Biomaterial research at VTT - case nanocellulose
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Background – importance in Finland

Forest products – paper & board, cellulose and timber- are among the most significant export items in Finland.

The demand of graphical papers has steadily decreased

- P&P companies in need of new initiatives.

Research on nanocellulose started at VTT in 2008

- Virtual Nanocellulose Centre between VTT – UPM – Aalto University
- Customer project with Stora Enso on manufacturing concept
- EU projects and national programmes on manufacturing and applications
Nanocellulose development - Pre-commercial production launched in 2011

UPM has started pre-commercial production of fibril cellulose.

Development of industrial production with VTT

UPM www.pages 1/1/2011

Stora Enso Packaging Newsletter 3/2011

Stora Enso
Biofibrils are products based on micro- and nano-fibrillated cellulose which give liquid product formulations new rheological characteristics or strengthen material properties.

GrowDex® is a novel wood-based cellulose nanofibril hydrogel for 3D cell culturing and other biomedical applications. It is highly biocompatible with human cells and tissues – but without any animal- or human-derived material.
Nanocellulose APPLICATIONS AT VARIOUS TRL LEVELS

- Electronic Devices & Components
- Optical Structure
- Diagnostics
- Stability for Food, Cosmetics & Paints
- Textiles
- 3D Composites
- Membranes
- Packaging
- Paper & Board

TRL 2-3
TRL 3-4
TRL 4-6
Bio-based stand-up pouch (SUP)

BIO-BASED BARRIER SOLUTION FOR SUSTAINABLE PACKAGING

3 LAYER BARRIER FILM STRUCTURE:
- Thermoplastic cellulose
- Nanocellulose film
- Thermoplastic cellulose

Oxygen, gas & grease barrier
Drivers for advanced biomaterials & nanomaterials

- **EU bans single use plastics** – potential alternatives from bio-based materials
- **Consumers prefer green solutions**
- **Sustainable production**
  - Abundant raw material
  - Utilisation of side streams
- **Biodegradability**
  - Compostability
Challenges for advanced biomaterials & nanomaterials

- Use of forest must be balanced with their growth – limits for felling?
- Forests are needed as carbon sinks – IPCC report on global warming
- Recycling must be solved – biodegradation is not the priority
- Brand owners banning multimaterials that are not recyclable
- Need for investments if not processable with existing machinery
- Properties vs. price
NEW AND FUTURE INVESTMENTS

**Metsä Group Äänekoski Bioproduct Mill**
- Production 1.3 Million tons of pulp/a, wood use 6.5 million m3/a, production started 2017
- Investment 1.4 billion€

**Renewal of Metsä Group Kemi pulp mill, 900 million€**
- (Or building a new mill > 1 billion€), pre-study
- No investment decision yet

**Boreal Bioref, Kemijärvi**, building to be started summer 2018,
- Production 0.5 million ton of pulp/a, wood use 2.8 million m3/a, to start 2020,
- Cost 950 million€
- Main owner Chinese Shanying

**Finnpulp, Kuopio**, softwood pulp & bioproduct mill, planning started
- Hengan International, tissue producer, as one of the minor stakeholders (investment 14 million€)
- Planned cost 1.4 billion€

**Kaidi Biorefinery, Kemi**, car biofuels
- Investment decision (900 million€) waits for environmental permits & new EU directive for renewal energy
- One of the owners private Chinese Sunshine Kaidi New Energy Group

**KaiCell Fibers** plans to build a new pulp mill to Paltamo, no investment decision yet

Source: Business Finland
The value-added of forest industry can be doubled and still meet the climate targets for 2050