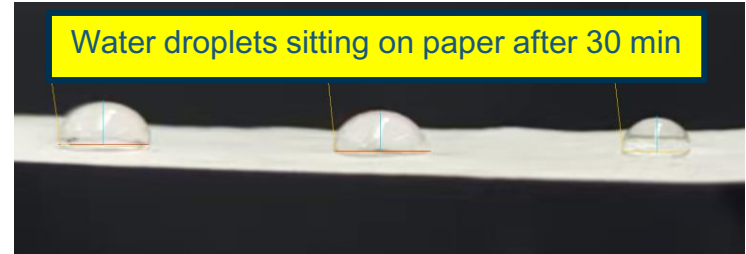
## *For VOC and Odor Absorption*



# Paper Coating for Food Packaging

## Novel coating solution for fiber-based packaging

- 100% renewable content
- Highly enhanced moisture and water resistance
- Integrating in paper making process
- Being recyclable



*Hydrophobic characteristics*

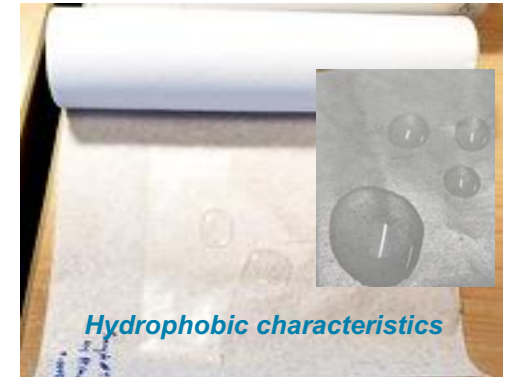
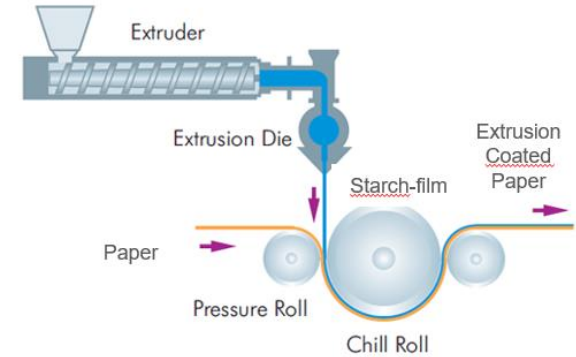


**Coated paper**



# Lamination Coating on Paper

- **Novel starch based-plastic lamination coating solution for fiber-based packaging** (*NRC's Patented Thermoplastic Starch Blending Technology, US 9,045,625*)
  - Highly enhanced moisture and water resistance
  - Starch: low cost and widely available in Canada  
→ cost-effective
  - 100% renewable
  - Performing in existing industrial equipment  
→ facilitating commercialization
  - Being compostable

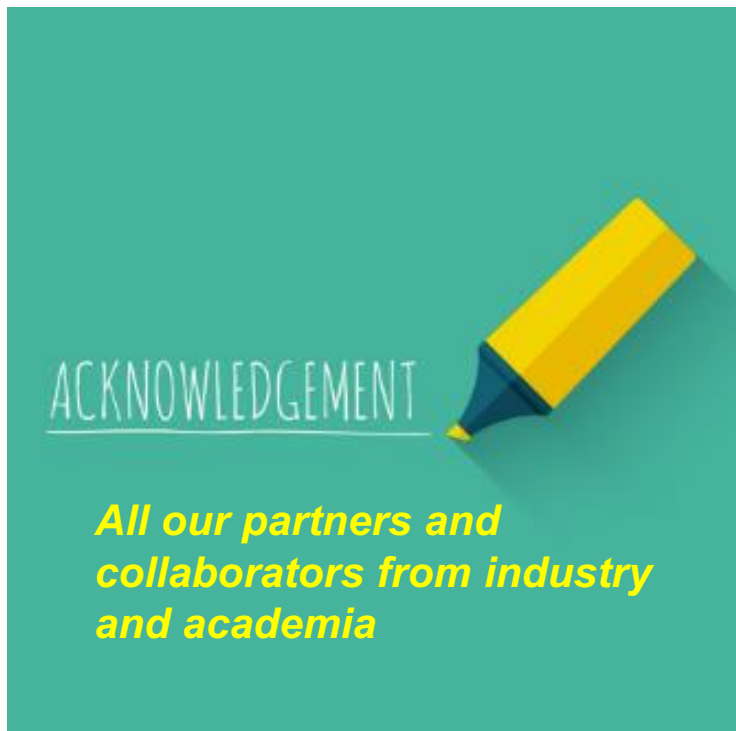


# Conclusions

- **NRC has great capabilities:**
  - Providing R&D services to develop innovative solutions to transform forest biomass into sustainable valued-added bioproducts for the manufacturing industry
  - Beside renewable materials, **recycling and enabling a circular economy** are a growing focus for NRC
- **NRC work closely with NRCan with OGDs, consortia, companies and academia to maximize innovation outputs for the forest and manufacturing industry**



# Acknowledgements



## NRC

- Éric Patenaude
- Karen Stoeffler
- Nathalie Legros

## NRCan

- Jean-François Lavasseur
- Matthew Schacker
- Allan Ding
- Marzouk Benali
- Bruno Gagnon

# THANK YOU / MERCI

**Minh Tan Ton-That, PhD • Senior Research Officer, NRC**

**[Minh-Tan.Ton-That@nrc-cnrc.gc.ca](mailto:Minh-Tan.Ton-That@nrc-cnrc.gc.ca)**