



**International Conference
on Nanotechnology for
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5 – 8 June 2017 • Montreal, Quebec, Canada
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Risk assessment of polymer composites containing cellulose nanofibrils (CNF)

Considerations of industrial production

PRESENTED BY

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Background

- In 2016 Tappi International Conference on Nanotechnology for Renewable Materials we reported results on risk analysis of polymer composites containing CNF, based on the production at laboratory scale
- The risk assessment took into account occupational exposure, consumer exposure and end-of-life.
- The overall conclusion of the risk evaluation was that no major concerns were found in the production, use and waste handling of the composites.



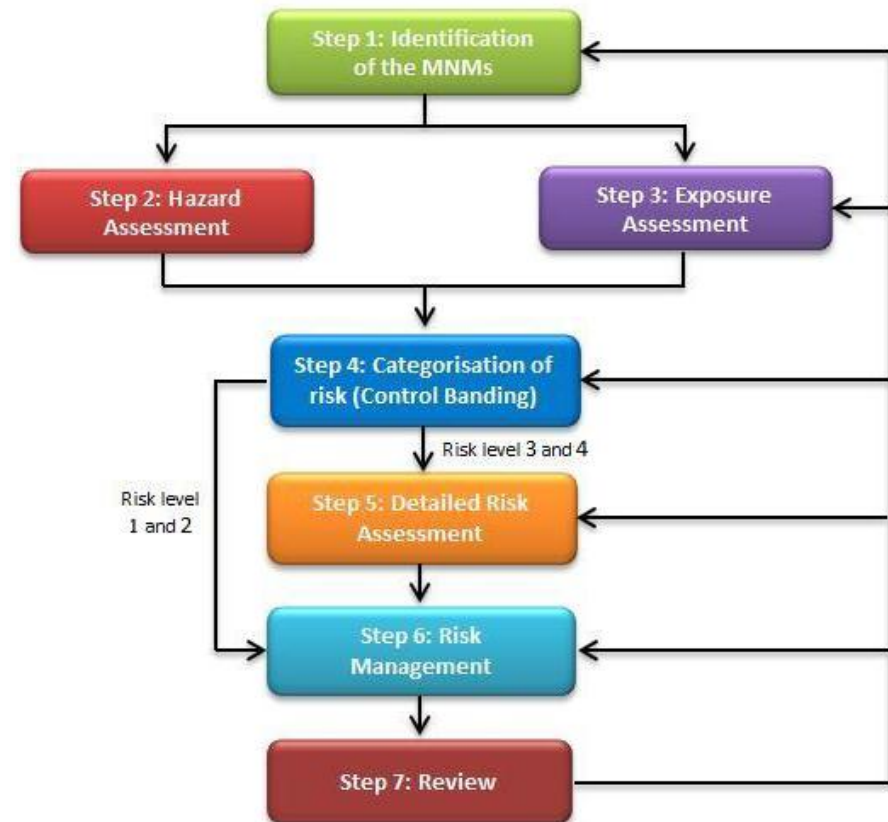
Objective

- The objective of the presentation is to take a step further in the risk assessment of CNF-containing polymer composites
 - By considering their production at small industrial scale
 - Main focus is given to the occupational exposure and exposure to environment during production



Risk assessment based on

- European Commission's *Guideline on the protection of the health and safety of workers from the potential risks related to nanomaterials at work*





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Approach



↑

Identified critical points

1. Occupational
2. Environment
3. Consumer use
4. End-of-life

↑

Information from the literature

1. Human health
2. Environment

Concern Category	Level of Exposure			
	Low	Medium-low	Medium-high	High
Low	1	1	2	2
Medium-low	1	2	2	3
Medium-high	2	2	3	4
High	3	3	4	4



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Hazard



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Available information

- Known effects of CNF exposure
 - To humans
 - To environment



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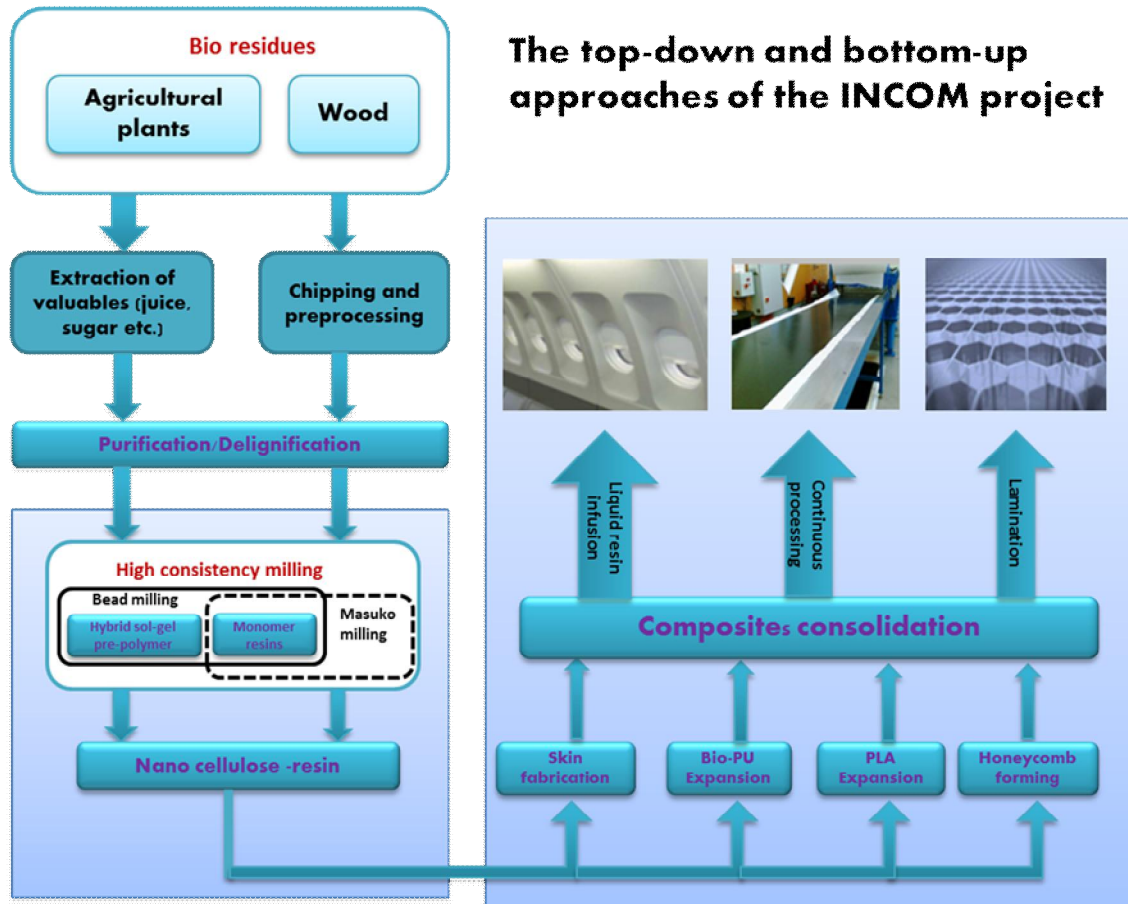
Exposure

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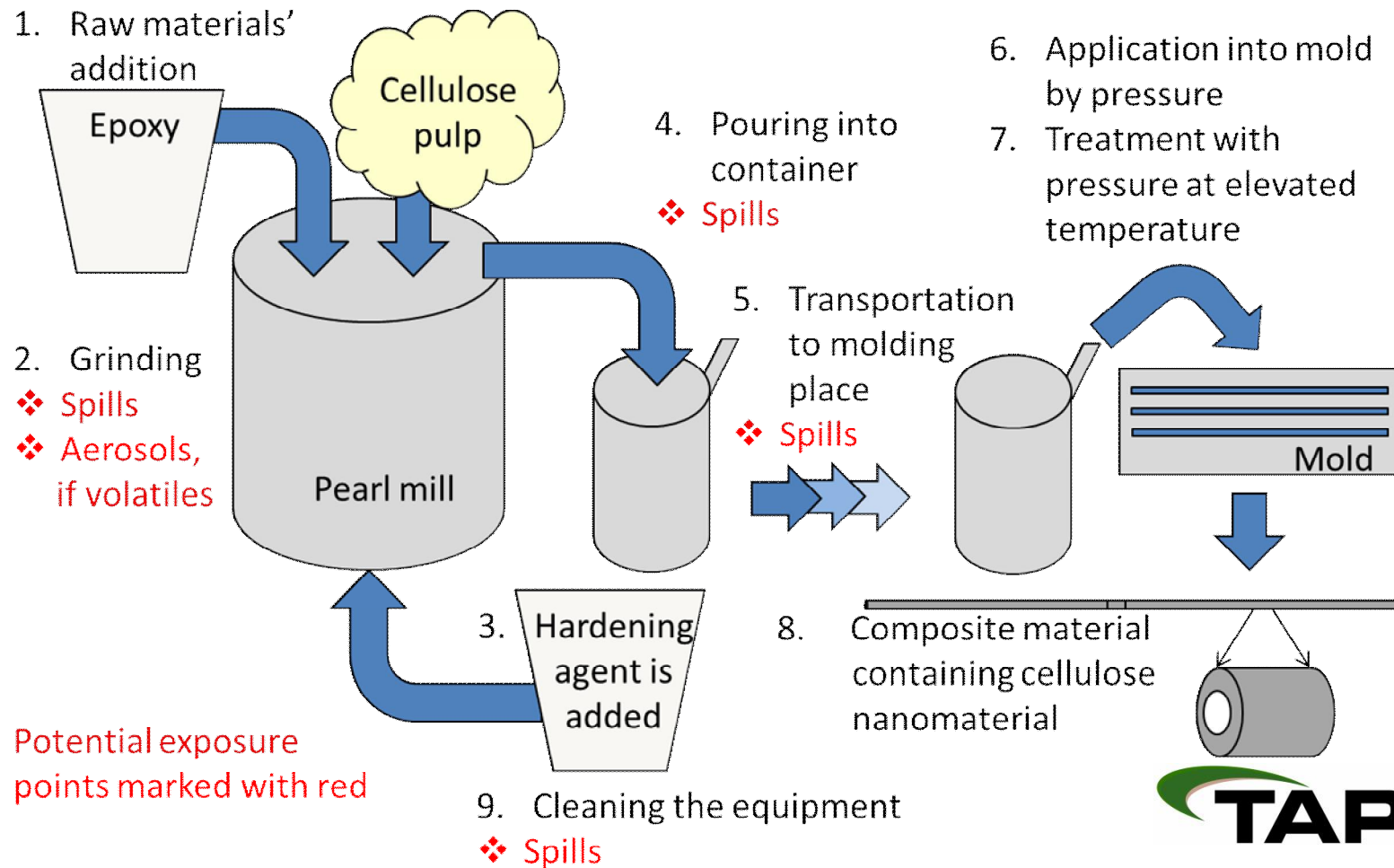
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Lab scale production @VTT



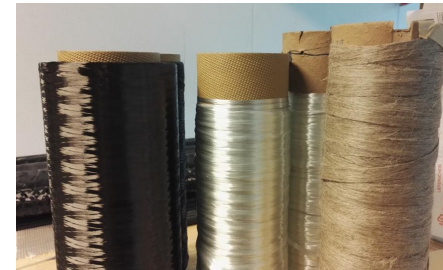


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Industrial production @ small scale

- Resin transfer molding – RTM
- Seed moulding compound – SCM
- Vacuum injection
- Filament winding





Main exposure routes

- Inhalation exposure
- Skin exposure



Potential occupational exposure – critical points

- Spills during mixing of CNF and polymer
- Pressure in the mould - RTM
 - Breakage or leakage of the piping
- Spills during winding
- Machining – cutting, sanding etc.
- Mitigation measures
 - Fume hood, fresh air hood



Potential environmental exposure

- Material waste
 - Raw materials
 - Finishing residues incl. dust
- Washing water
 - Containers
 - Floors, surfaces etc.
- Mitigation
 - Minimize raw material waste
 - Re-use of finishing residues
 - Minimize dust in the working space, fume hood
 - Suitable cleaning methods for spills



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Additional exposure considerations

- Consumer exposure
 - Depends on the end-use
 - Wear and tear
 - Machining, drilling etc.
- End-of-life
 - Recycling
 - Re-use
 - waste disposal: incineration, landfill



Conclusions

- No major concern found in industrial production @ small scale
- EU Guideline turned to be a suitable tool for assessing the industrial production of polymer composites containing CNF
- As typical for risk assessment, exposure during the production steps and hazard related to the materials should be evaluated case-by-case
 - Increasing knowledge of hazardous properties and behavior of nanomaterials calls for continual review of the risk assessment and management measures



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Acknowledgements

- The research leading to these results has received funding from the European Union Seventh Framework Programme under grant agreement no 608746.
- Co-authors Marja Pitkänen and Lisa Wikström





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Thank you! Questions?

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