

# Comparison Of Cellulose- Based Films for Barrier Packaging Applications

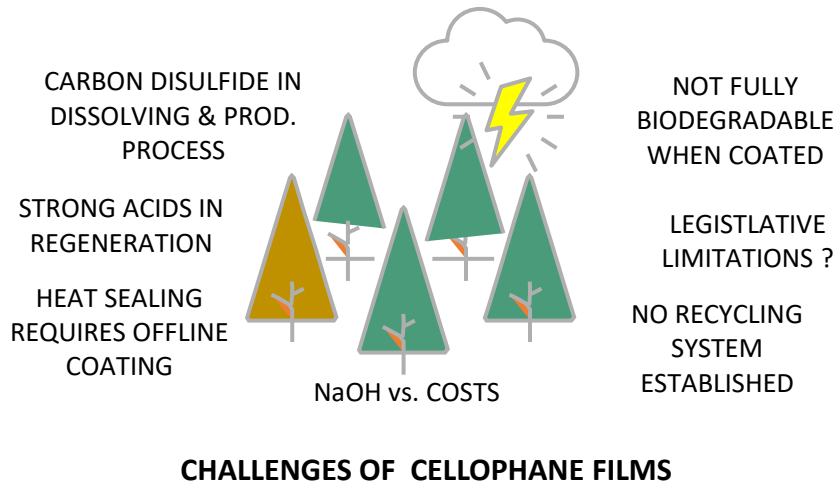
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**VTT**

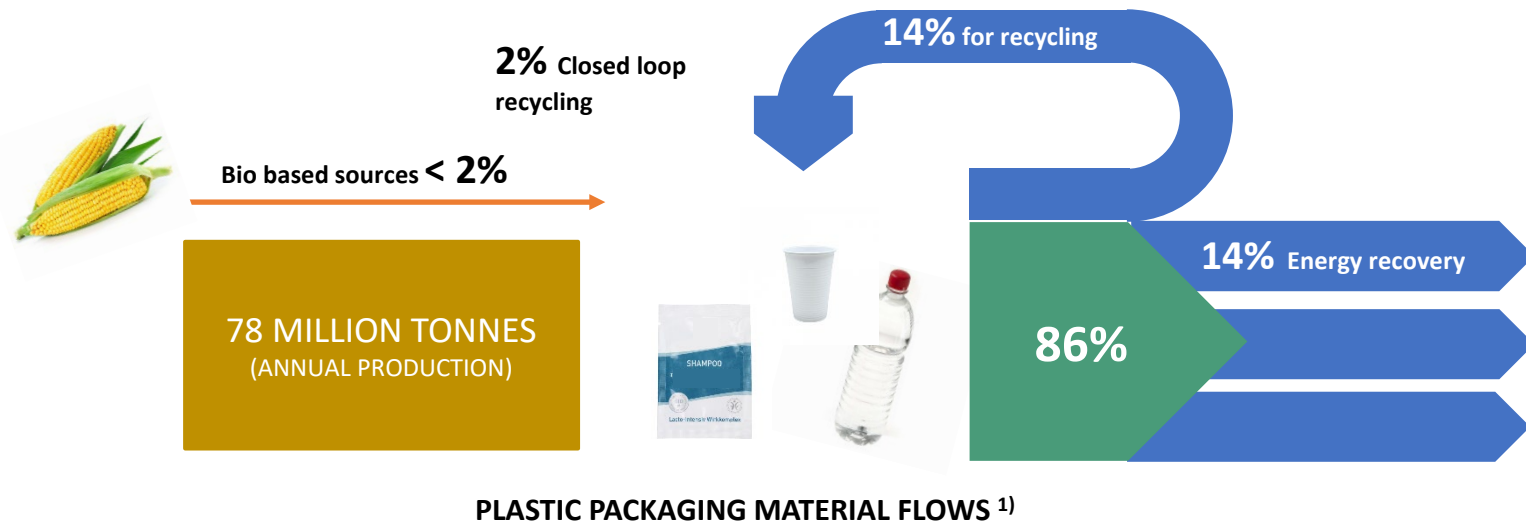


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## Current market and challenges



GLOBAL PRODUCTION OF 0.077 Mt (3.2%) OF GLOBAL BIOPLASTIC PRODUCTION CAPACITY AND 4.5% CAGR <sup>3,4)</sup>



GLOBALLY 9% OF ALL PLASTIC IS RECYCLED AND 22% MISMANAGED <sup>2)</sup>

LITTER = MACROPLASTICS AND MICROPLASTICS

1) Adopted from <https://archive.ellenmacarthurfoundation.org/explore/plastics-and-the-circular-economy>  
 2) <https://www.oecd.org/environment/plastic-pollution-is-growing-relentlessly-as-waste-management-and-recycling-fall-short.htm>  
 3) <https://www.european-bioplastics.org/market/>  
 4) <https://www.marketreportsworld.com/global-cellophane-market-21185375>  
 Pictures: plastic cup, pakkaa.fi; shampoo sample, ecco-verde.fi; plastic bottle: pakkaustukku.fi; corn: tukkukauppa.heinontukku.fi



## Value increment of Finnish forest sector by 2035<sup>1)</sup> Fibrillating industry

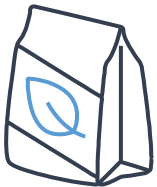


Textile fibre

Value + + + +

70% of pulp to  
textile fibres  
Export

Textile fibre = transparent films  
Raw material & chemistry



Packaging plus

Value + +

60% produced as  
more valuable

Hybrid structures  
Dissolved & fibres

- 1) Suomi elää metsästä myös 2035 – avauksia metsäsektorin arvonlisän tuplaamiseen. Luke Metsäareena 2023 [https://www.luke.fi/sites/default/files/2023-02/Johanna\\_Kohl\\_Mets%C3%A4areena.pdf](https://www.luke.fi/sites/default/files/2023-02/Johanna_Kohl_Mets%C3%A4areena.pdf)
- 2) [https://www.stat.fi/til/salatuo/2020/salatuo\\_2020\\_2021-11-02\\_tie\\_001\\_fi.html](https://www.stat.fi/til/salatuo/2020/salatuo_2020_2021-11-02_tie_001_fi.html)
- 3) <https://jukuri.luke.fi/handle/10024/553167>



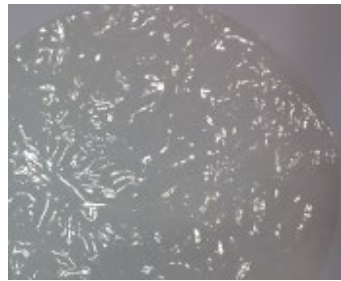
## Key enabling technologies for stand alone films



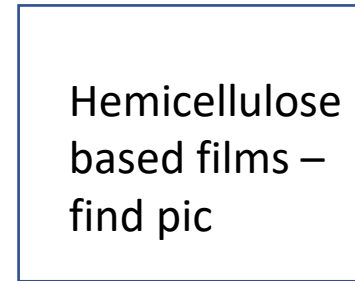
Fibrillated  
cellulose



ThermoCell



Dissolved and  
regenerated  
cellulose



Hemicellulose



## Key enabling technologies – cellulose dissolving

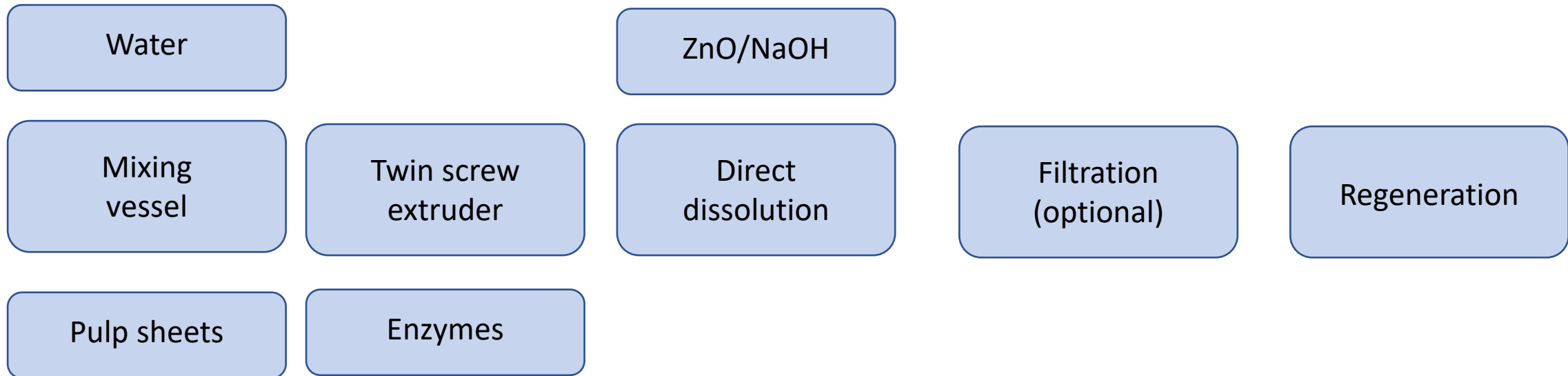
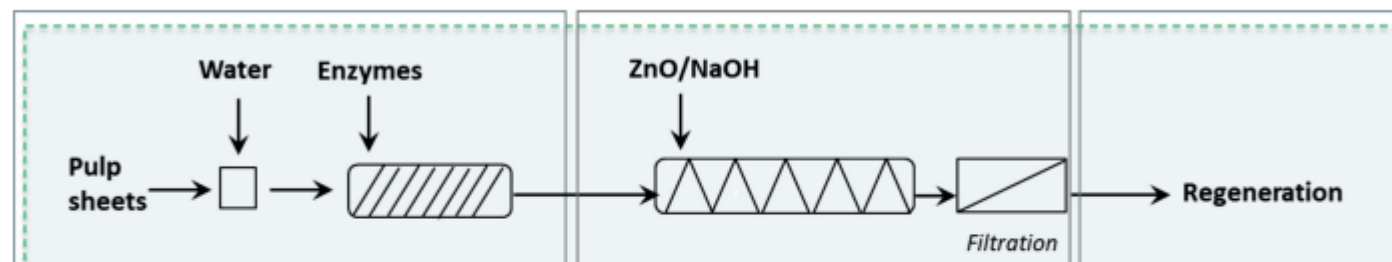
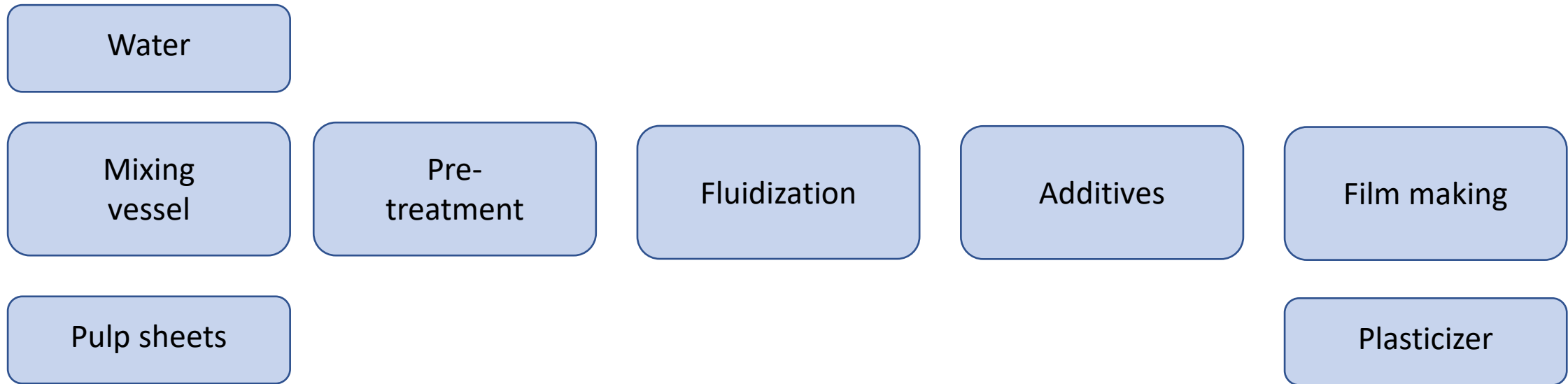


Fig. 1  
Schematic presentation of Biocelsol process



## Key enabling technologies – cellulose fibrillation



## Key enablers – lab to pilot

### Cellulose film

Dissolution

Air removal

Casting to support

Post plastization

Drying and rewinding

### CNF film

High shear mixing

Air removal

Casting to support

Drying

Delamination and rewinding

- Process description of
  - Nanocellulose film casting
  - Cellulose film



## Key enablers – lab to pilot





## Comparison of films Dissolved cellulose vs. Fibrillated cellulose

- Commercial softwood kraft pulp
- Effect of common plasticizer on prioritized properties
  - Tensile
  - Oxygen barrier
  - Water vapour barrier
- Results now pending



Tensile properties  
Dissolved cellulose vs. Fibrillated cellulose



Barrier properties  
Dissolved cellulose vs. Fibrillated cellulose



Bursting strength  
Dissolved cellulose vs. Fibrillated cellulose



## Other properties

## Dissolved cellulose vs. Fibrillated cellulose

- Recycling (pic)
- Printing
- Mouldability vs. strain
- Twist & wrap
- Food contact
- Heat sealability



## Summary and conclusions

- Add here



**Thank You**  
**Questions & Comments ?**

