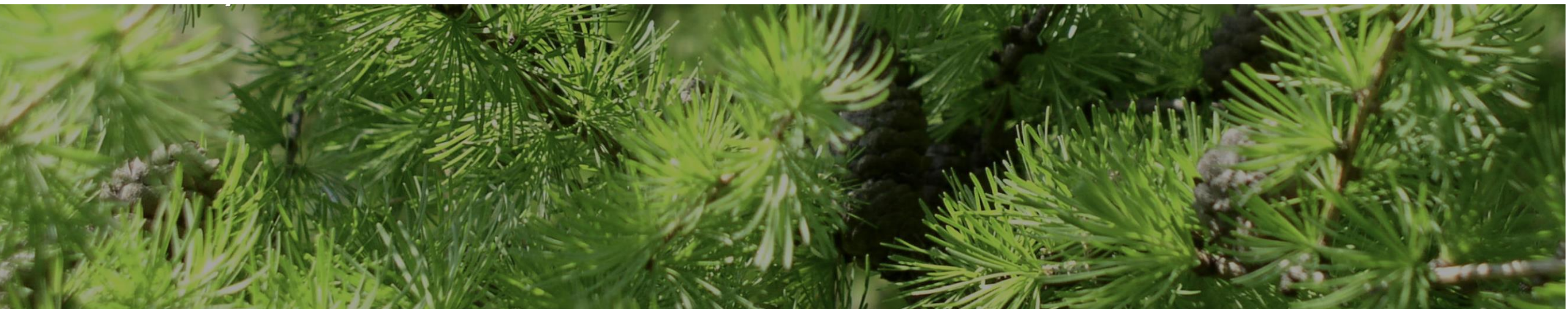


# High consistency refining with hammer mill and ATREX – Impact on fibre morphology and paper structure

BIOHUB 5.6.2024

Dr. Antti Laukkanen



100+ years in green transition pioneering

# KCL biomass treatment and BIOHUB

KCL is building novel capabilities

- Cellulose pulp related processes are still important

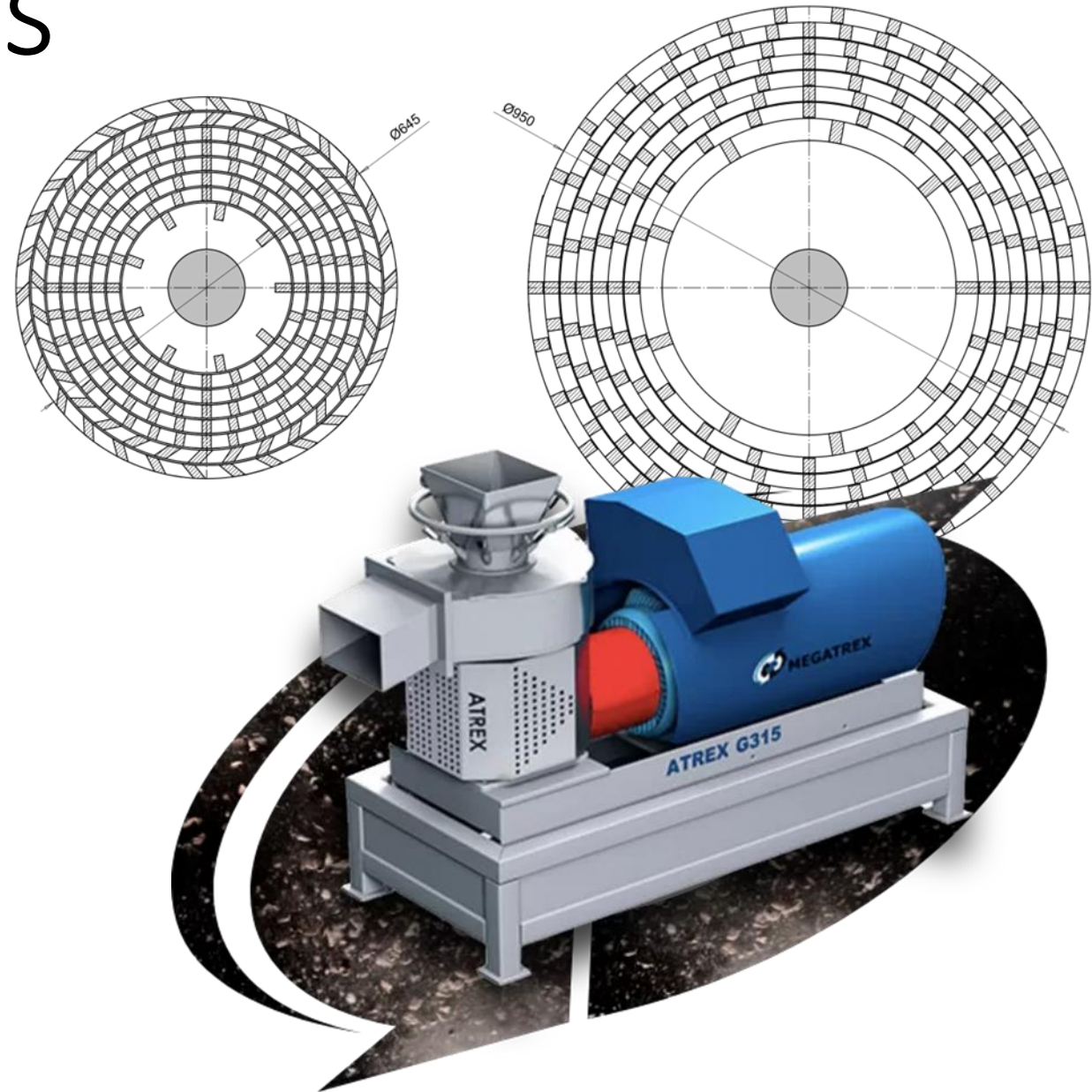
New methods for HC refining installed in KCL

- ATREX and hammermill

# HC fiber treatments

## Atrex mill(s)

- Atrex CD 650 (115 kW) or G-600 (350 kW)
  - High or low consistency (dry or wet) processing with extremely versatile raw material base
  - Filling choices from crushing, mixing and dispersing
  - In pilot- and industrial capacity
  - Continuous or batch

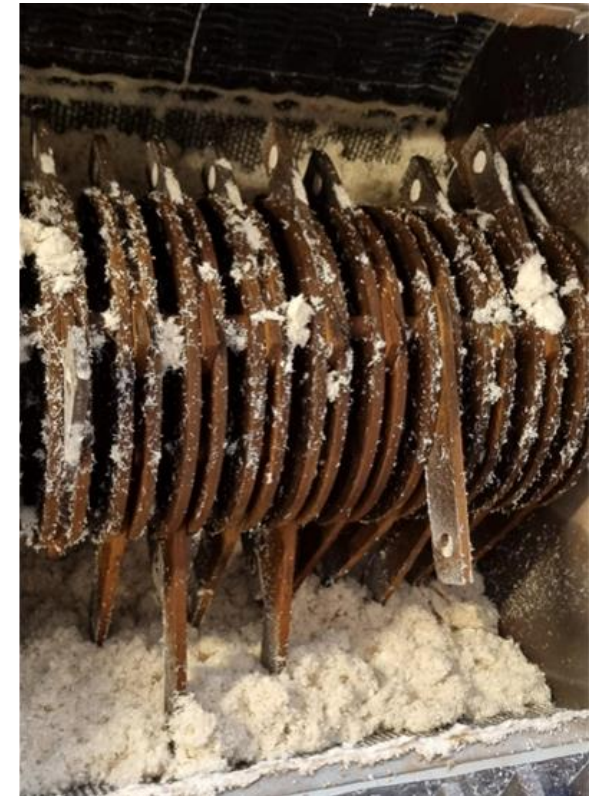




# HC fiber treatments

## Hammermill (90kW)

- Powerful milling & crushing
- Feeding screw for constant inlet
- Several different sizes of sieves
- In pilot- and laboratory-scale



# Test protocol



*Northern bleached  
softwood kraft (NBSK)*

Pulper

4%

Thune  
press

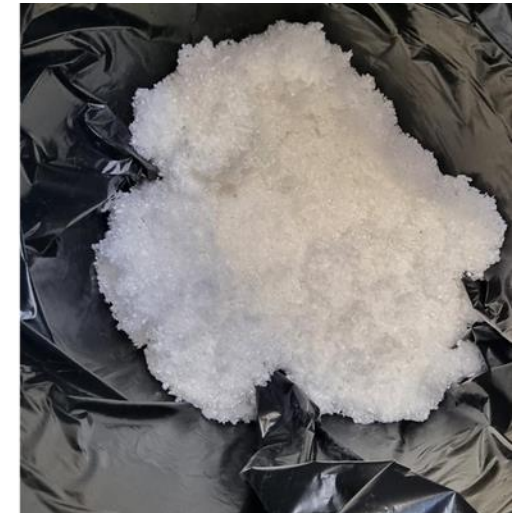
35%

1-2 pass  
Mixing: 500 kWh/t  
Crushing: 1500 kWh/t

**ATREX**

35%

1-2 pass, 930 kWh/t  
**Hammer  
mill**



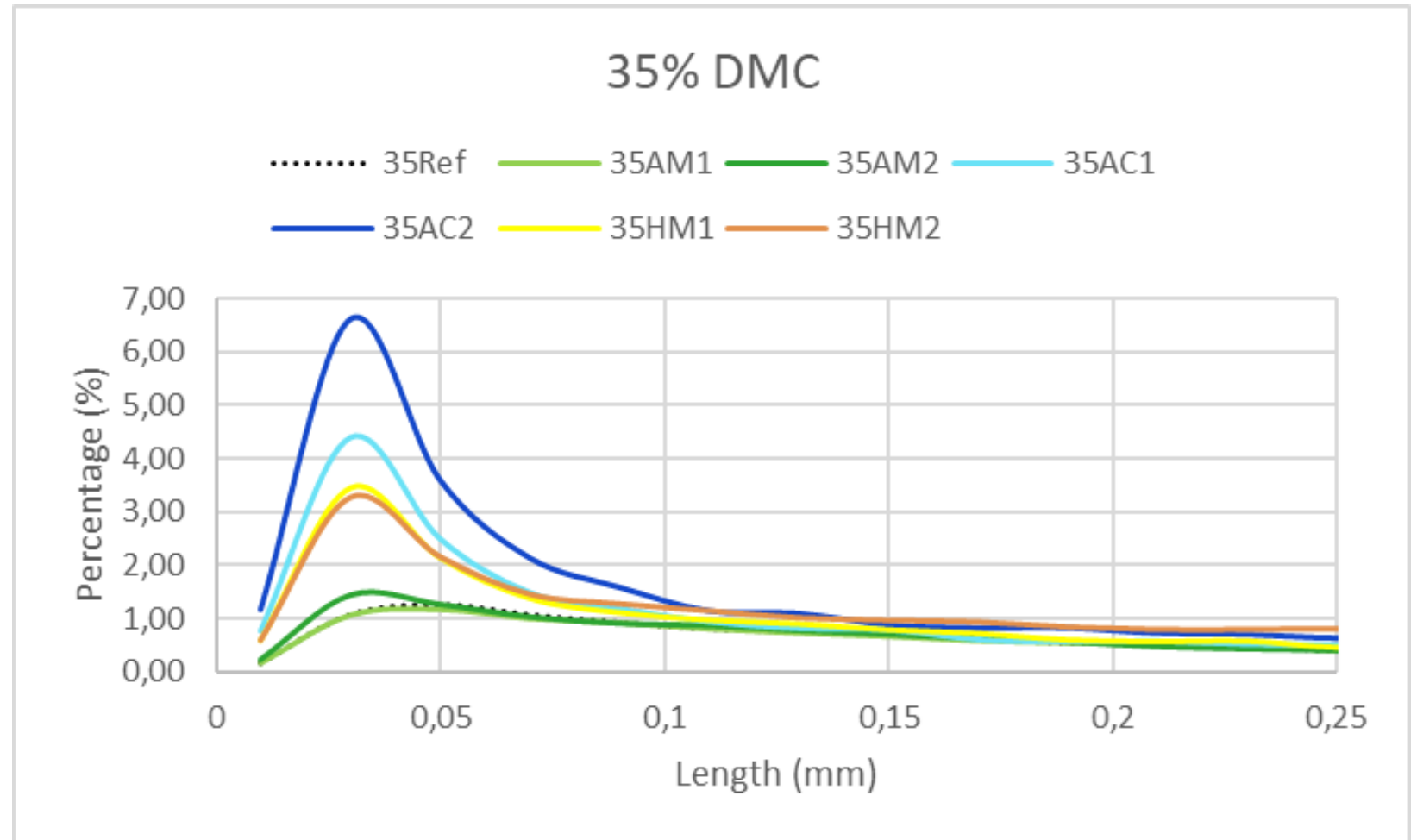
# Test points

Abbreviation	Description
35Ref	Unrefined pulp with 35% DMC
35AM1	35% DMC pulp refined once with Atrex mixing geometry
35AM2	35% DMC pulp refined twice with Atrex mixing geometry
35AC1	35% DMC pulp refined once with Atrex crushing geometry
35AC2	35% DMC pulp refined twice with Atrex crushing geometry
35HM1	35% DMC pulp refined once with hammermill
35HM2	35% DMC pulp refined twice with hammermill

# Fiber properties

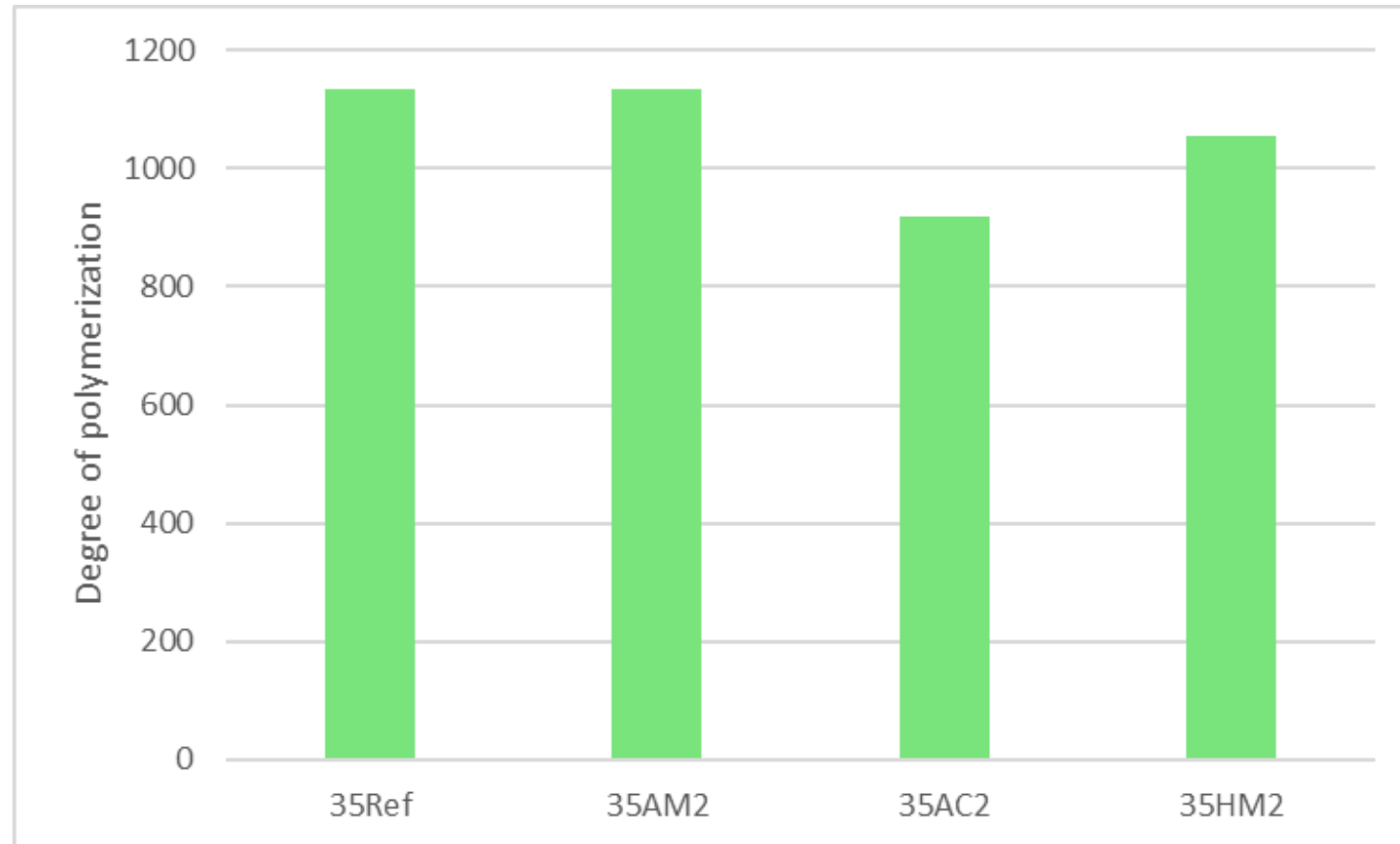
# Fiber length distribution, 35% DMC

TP	Length weighted fibre length (mm)
35Ref	2,03
35AM1	2,04
35AM2	1,97
35AC1	1,77
35AC2	1,62
35HM1	1,83
35HM2	1,54



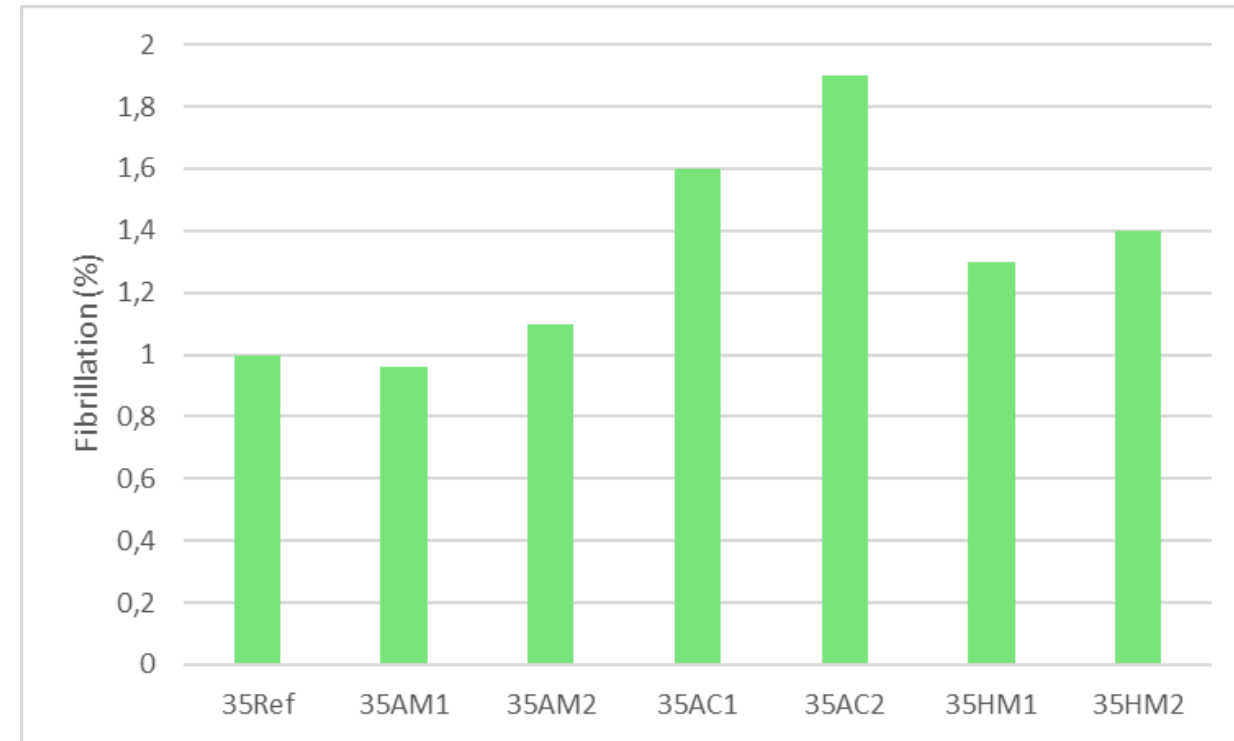
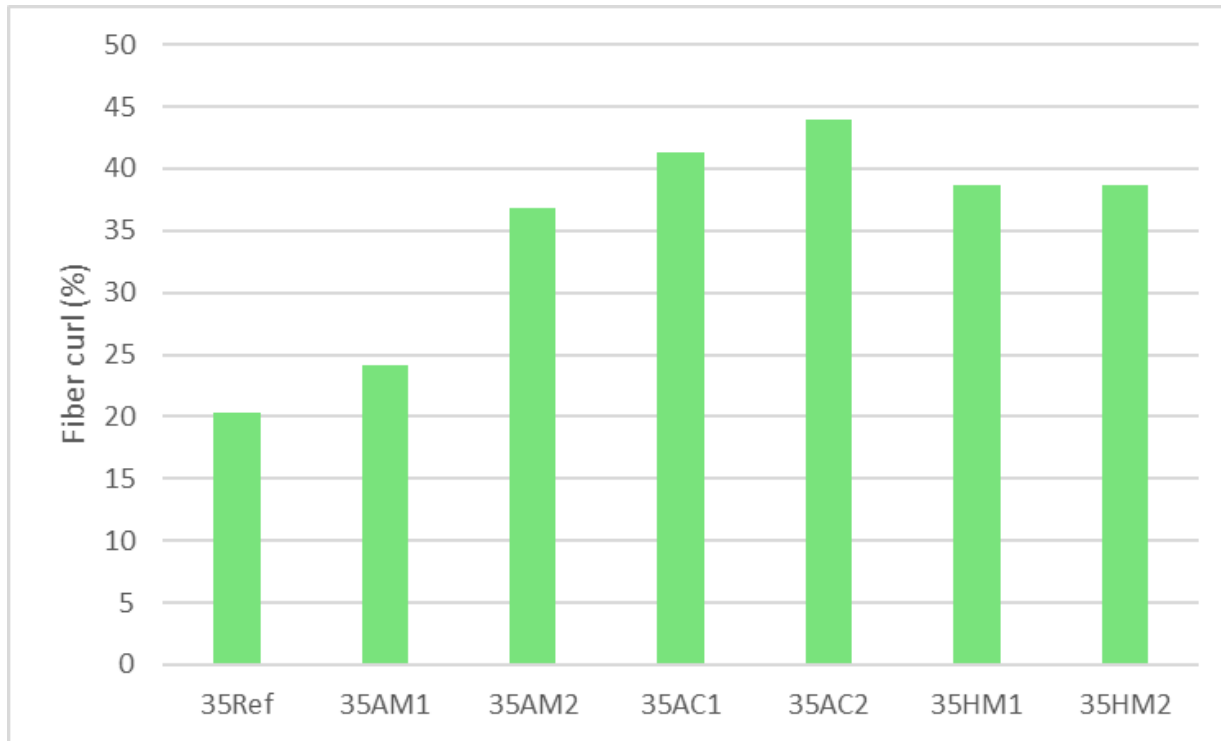


# Degree of polymerization





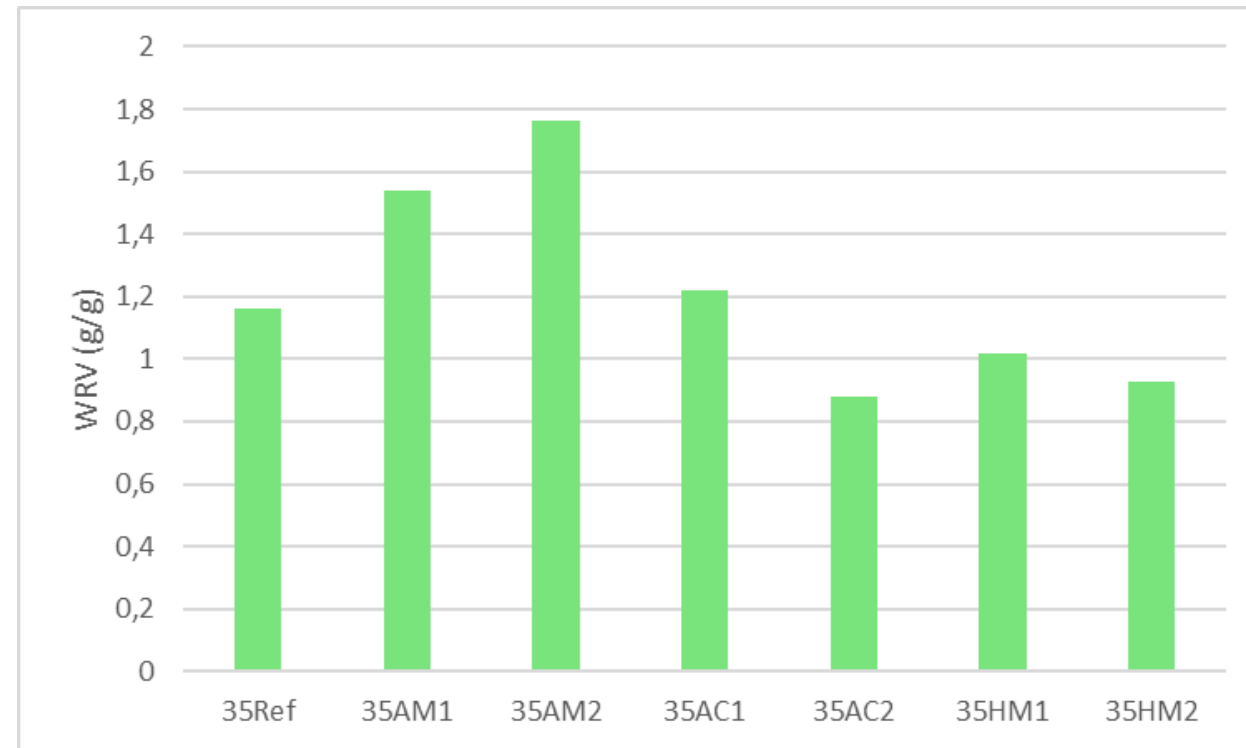
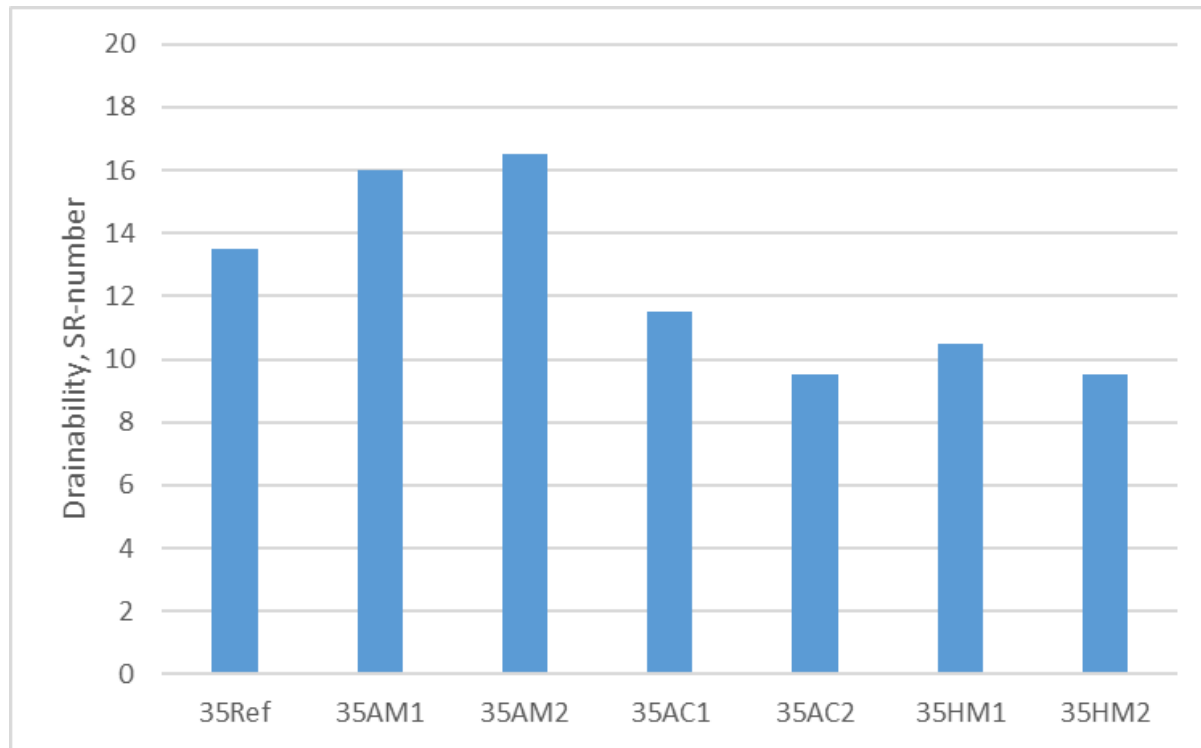
# Curl and Fibrillation



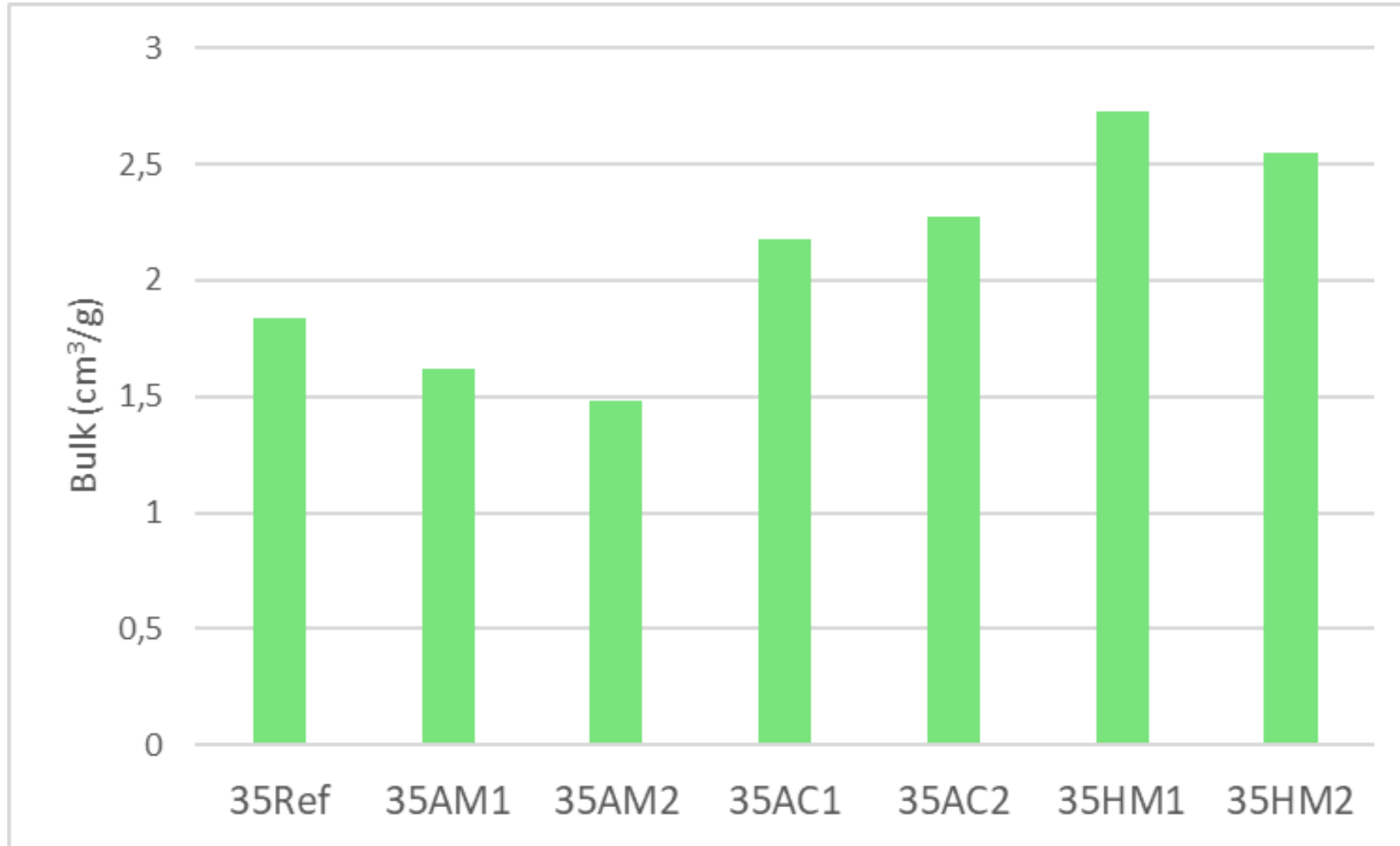
# Pulp and Sheet properties



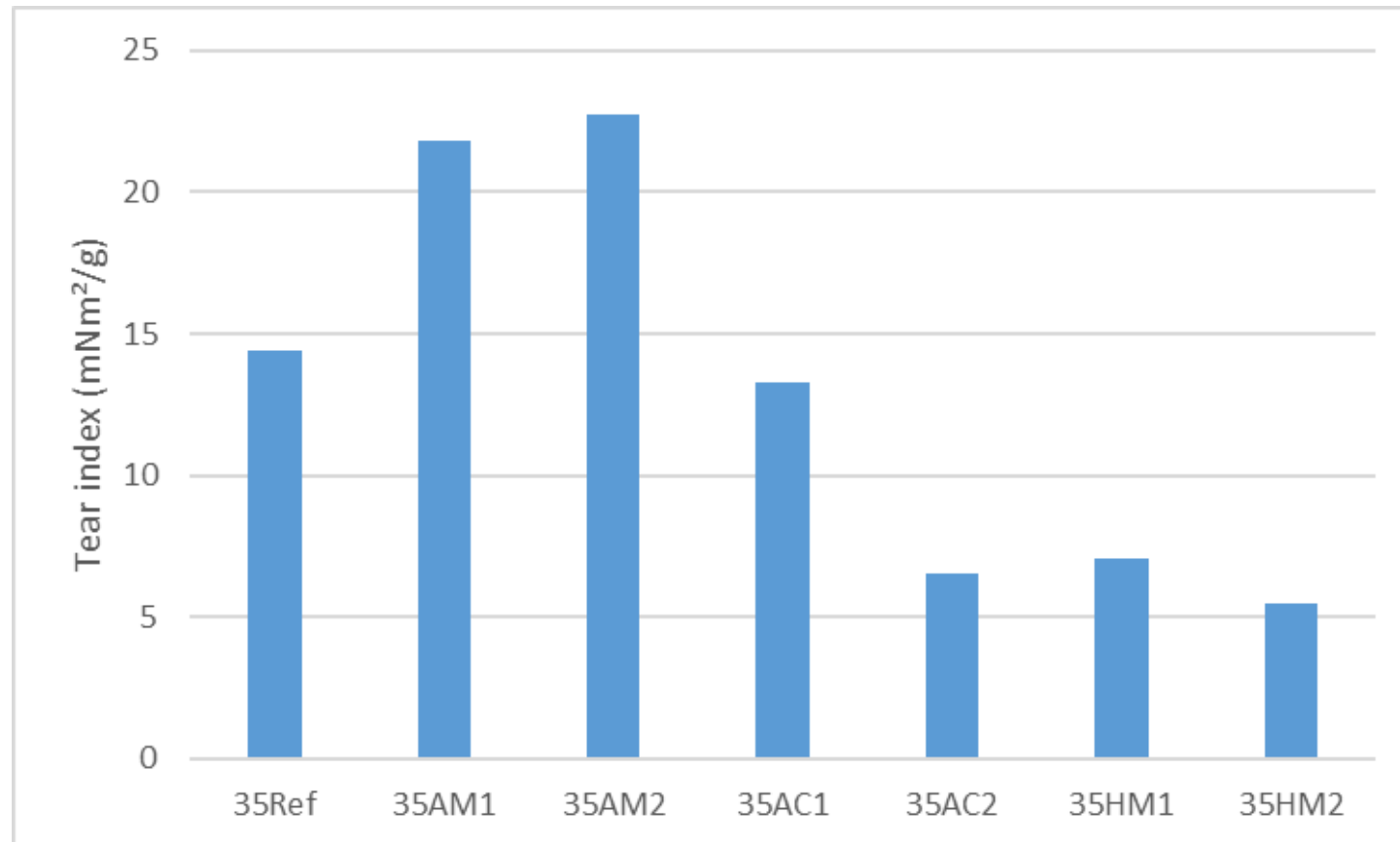
# Drainability and WRV



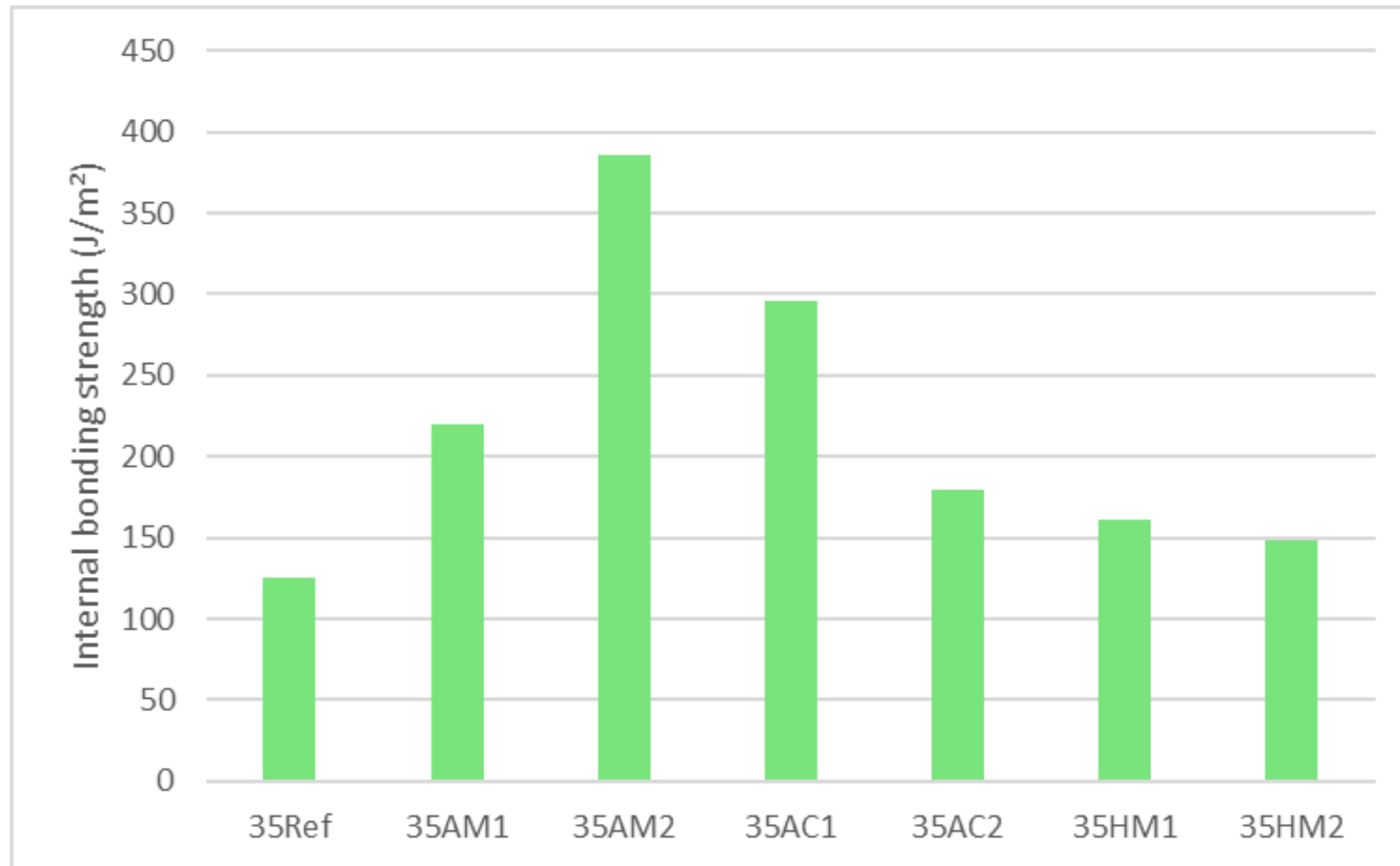
# Apparent specific bulk volume (Bulk)



# Tensile index



# Internal bonding strength





# Conclusions

- Refining with Atrex crushing geometry or hammer mill decreased fiber length and enhanced fibrillation
- Fiber curl and kink index were increased by all HC refining options, the most with Atrex crushing geometry and hammer mill.
- Atrex crushing geometry and hammer mill refining of fibers resulted in sheets with lowest density and highest bulk.

# Contact

Please contact me or Risto Hertzberg regarding the HC refining in KCL



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