



Mercer Pulp Products

Exceptional People Creating Bioproducts for a More Sustainable World

Refining – often missed opportunities to unlock the full fiber potential

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Agenda

Presentation

- NBSK just a commodity?
- Challenges in everyday refining

Appendix

- Mercer Pulp Mills
- Mercer Fiber Center

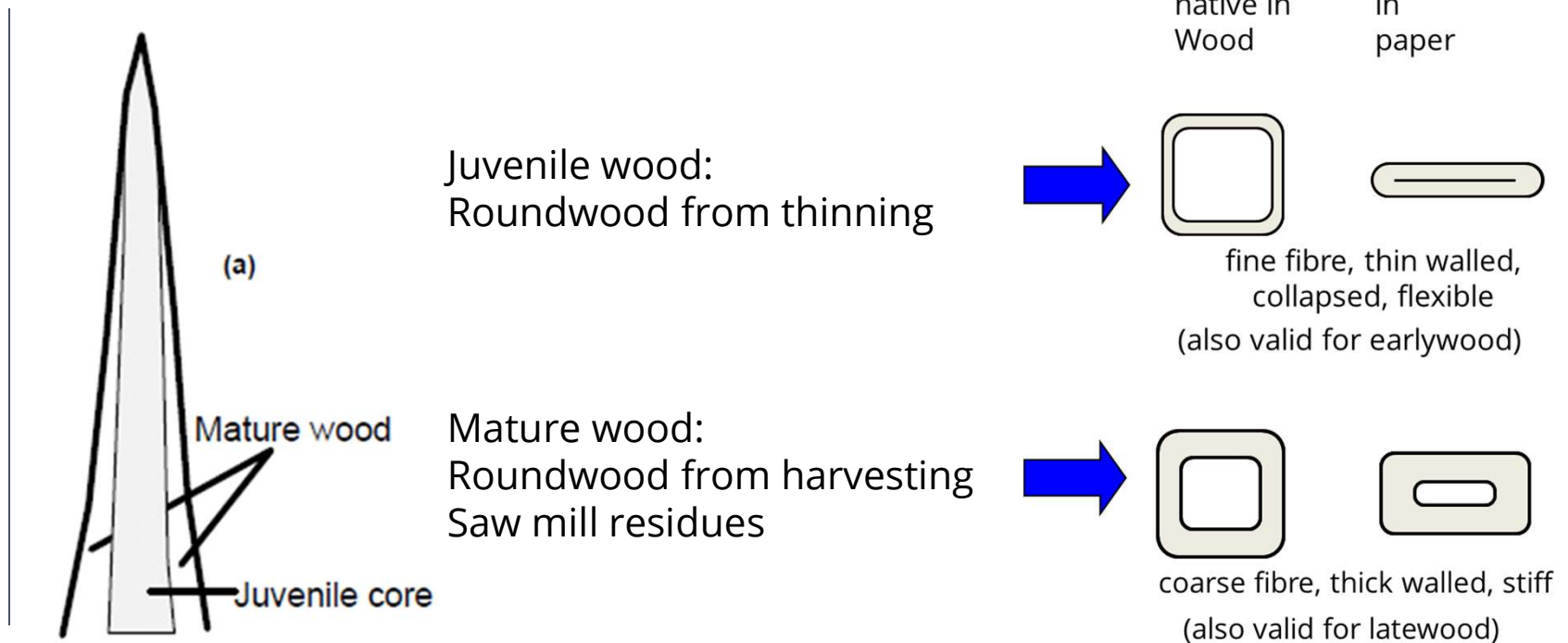
MERCER PULP MILLS





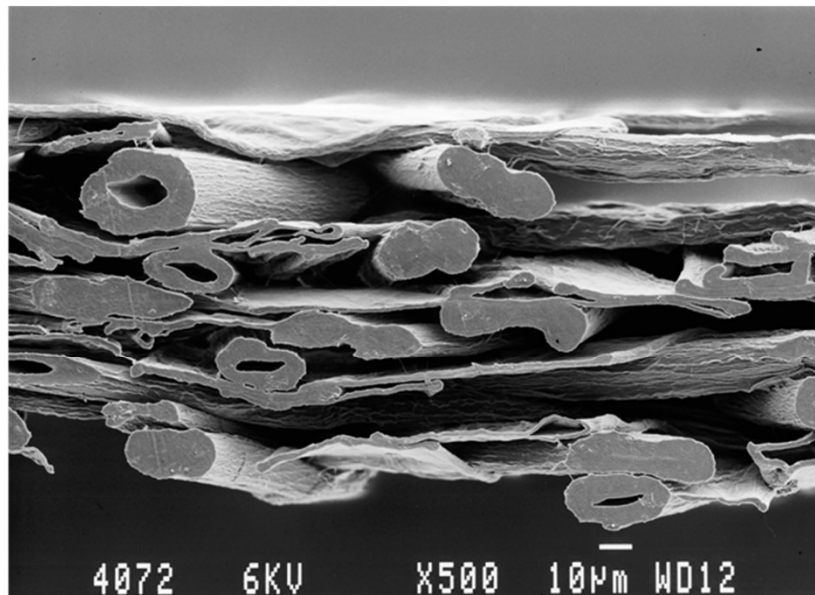
NBSK - purely a commodity?

One Tree - Two Pulps

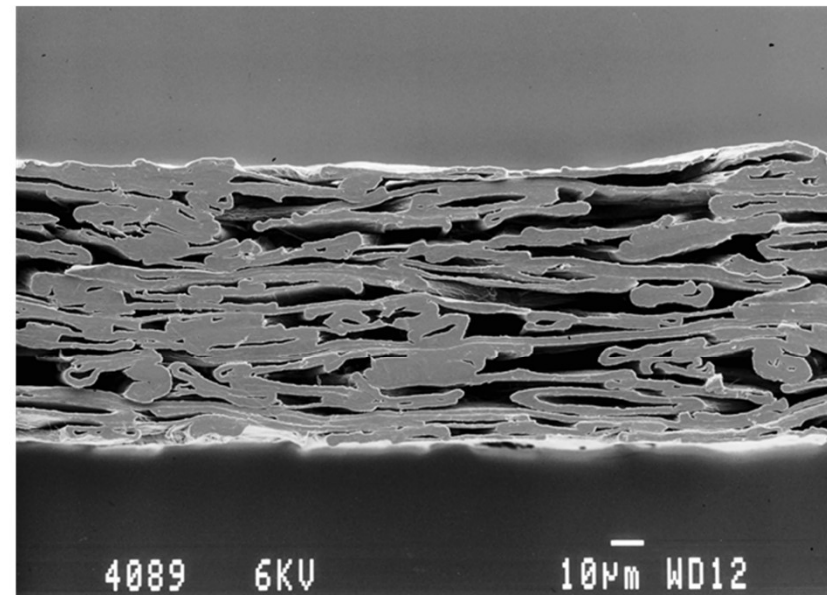


The Importance of Fibre Coarseness

Low Coarseness Fibres Have the Ability to Collapse Easily



High Coarseness Fibre \approx 189 mg/m



Low Coarseness Fibre \approx 100 mg/m

NBSK Pulp Quality I

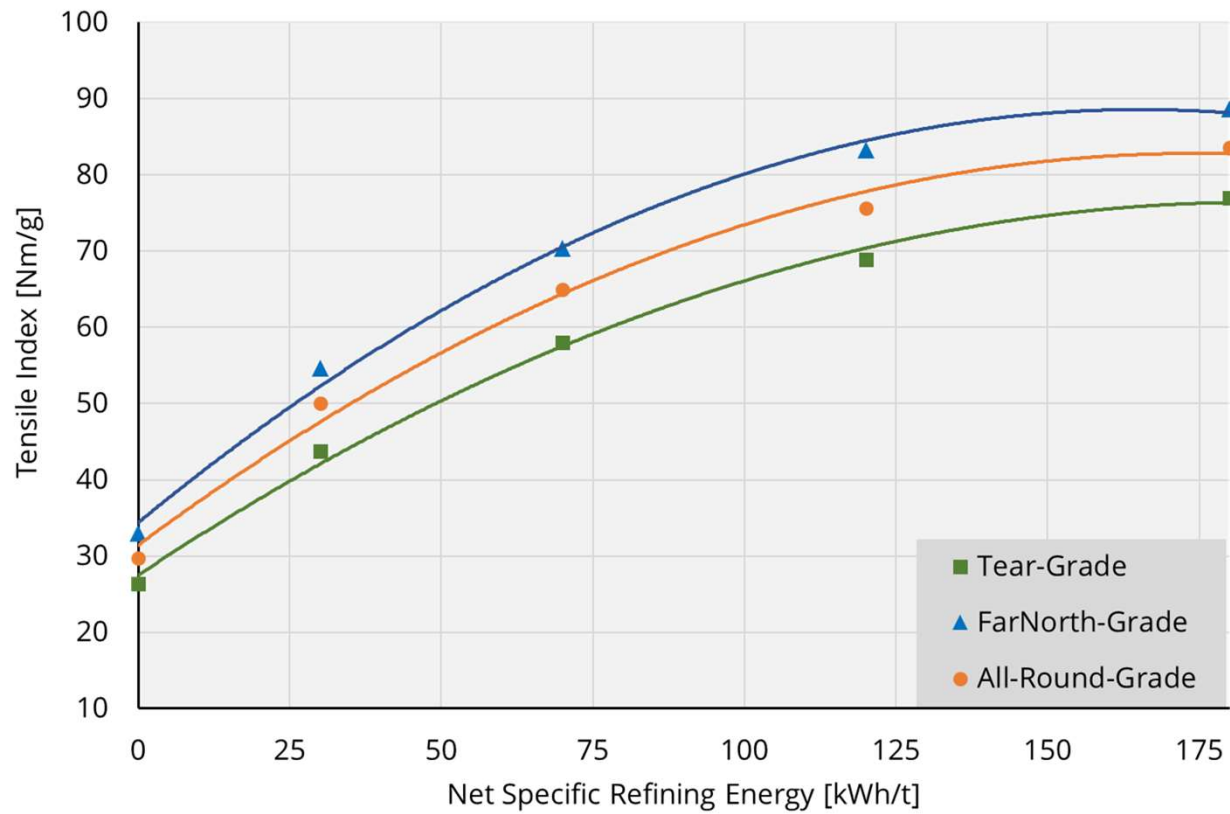
The quality baseline of pulp is determined by the tree species used and the ratio between juvenile and mature wood chips.

An appropriate way to differentiate between types of NBSK is as follows:

- Far North/Canadian grades - low coarseness fibers from slow growing northern tree species
- Tear grades - high coarseness, high fiber length, mostly mature wood chips
- All-round grades - balanced blend of juvenile and mature wood chips

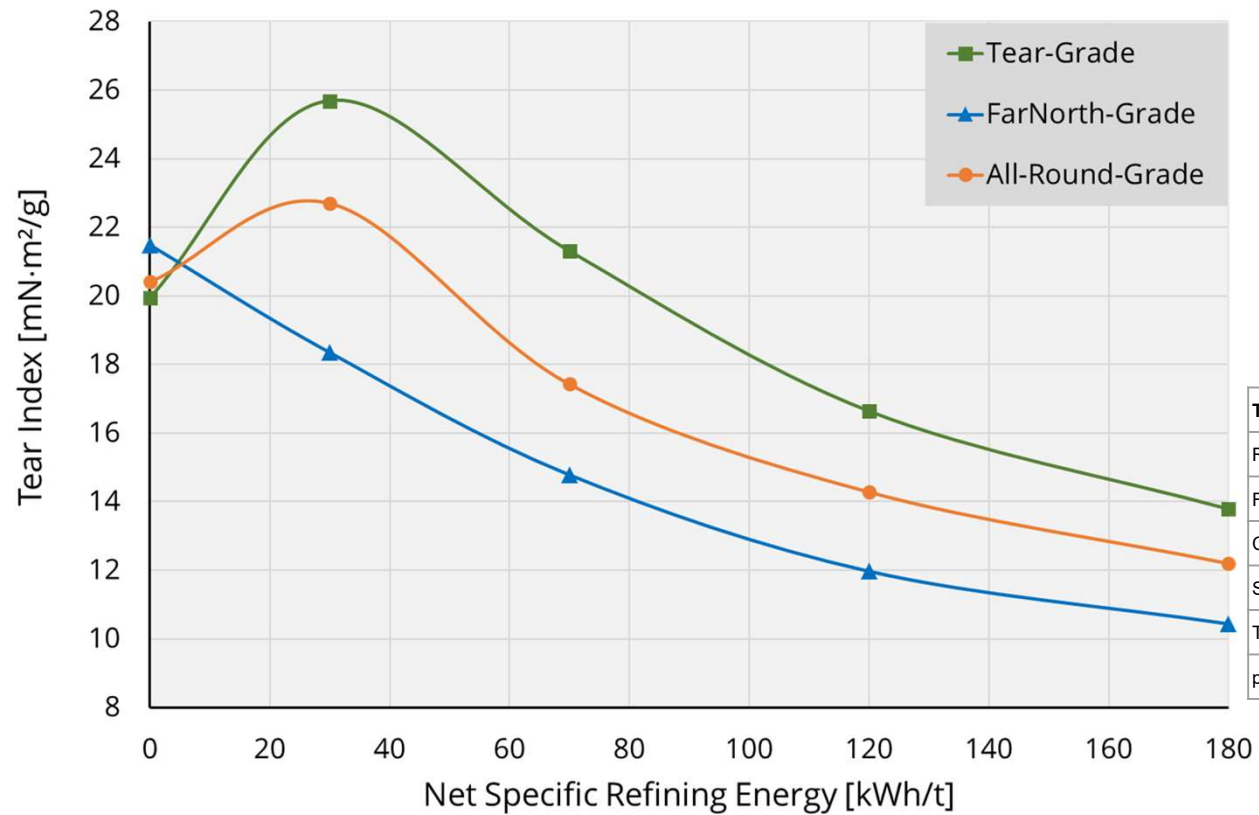
For the sake of completeness, high and low Kappa unbleached should also be mentioned here.

NBSK Pulp Quality II



Trial Data	
Refiner	LR40
Filling	Disc Pluralis 3.8/5-1.1-56
Consistency	4%
SEL	1,5 J/m
Temp. Start	40°C
pH/Conductivity	7,5 / 150 mS

NBSK Pulp Quality III



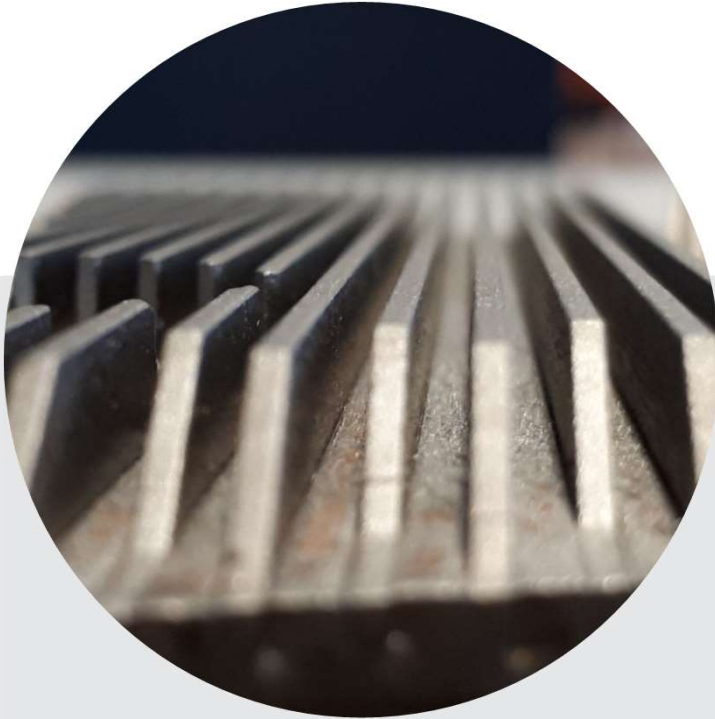
Trail Data	
Refiner	LR40
Filling	Disc Pluralis 3.8/5-1.1-56
Consistency	4%
SEL	1,5 J/m
Temp. Start	40°C
pH/Conductivity	7,5 / 150 mS

Intermediate Conclusion

NBSK - purely a commodity?

Not as much, as you might thought 5 minutes ago!

To constantly meet the quality of your paper, it is always a good choice to start with the best matching raw materials.



Refining

Challenges in Everyday Refining

Once a paper mill is built, the equipment often stays the same, but the production situation changes.

With respect to refining only a limited number of parameters can be influenced by papermakers.

Somewhat adjustable

Consistency
Throughput
Rotational Speed
Load

Easy to adjust

Material
Cutting angle
Bar and Grove design

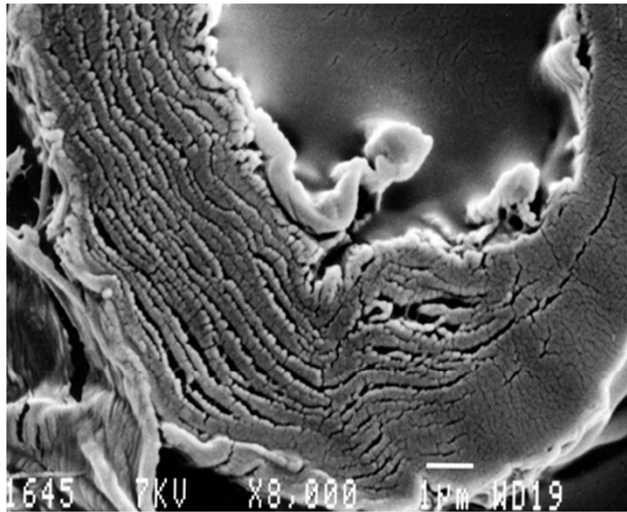
Energy and Intensity

$$\text{Specific Refining Energy [kWh/t]} = \frac{\text{Refining power [kW]}}{\text{Mass flow [t/h]}}$$

$$\text{Specific edge load [J/m]} = \frac{\text{Net refining power [kW]}}{\text{Cutting edge length [km/s]}}$$

Low Refining Intensity - appr. SEL = 1.0 J/m (NBSK)

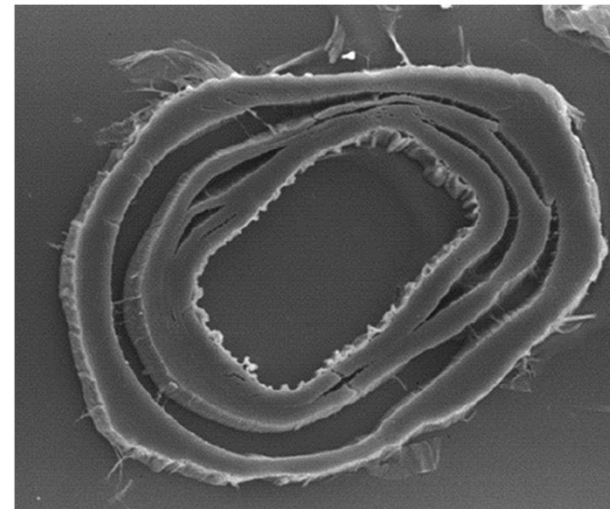
internal fibrillation, delamination



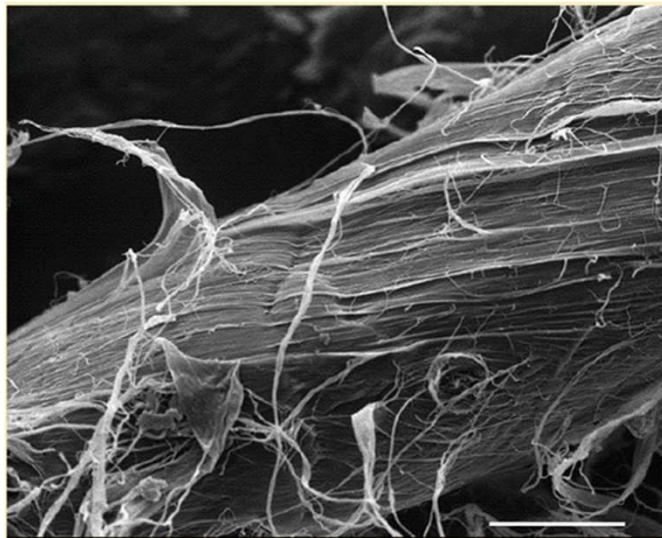
Swelling measured by Water Retention Value (WRV)

WRV often used as measure of refining

Fibre weakened by ruptures in wall
Water drawn in promotes swelling



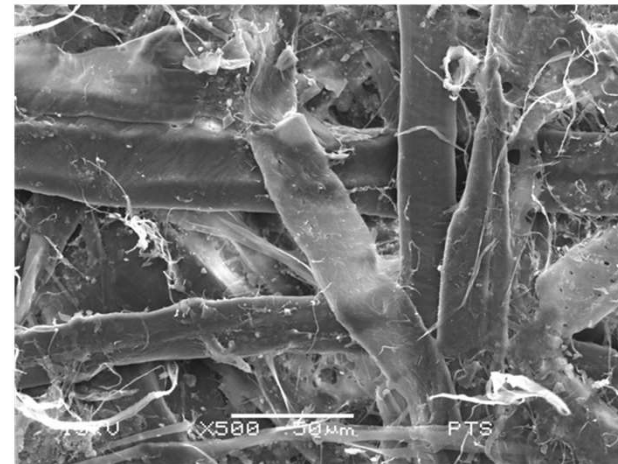
High Refining Intensity - appr. SEL = 3.0 J/m (NBSK) external fibrillation, fines production and fiber shortening



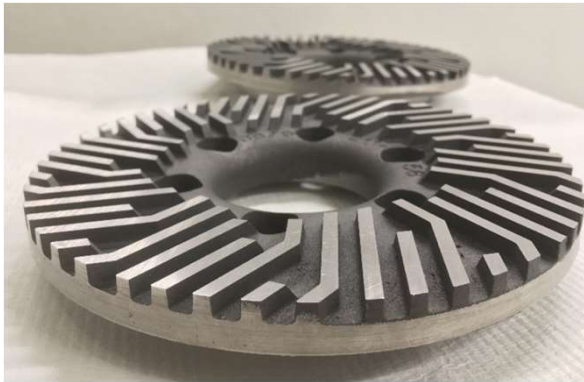
Fiber cutting

Exposed surface fibrils

Some are peeled off to become fines or colloidal material



How to Change Cutting Edge Length?



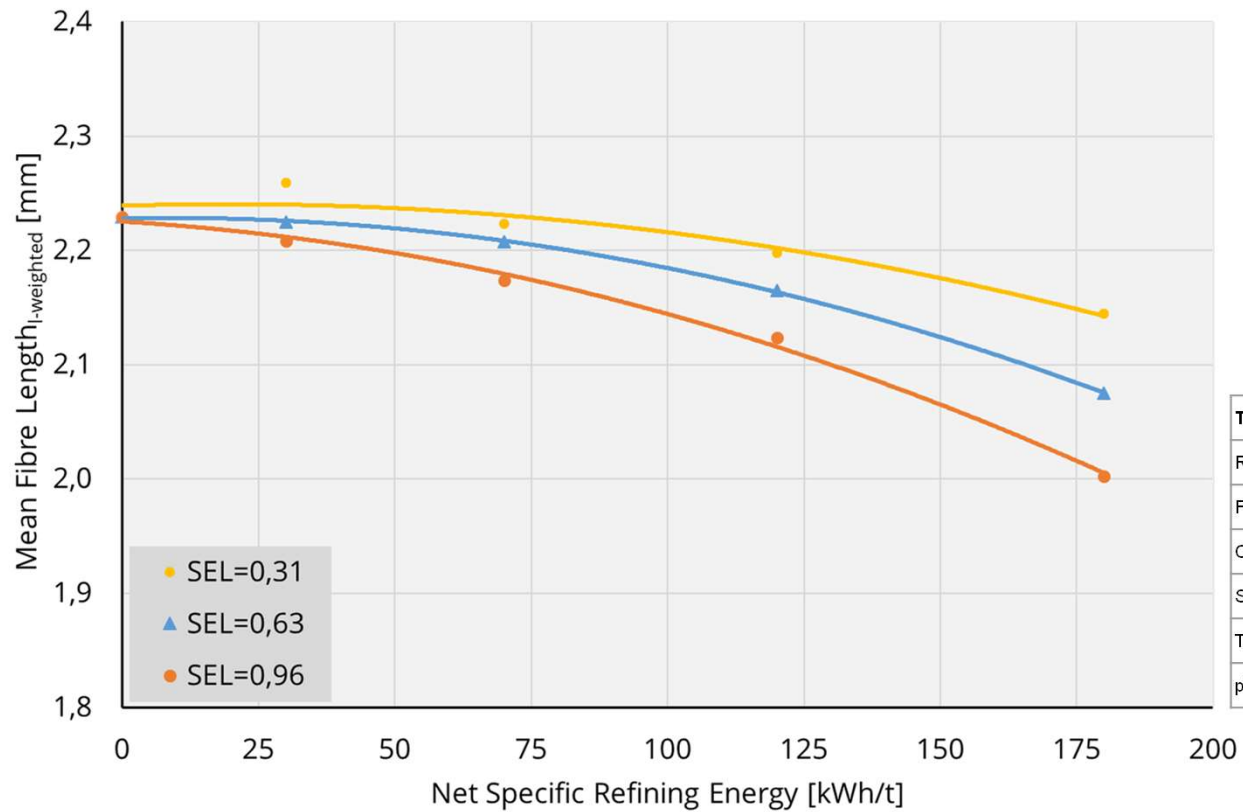
CEL = 2,0 km/s



CEL = 2,9 km/s

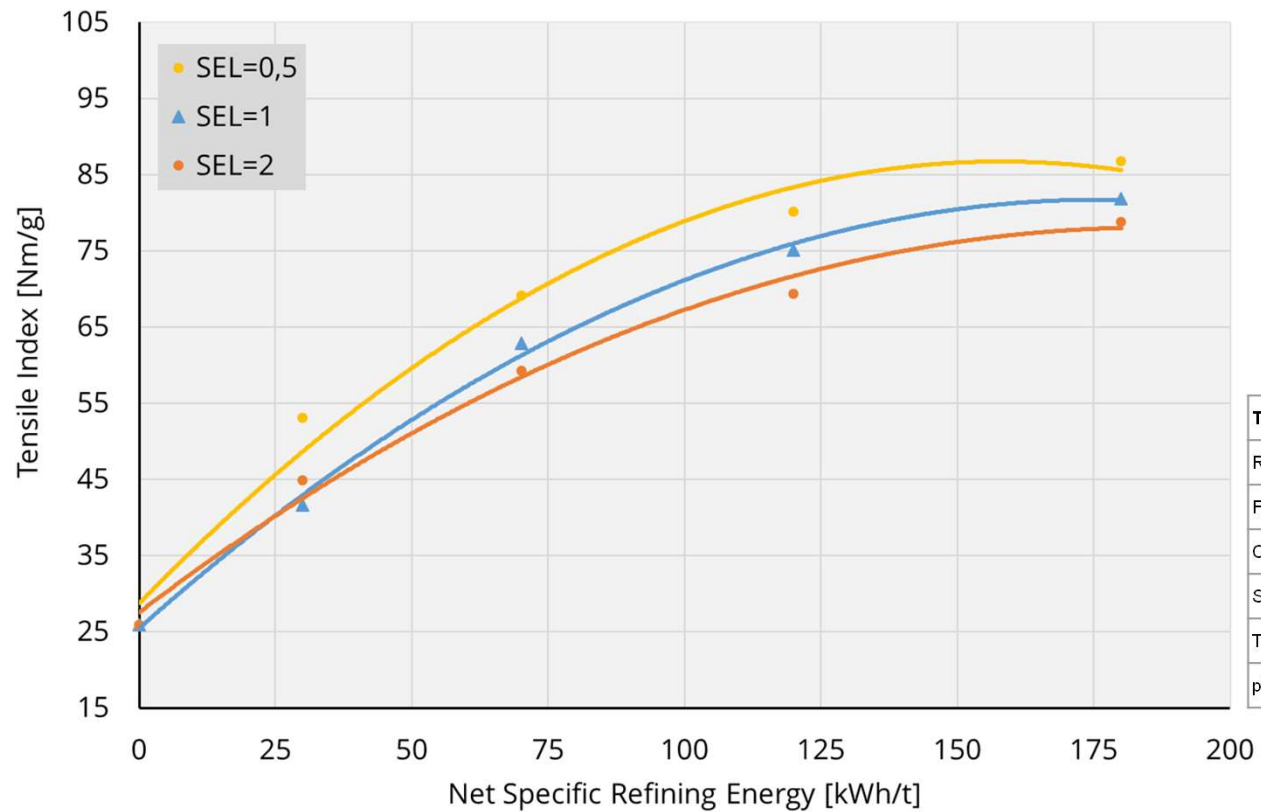
$$\text{Specific edge load [J/m]} = \frac{\text{Net refining power [kW]}}{\text{Cutting edge length [km/s]}}$$

Influence SEL I



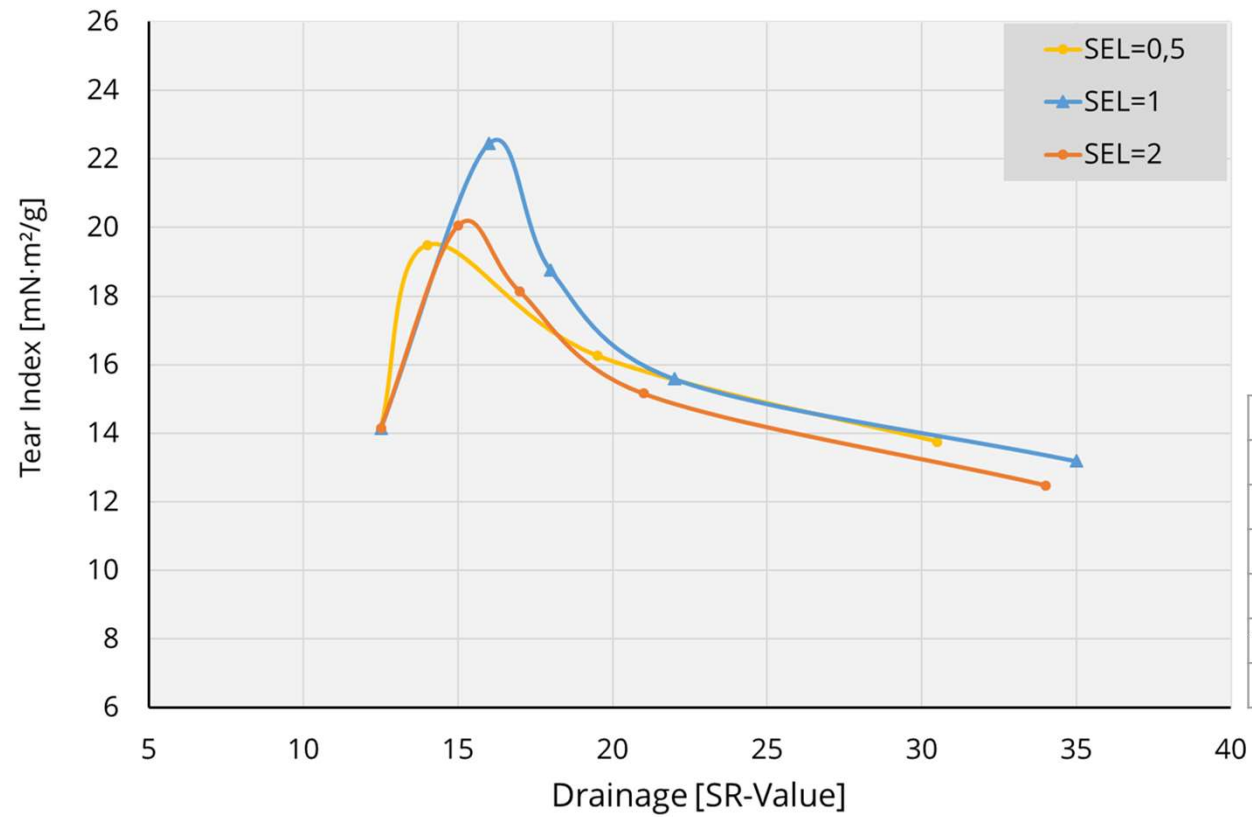
Trail Data	
Refiner	LR40
Filling	Disc Pluralis 1.7/4-2.3-60
Consistency	4%
SEL	0,31/0,63/0,96 J/m
Temp. Start	40°C
pH/Conductivity	7,5 / 150 mS

Influence SEL II



Trail Data	
Refiner	LR40
Filling	Disc Pluralis 3.8/5-1.1-56
Consistency	4%
SEL	0,5/1/2 J/m
Temp. Start	40°C
pH/Conductivity	7,5 / 150 mS

Influence SEL III



Trail Data	
Refiner	LR40
Filling	Disc Pluralis 3.8/5-1.1-56
Consistency	4%
SEL	0,5/1/2 J/m
Temp. Start	40°C
pH/Cond.	7,5 / 150 mS

The Mercer Fiber Center



- Robust industrial like refining
- Static and dynamic lab sheet forming
- Freenes, Water Retention, Fiber Morphology testing
- Paper chemistry testing

Summary

- The choice of pulp sets the baseline for quality
- The most promising way to adjust the refining effectiveness is by optimizing the Specific Edge Load
- Collaboration between production, purchasing and suppliers is the superior way to improve savings and quality



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