Laminated Structures for Interior Architecture

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Objectives

- Create manufacturing technology for base material and explore machinability
- Visualise preliminary potentials outside of labscale
- Develop a comprehensive understanding of this particular material for further research and products
Technology Overview

- Novel manufacturing technology to produce rigid and solid structures from pulp and nanocellulose
- Structures may serve as alternative for
  - Domestic dividing walls instead of gyspym and chip board
  - Office dividing walls being light and sound absorbing
  - Furniture
- Entirely bio-based and bio-degradable
- Various finishing possibilities
  - Embossed patterns
  - Pictures
  - Painting

Photo: Eeva Suorlahti
Introduction to Nanocellulose

Nano/Microfibrillated cellulose (N/MFC)

Cellulose nanocrystals (NCC)

Bacterial cellulose (BC)

High-Consistency enzymatic fibrillated cellulose (HefCel)*

*FI26698 Process For Producing Fibrillated Material
Technology Description*
Basic structure

**STEP 01**
MANUFACTURE AND DILUTION OF NANOCELLULOSE
80...100 g/L

**STEP 02**
SELECTION OF RIDIG CELLULOSE CORE MATERIAL
APPLICATION ORIENTED

**STEP 03**
GLUING AND PILING OF INDIVIDUAL LAYERS
THICKNESS DEPENDANT ON LAYER COUNT

**STEP 04**
PRESSING AND WATER REMOVAL
PLANAR LEVELS, STRUCTURES SURFACES OR NIP

**STEP 05**
DRYING OF STRUCTURE
105 °C OR HIGHER TEMPERATURE

*Patent application 20185017
Performance of Rigid Layered Structures
Base Material
Shaping Boards

- Drilling & sawing by using woodworking tools

Photo: Eeva Suorlahti
Visual Potentials of Base Material

Finnish Forest Industry. Forest industry based products are significant part of Finnish export accounting for 13.1% of the export value (2015). Due to the declining markets of newspapers the forest industry is constantly looking for new business opportunities. The current large players in the forest sector are excellent in dominant B2B business, whereas for more consumer oriented business concepts are expected. The number of cellulose SME companies is also very limited as the industry has been based on bulk and large volumes. In order to attract future investments and entrepreneurs to the ecosystem, new attractive high value product visions have to be generated.

The current annual growth of Finnish wood biomass − 104 million m$^3$ and the current annual use is 65.3 million m$^3$ (2014) of wood. Thus the usage of Finnish forest resources could be increased significantly. The imbalance will become even greater through three main factors: increasing through systematic natural resources policy, forest management and effect of global warming and reduced use of traditional forest industry. Thus, the national cellulose raw material asset will increase in its significance and products derived thereof should subsequently be an increasing part of our economy. Furthermore, the wood in Finland is produced sustainably in certified forest and this offers potential added value in branding.
Structural Experiments
Slab Structure

With cellulose fillings

Photo: Eeva Suorlahti
ZigZag Structure

Moulded Slats → Core structure → Structure with boards

Photos: Eeva Suorlahti
Grid Structure
Foam Filled Grid Structure
Curved Grid Structure

Photo: Eeva Suorlahti
Conclusions and Value Propositions

- Method to produce a novel structure combining nanocellulose and cellulose was developed.
- Method was demonstrated by creating interior architecture design elements.
- Strength properties surpass reference materials.
- Surface of structure can be finished using:
  - Patterns, pictures or 3D forms.
- Bio-based and bio-degradable.
- Economy: competitive raw material price, simple production process.

Photo: Eeva Suorlahti
Thank You for Your Attention!

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