

# New feedstock approaches for cellulose filaments production towards a circular economy

Antje Ota<sup>1</sup>, Marc P. Vocht<sup>1</sup>, Ilona van Zandvoort<sup>2</sup>, Karla M. Dussan Rojas<sup>2</sup>, André van Zomeren<sup>2</sup>, Jaap W. van Hal<sup>2</sup>, Frank Hermanutz<sup>1</sup>

<sup>1</sup> German Institutes of Textile and Fiber Research Denkendorf,

<sup>2</sup> Biobased and Circular Technologies Group, Netherlands Organisation for Applied Scientific Research TNO, Petten

DITF

DEUTSCHE INSTITUTE FÜR TEXTIL+ FASERFORSCHUNG

## HEREWEAR Project: Enabling Local, Circular & Bio-based Textiles

Design and manufacture clothing that is truly sustainable via:

- Assuring circularity of textiles
- Textiles made from locally-sourced bio-based materials / waste
- Local small-scale automated production and networked manufacturing

## HEREWEAR innovation

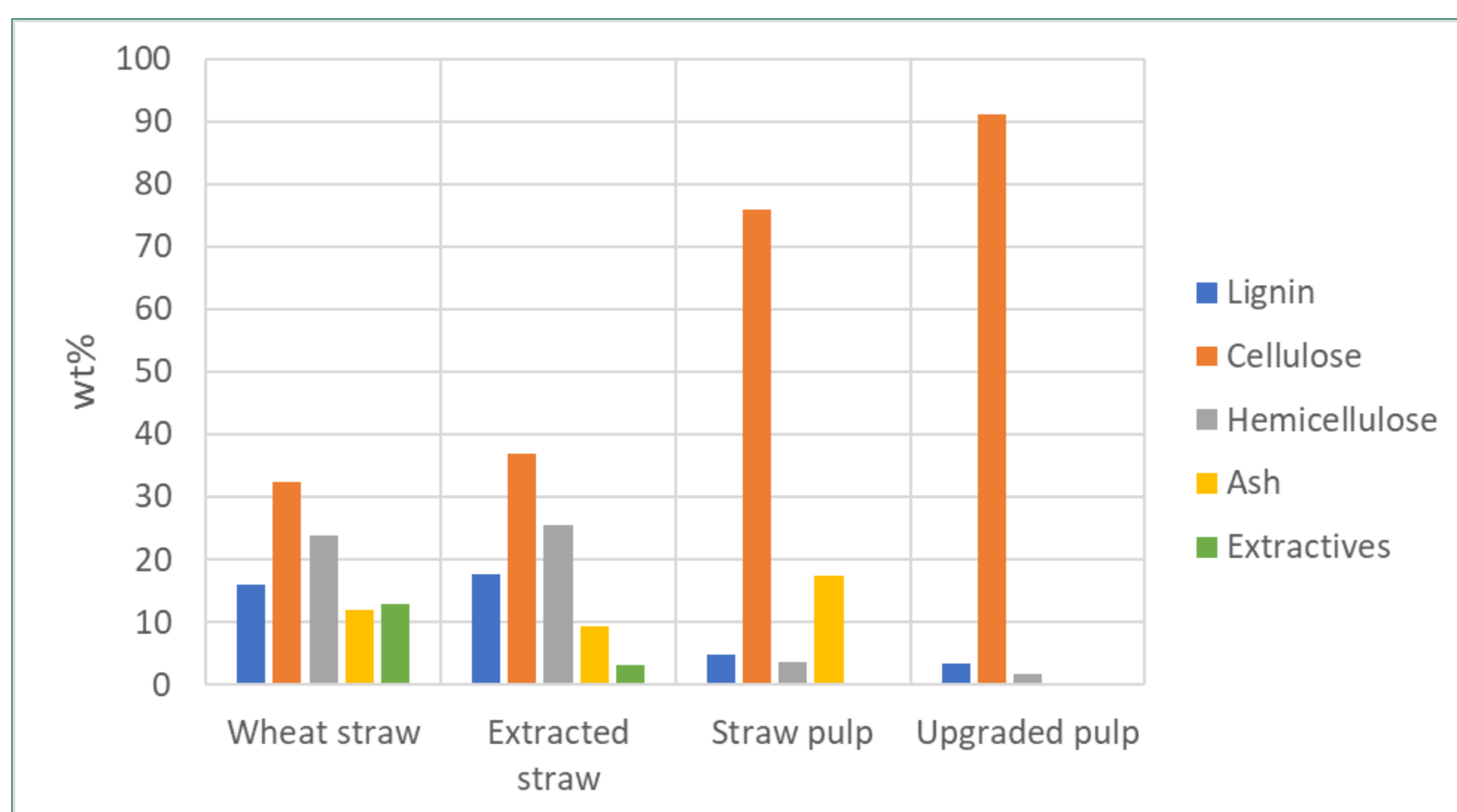
- Cellulose filaments from bio-based waste streams
- HighPerCell® technology: Ionic liquids as direct solvent with nearly 100% recovery rate

## Feedstock processing

- Pulp production from underutilized feedstock wheat straw
- Pulping was performed by three step procedure



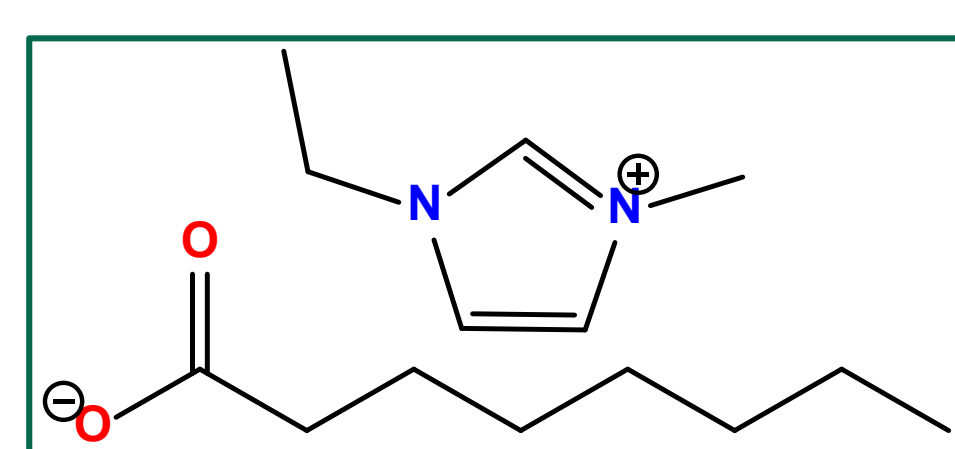
- ELENANOR pre-extraction for enrichment of lignocellulose content
- Acetone-based organosolv Fabiola™ for cellulose extraction
- Alkaline Upgrading (99% removal of Si rich ash)



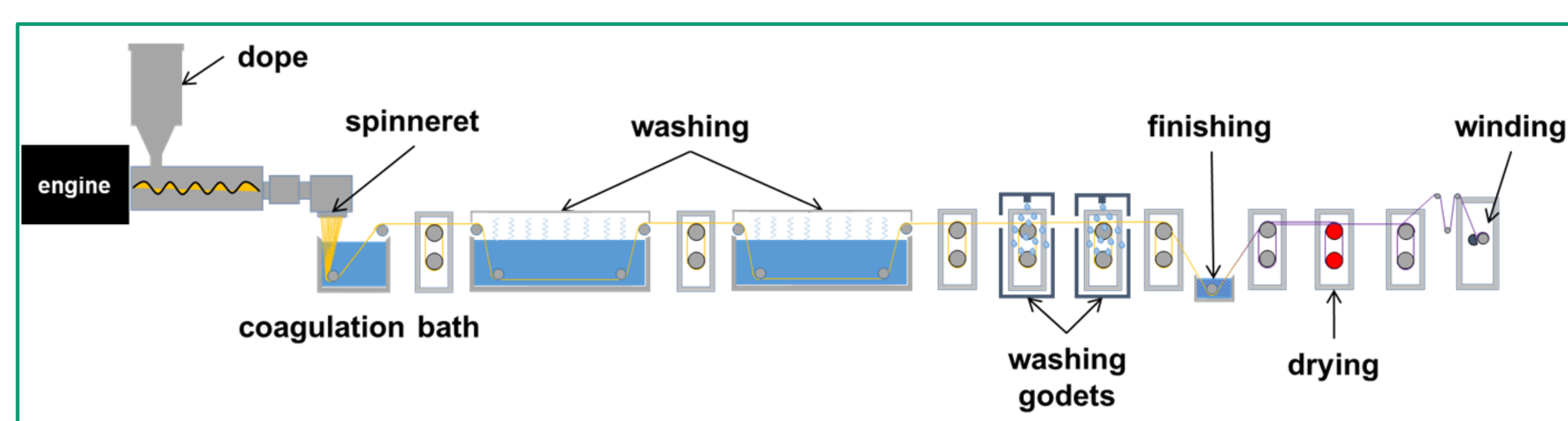
Pulp composition during all process upgrading steps

## HighPerCell® technology for filament spinning

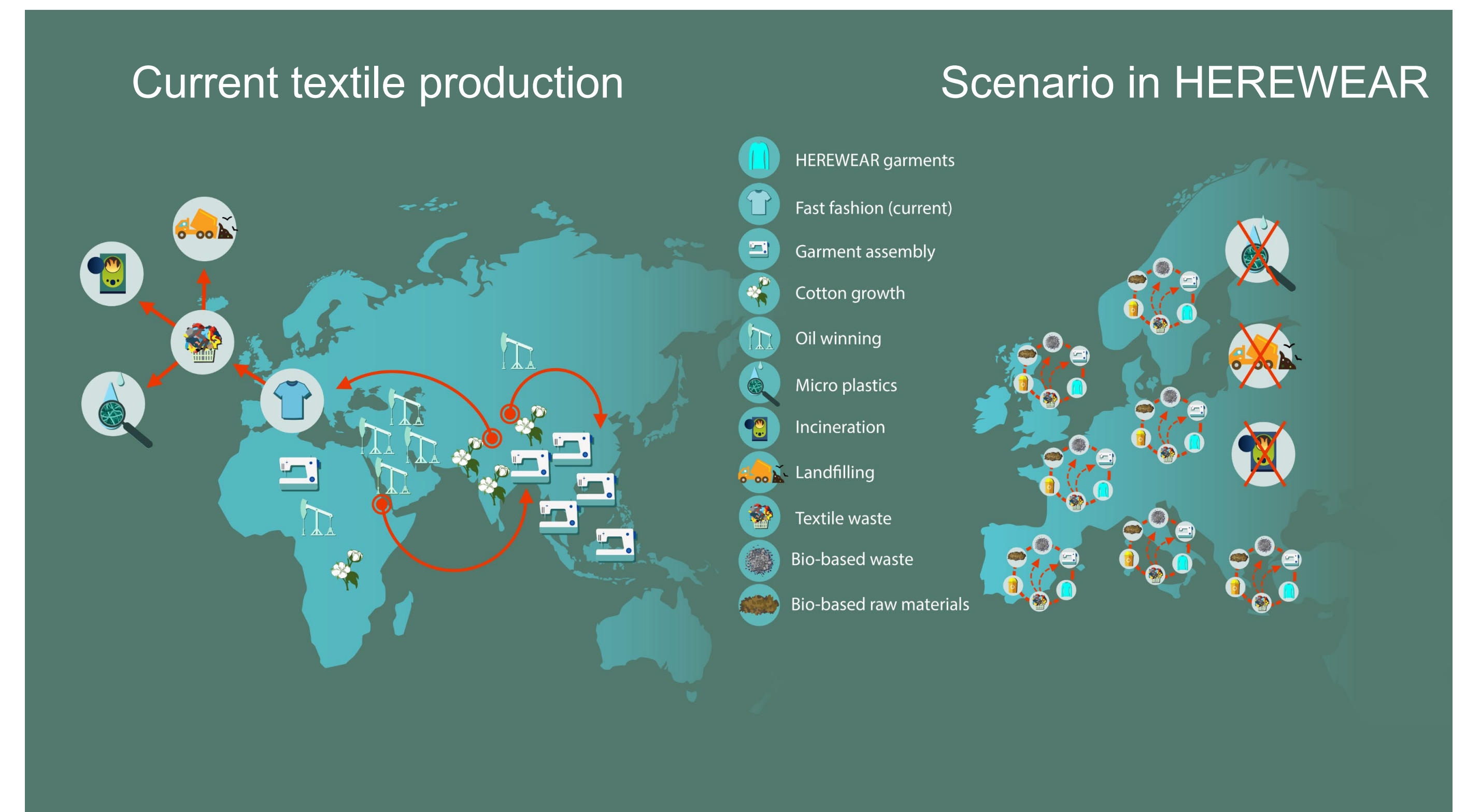
- Patented, innovative spinning process for cellulose filaments
- Ionic liquid (IL) as direct solvent (up to 20 wt.-% cellulose)
- Environmental friendly, material efficient technique
- Continuous processing into filaments for textile (knits, woven fabrics) as well for technical application (reinforcement filaments for composites)
- Closed loop process (fresh and recycled IL applicable)



IL: 1-ethyl-3-methyl imidazolium octanoate



Processing scheme of dry-wet spinning of cellulose filaments using IL.



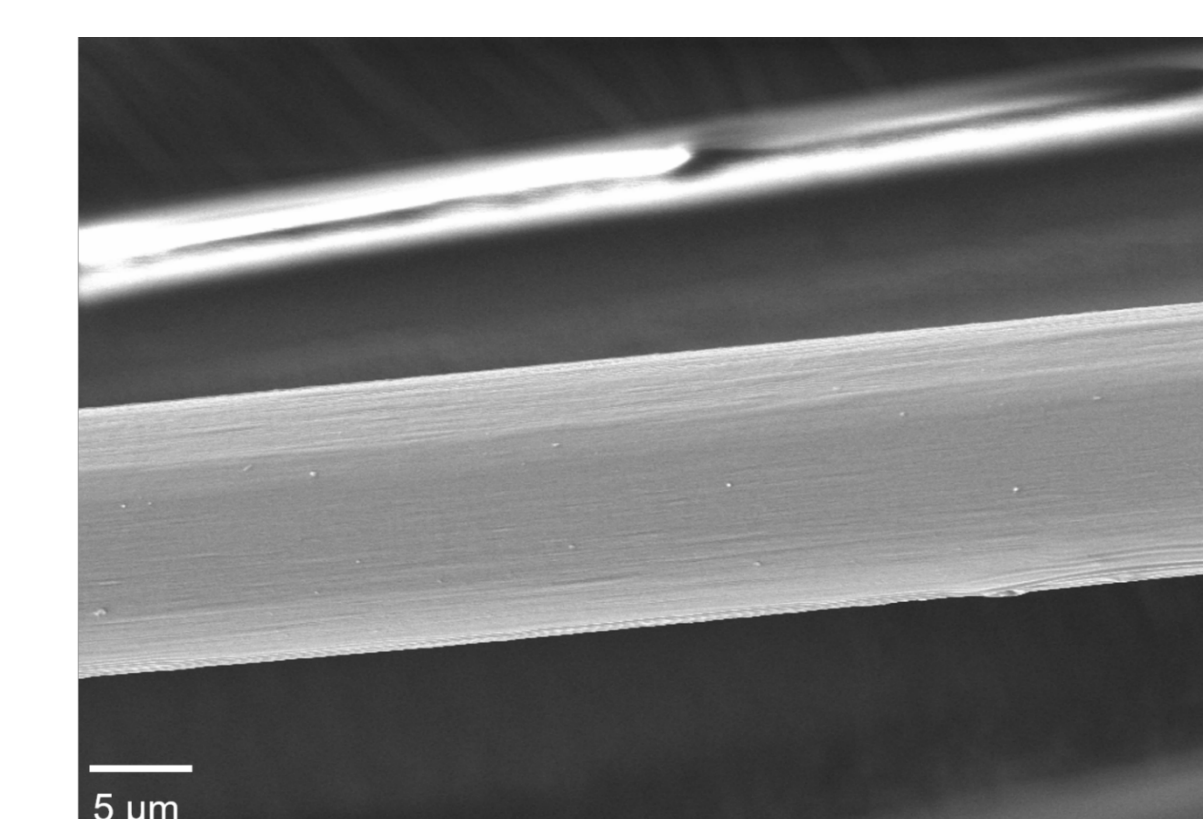
## First continuous wheat straw based filament using HighPerCell® technology

Pulp parameters	Wheat straw bleached	Wheat straw unbleached
α- cellulose content	95.4	93.5
Ash content [wt.-%]	0.11	0.48
Degree of polymerization	1160	1320

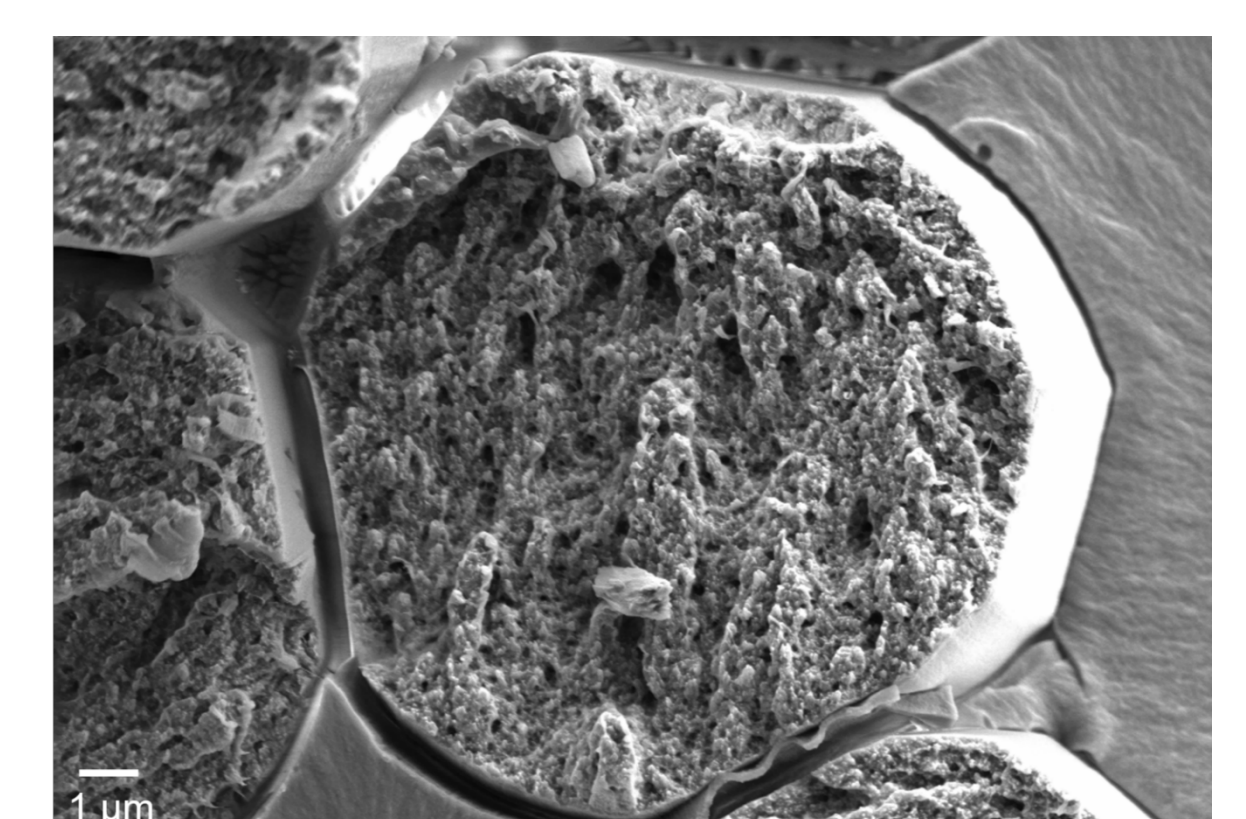


- Filaments from unbleached and bleached were successfully spun
- Textile-mechanical properties are comparable to a cellulose viscose fiber

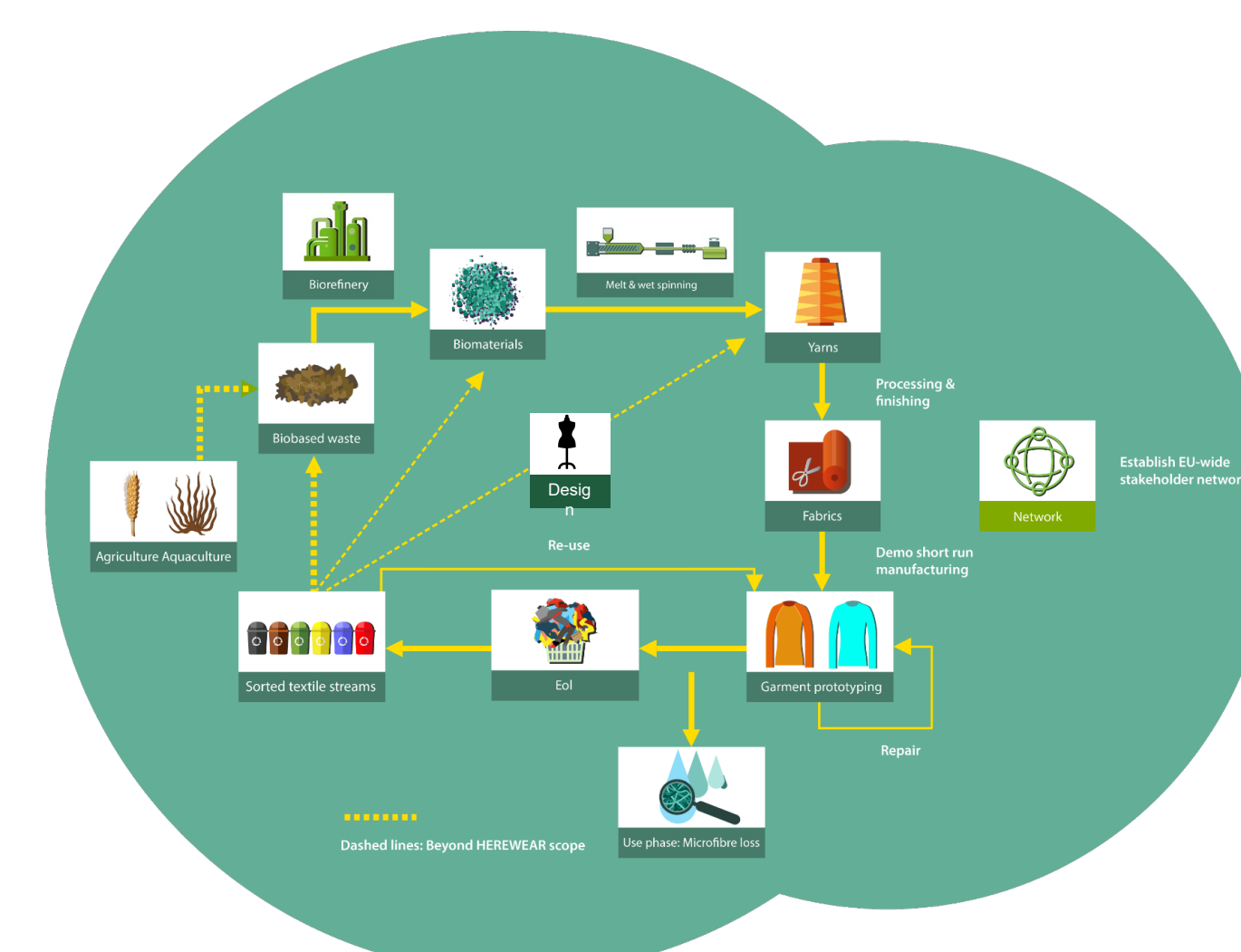
Spinning conditions	
Dope concentration	12 wt.-%
Degree of polymerisation	410 - 520
Spinning temperature	75°C
Filament count	64 / 250
Filament properties	
Fineness [dtex]	1.9 - 2.5
Tenacity [cN/tex]	18 - 28
Elongation [%]	4 - 9
Young's modulus [cN/tex]	1000 - 1600



Cellulose filament surface.



Filament cross-section.



EU based circular, bio-based garment and fabric production (left) and Herewear partner (right)

## Acknowledgement

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Contact: [antje.ota@ditf.de](mailto:antje.ota@ditf.de) / +49 711 9340 173

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