Mikro- ja nanokuituja ruoantuotannon sivuvirroista

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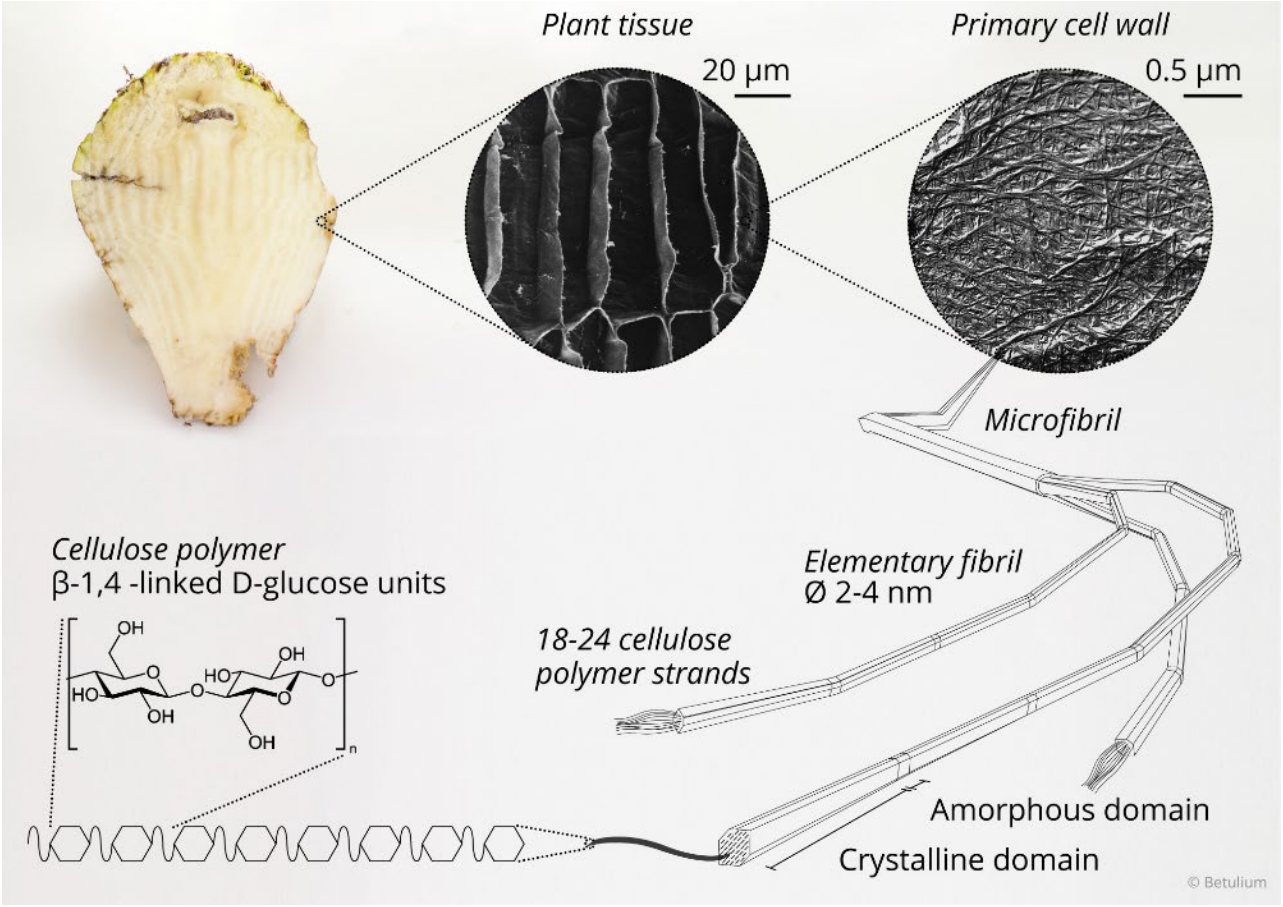
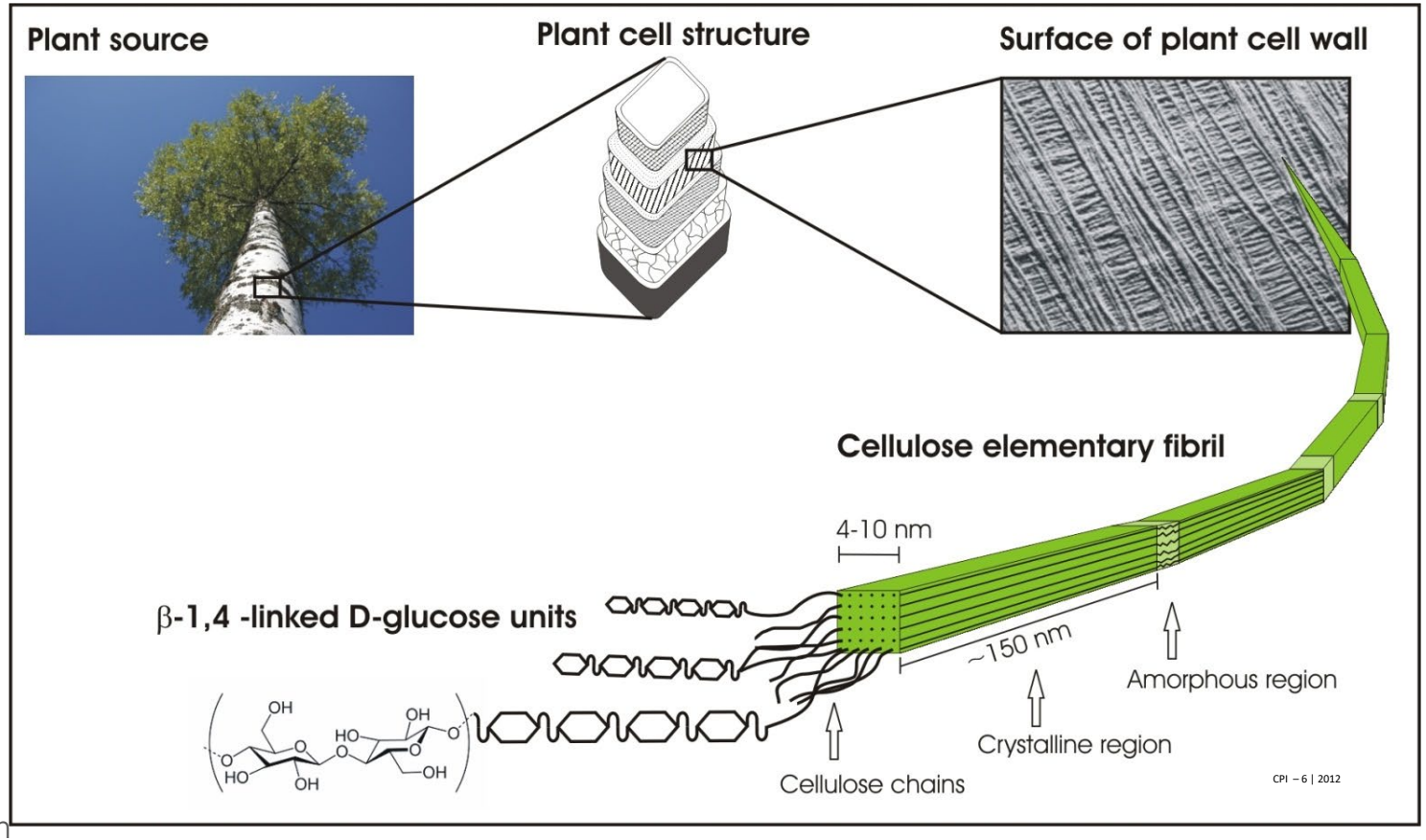
FarKos Seminar

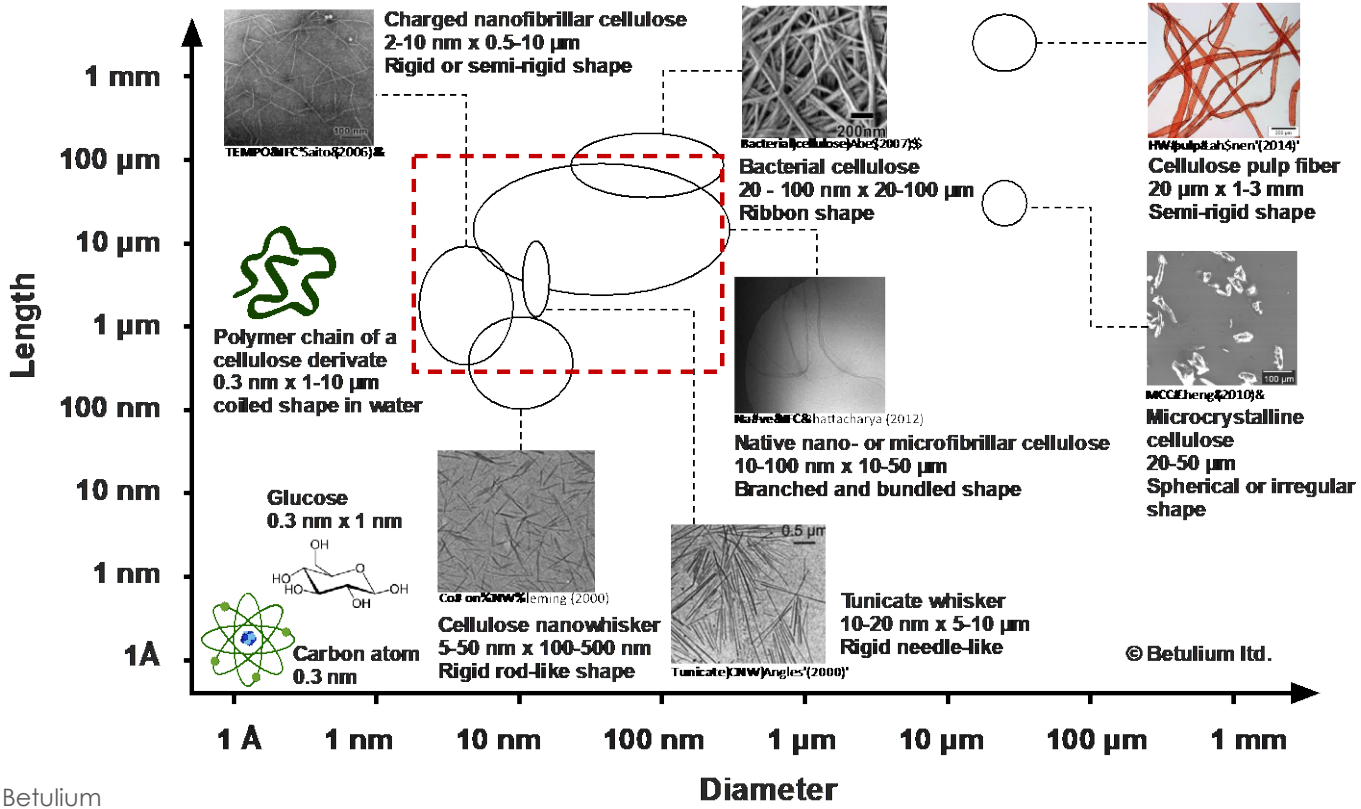
Nanofibers from vegetables



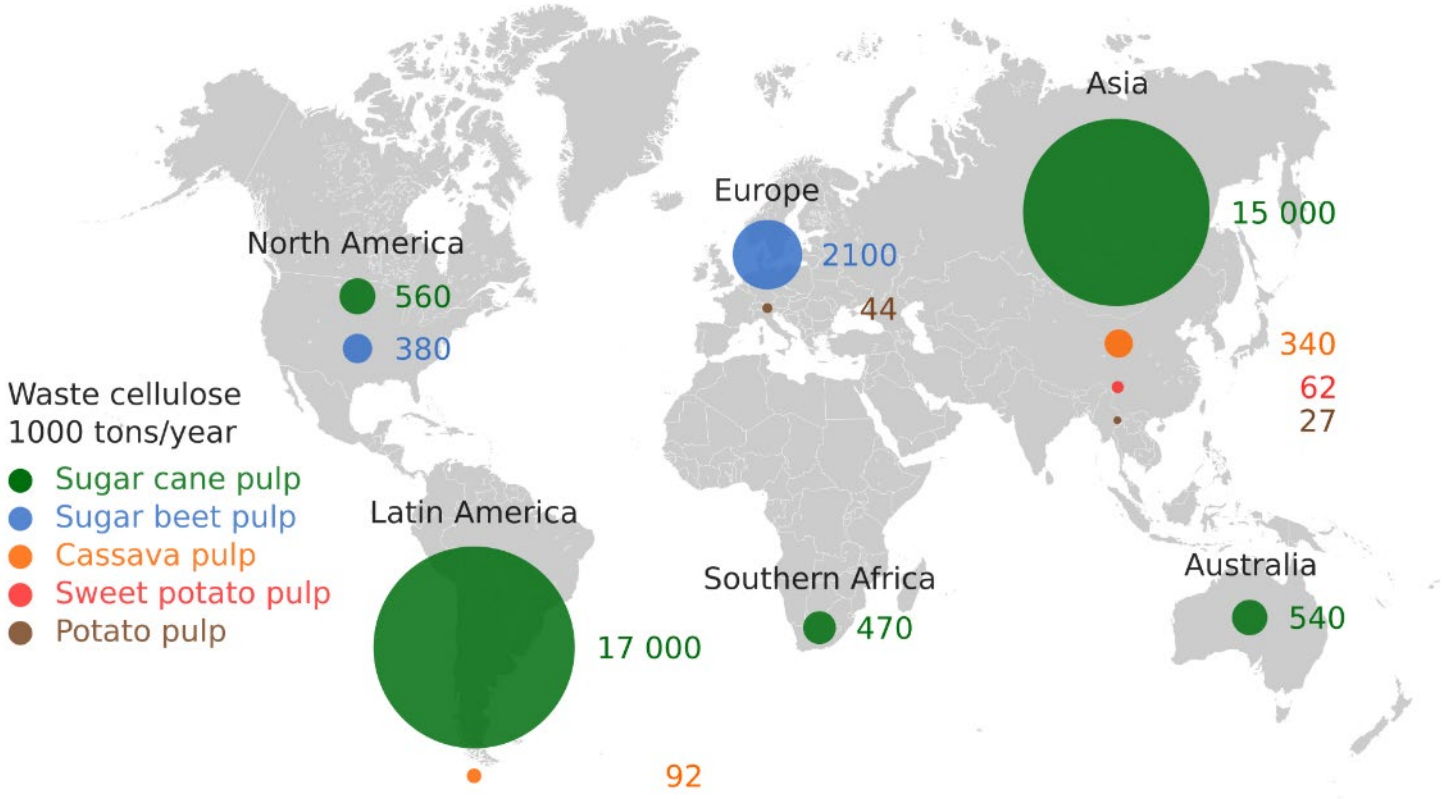
Nanofibers from wood



World of Cellulosics



Non-wood cellulose



Production of sugar beet based MFC

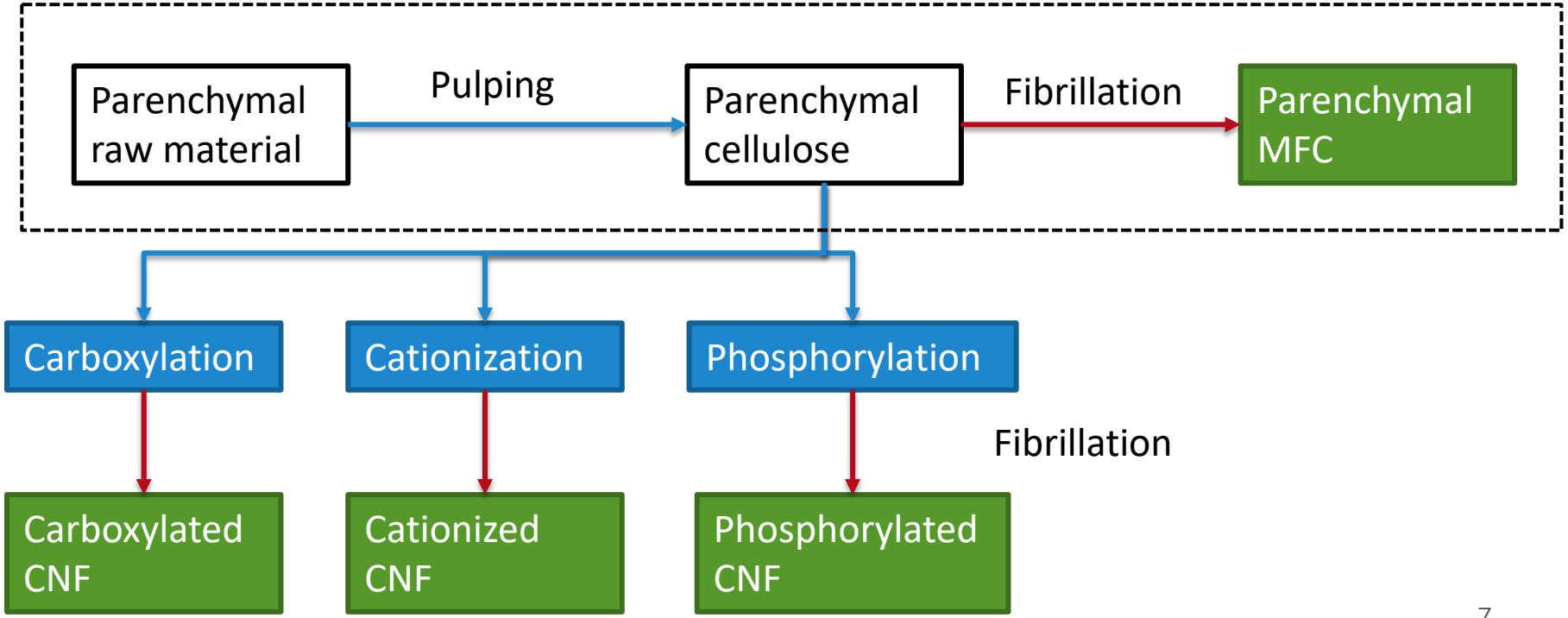
Betulium built the first commercial production line in Säkylä, Finland 2019

- Utilizes sugar beet pulp – located beside a sugar factory
- Produces several MFC product types
  - Liquid, wet granulate, or dry products
  - Can be packed in IBC's, bulk, or big bags

Capacity is dependent on product type

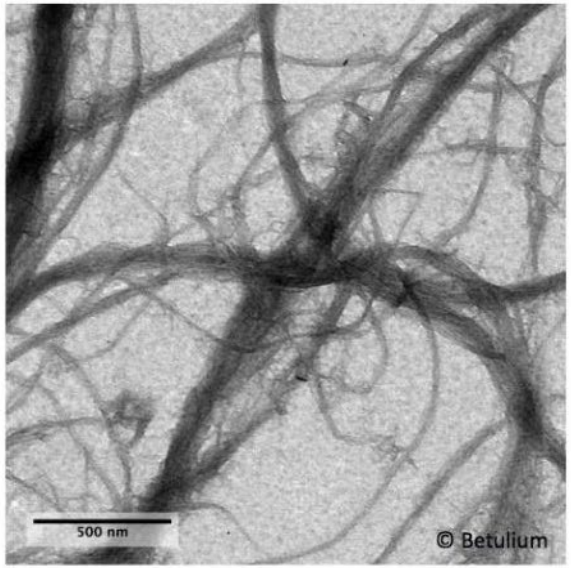
- Certain grades are being produced in commercial quantities and others are still in demonstration stage

Production schema



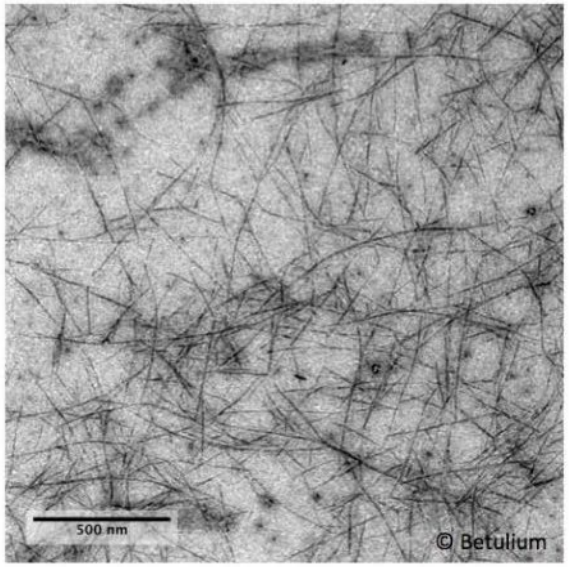
Microfibrillated cellulose and cellulose nanofibers from sugar beet

Native types



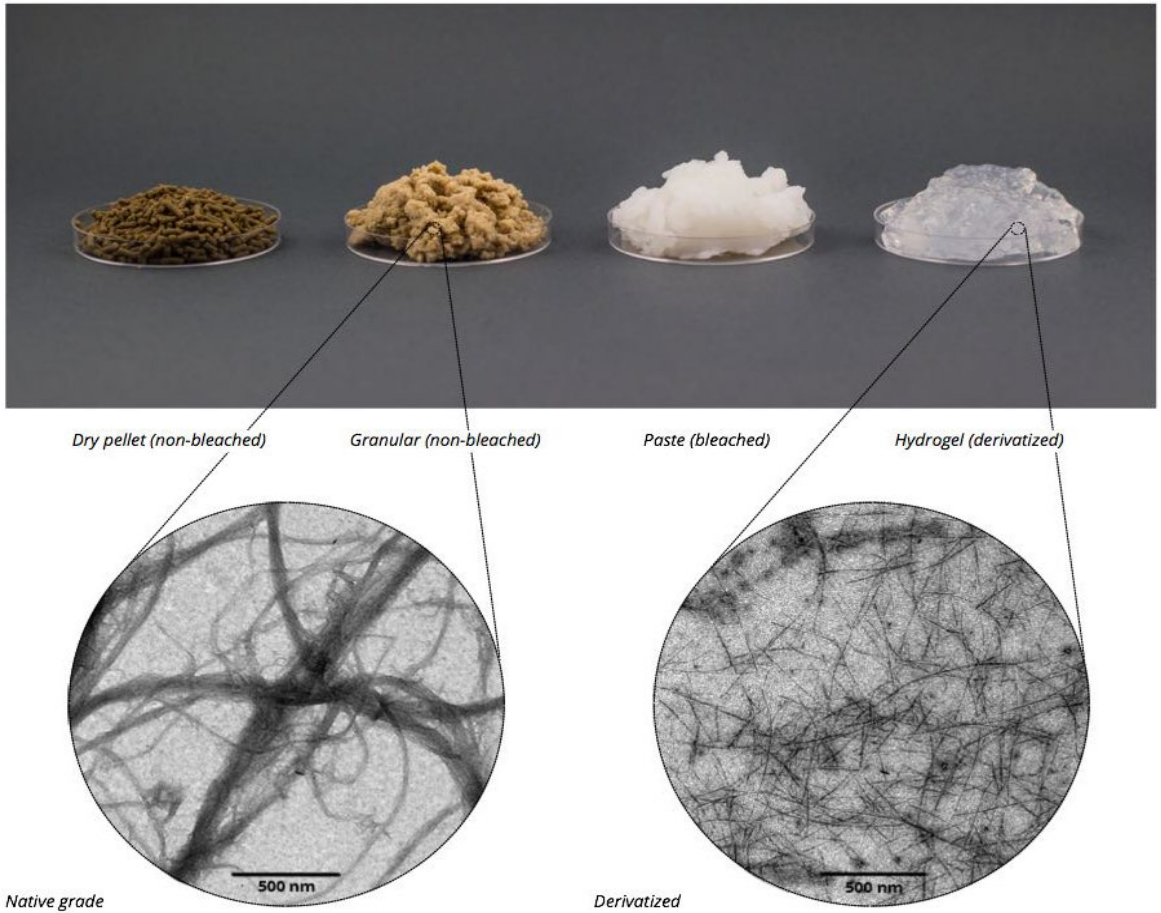
Expanded network of cellulose microfibrils. Scale bar 500 nm

Derivatized types



Individually dispersed elementary fibrils. Scale bar 500 nm

Examples of different product forms



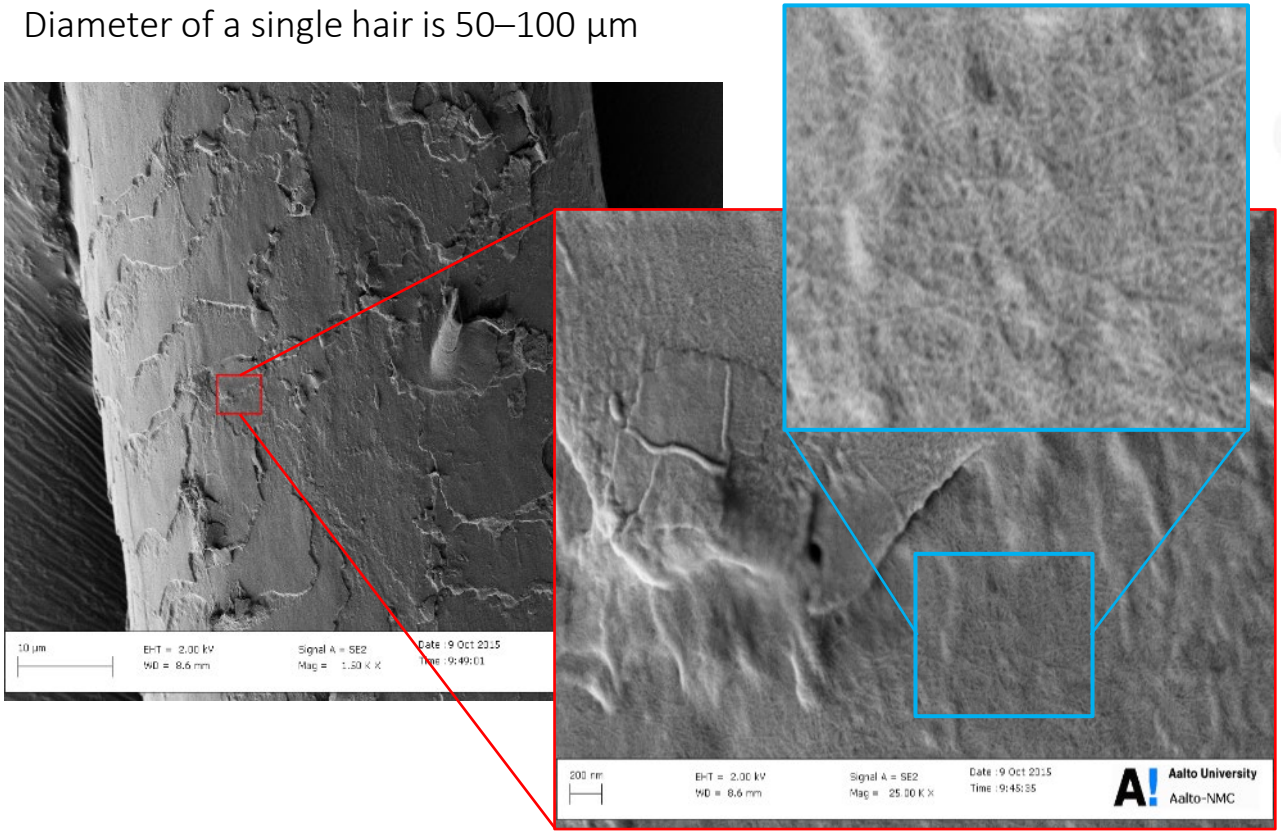
Native grade

Derivatized

How small is it?

Diameter of a single hair is 50–100 µm

Diameter of a single cellulose nanofibrils is 4 nm



Main functions

Two separate properties, and products, to be commercialized

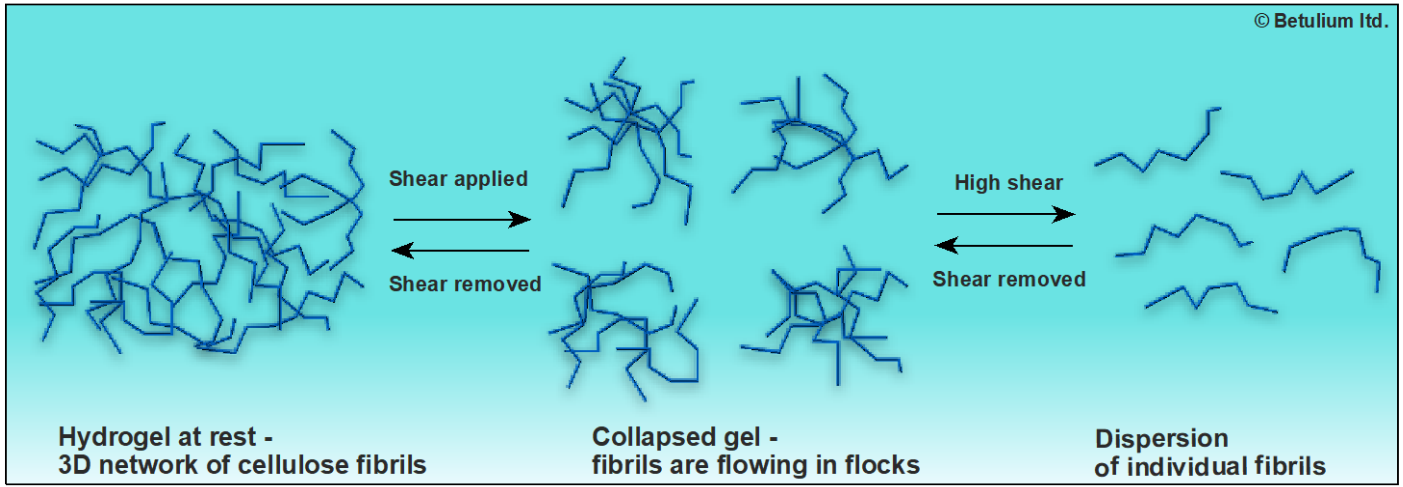
(1) MFC as a binder

- High surface area, 100 m^2/g
- Strong, stiff, and impermeable material
- Very good binder

(2) MFC as a rheology modifier

- Gel former, stabilizer, rheology modifier

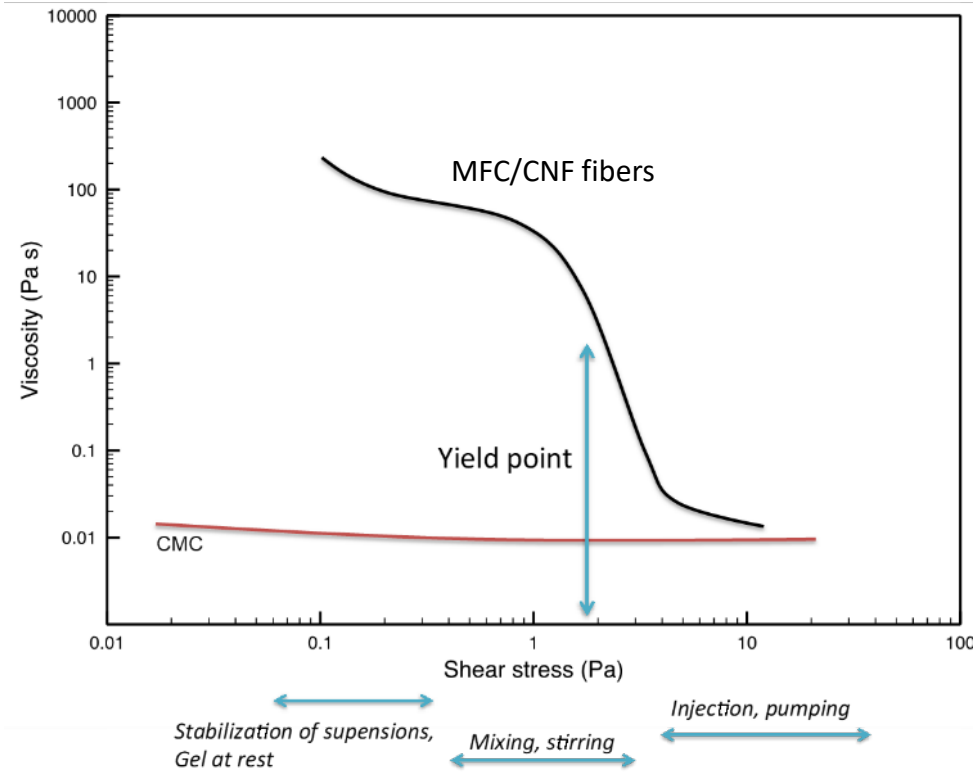
Nanocellulose in water



Gel structure is formed by interlocked cellulose fibrils or fibril bundles

- No thermal melting, like in xanthan
- No changes in conformation at harsh conditions
- Decomposition rate is slow due to fibrillar structure, i.e. each structural element is made of several polymer chains

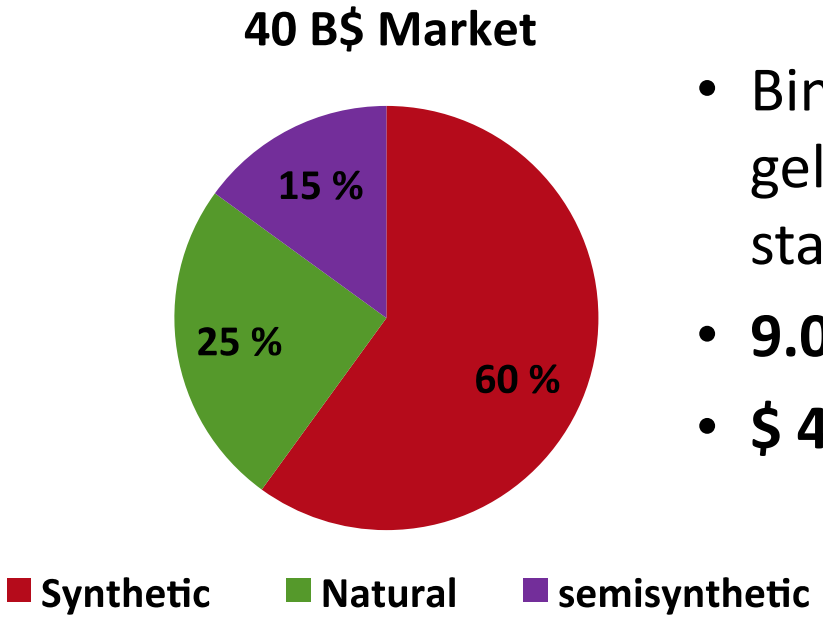
Flow behavior of MFC/CNF



High yield stress is needed to stabilize suspensions…

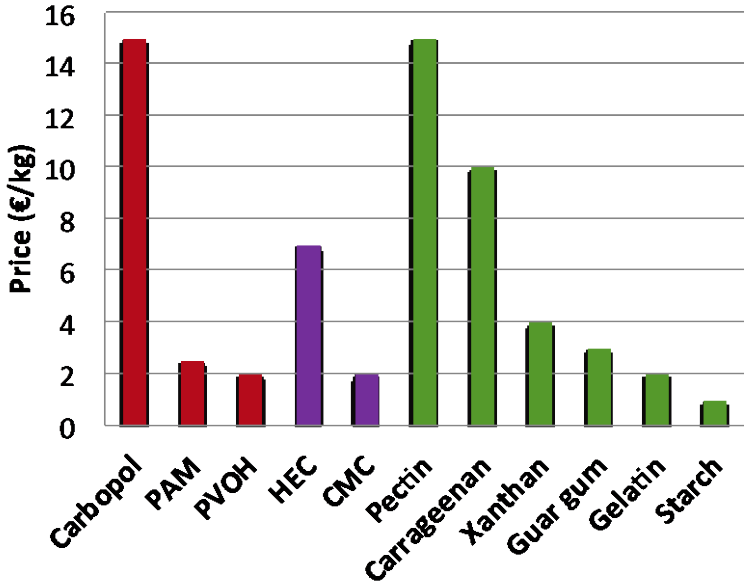
… and allow spreading or injection

Global market for water soluble polymers



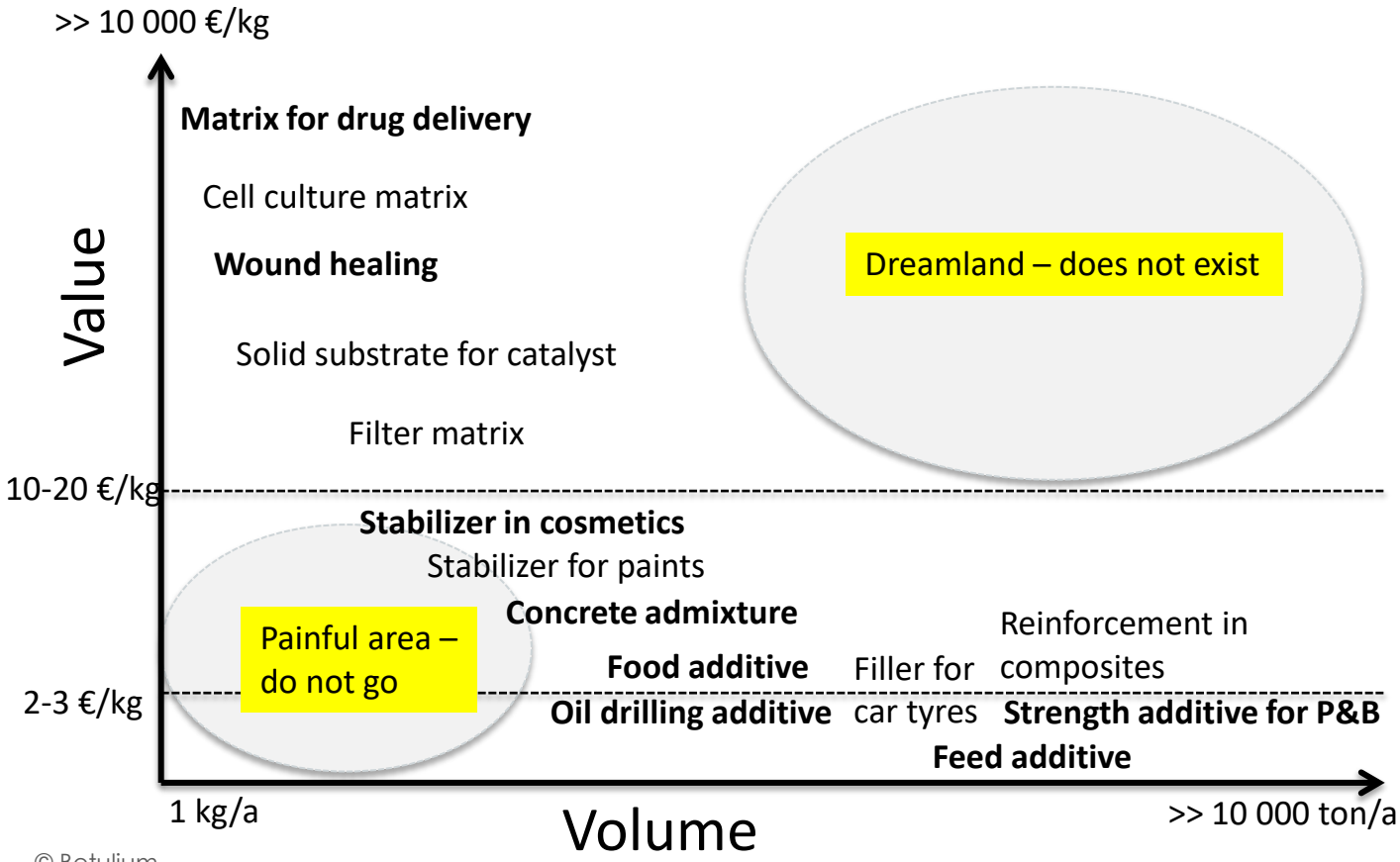
- Binders, flocculants, gelants, thickeners, stabilizers,…
- **9.0 million ton by 2019**
- **$ 40 Billion by 2019**

Global market for water soluble polymers



Depending on the cost, nanocellulose has a remarkable potential to replace existing products

Applications for nanocellulosics

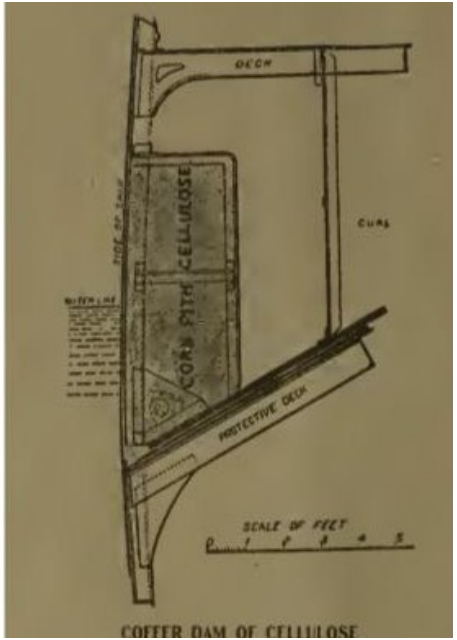


Nanocellulose aerogels in battleships

– US Navy 1895

SHIPPING CELLULOSE BY CARLOADS

Herbert Myric, A Revolution in Agriculture, Library of Congress



COFFER DAM OF CELLULOSE

…If a shell from enemy pierces the side of a ship below water line, the cellulose will swell up quickly that no water will get in to the ship…