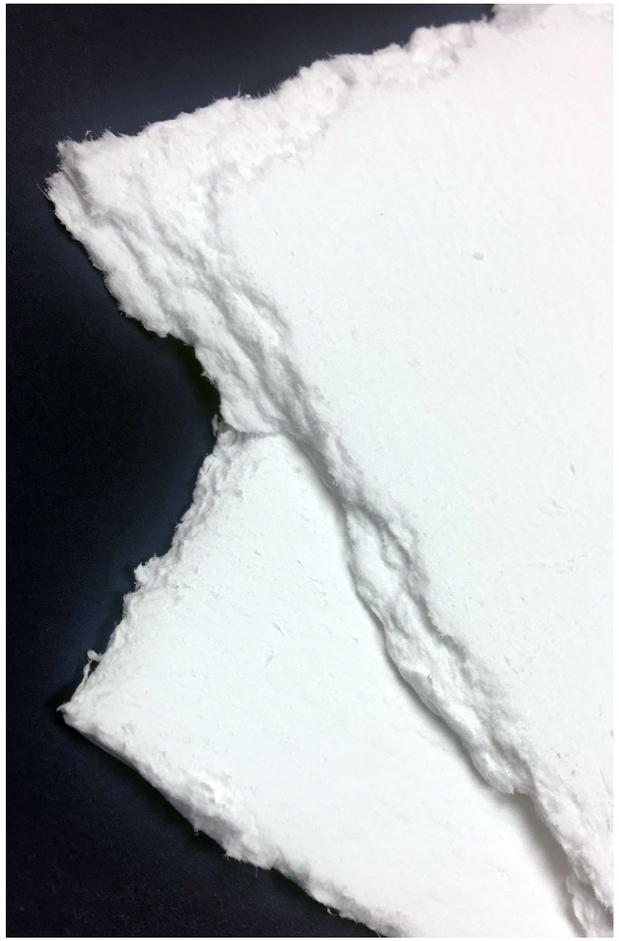
MINIFIBERS, INC.

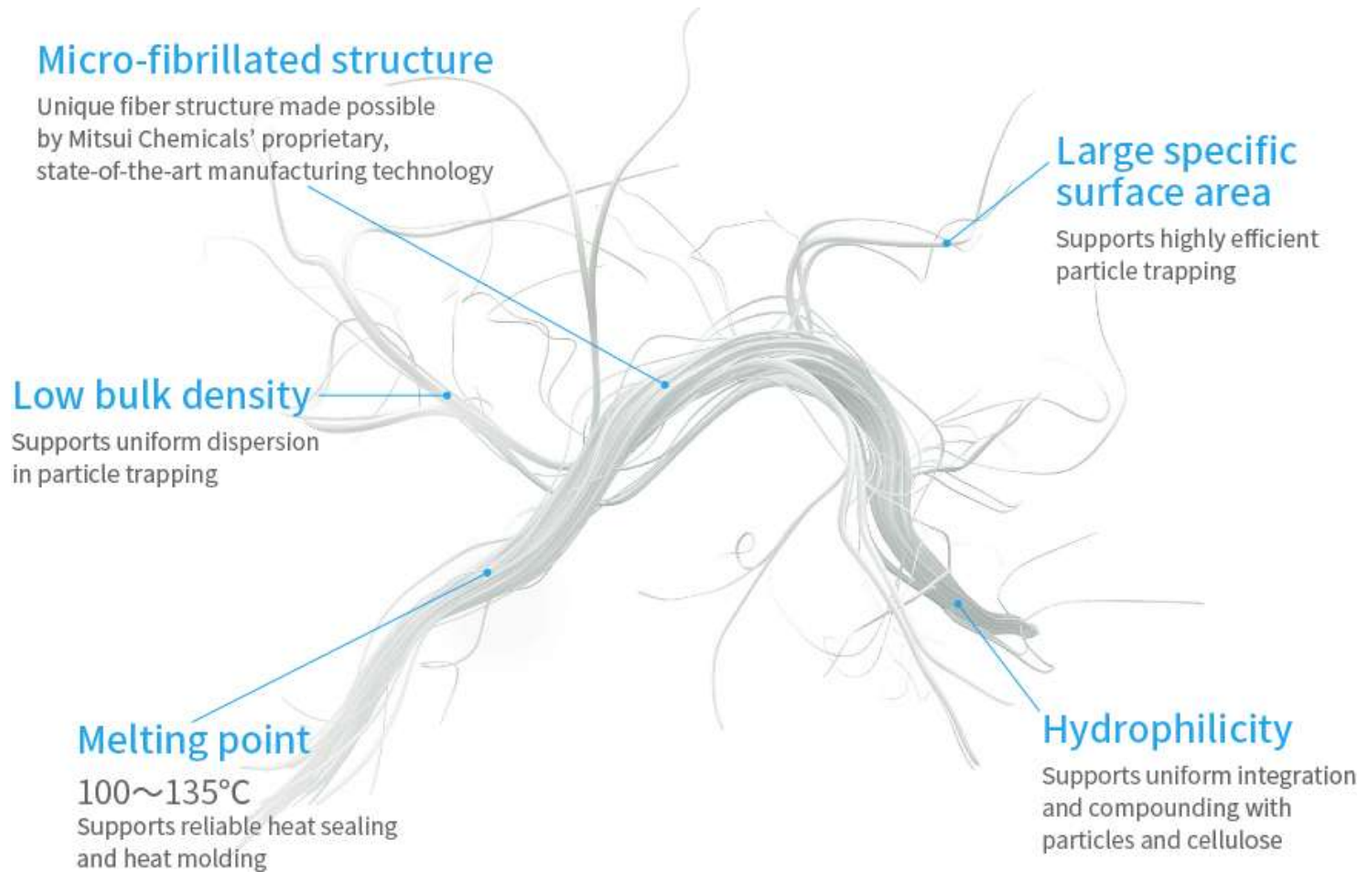
Fybrel®

for Fiber Cement Applications

What is Fybrel®?

Fybrel® is a hydrophilic, highly fibrillated polyolefin pulp.

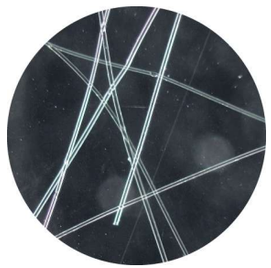




Fybrel® Characteristics

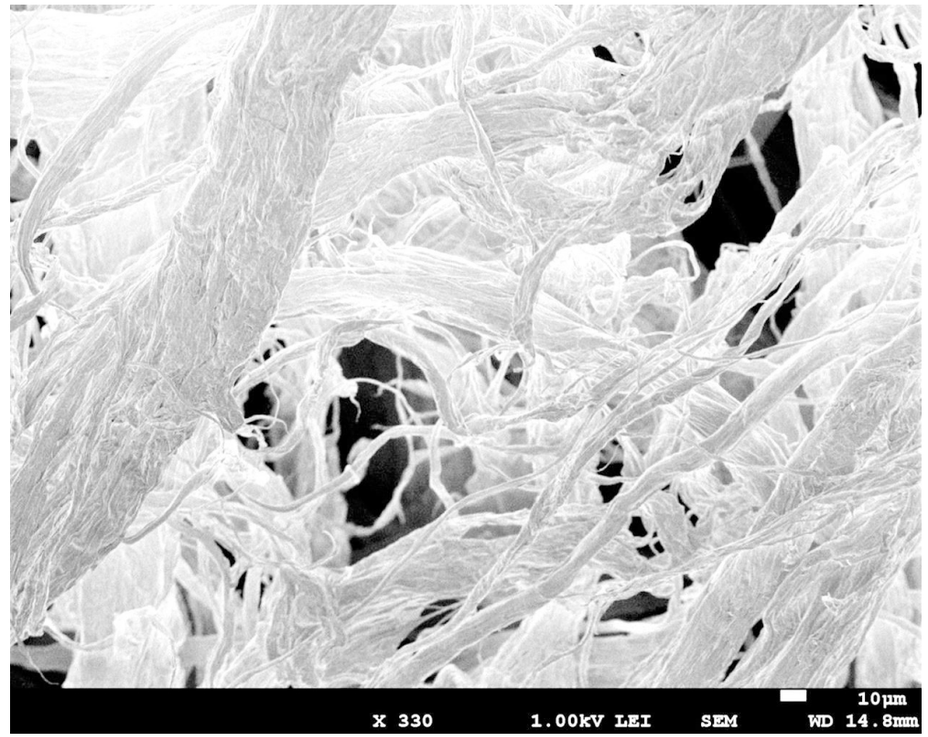
Wooden Pulp
(before beating)

Fybrel®



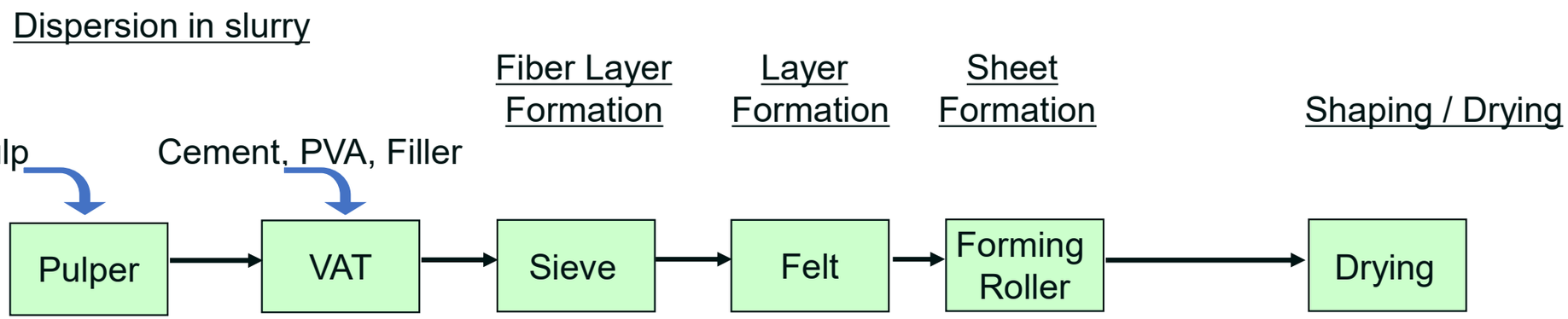
Polyolefin Straight
Cut Fiber

The main branch is up to 20 microns in diameter, but the three dimensional structure is complex.



Advantages of Fybrel® in Fiber Cement Process

《 Preparation 》 《 Sheet Manufacturing 》 《 Drying 》



Advantages of Fybrel®

Hydrophilic
- Good dispersion in water
- Shortens the refining process

Fibrillated
- High surface area
- Improves cement trapping

Made of polyolefin
- Chemically stable
- Dimensionally stable

Cement Trapping / Water Drainage

Improve Cement Trapping
- Speed up

Uniform Sheeting
- Improving quality (less cracking)

Alkali resistance

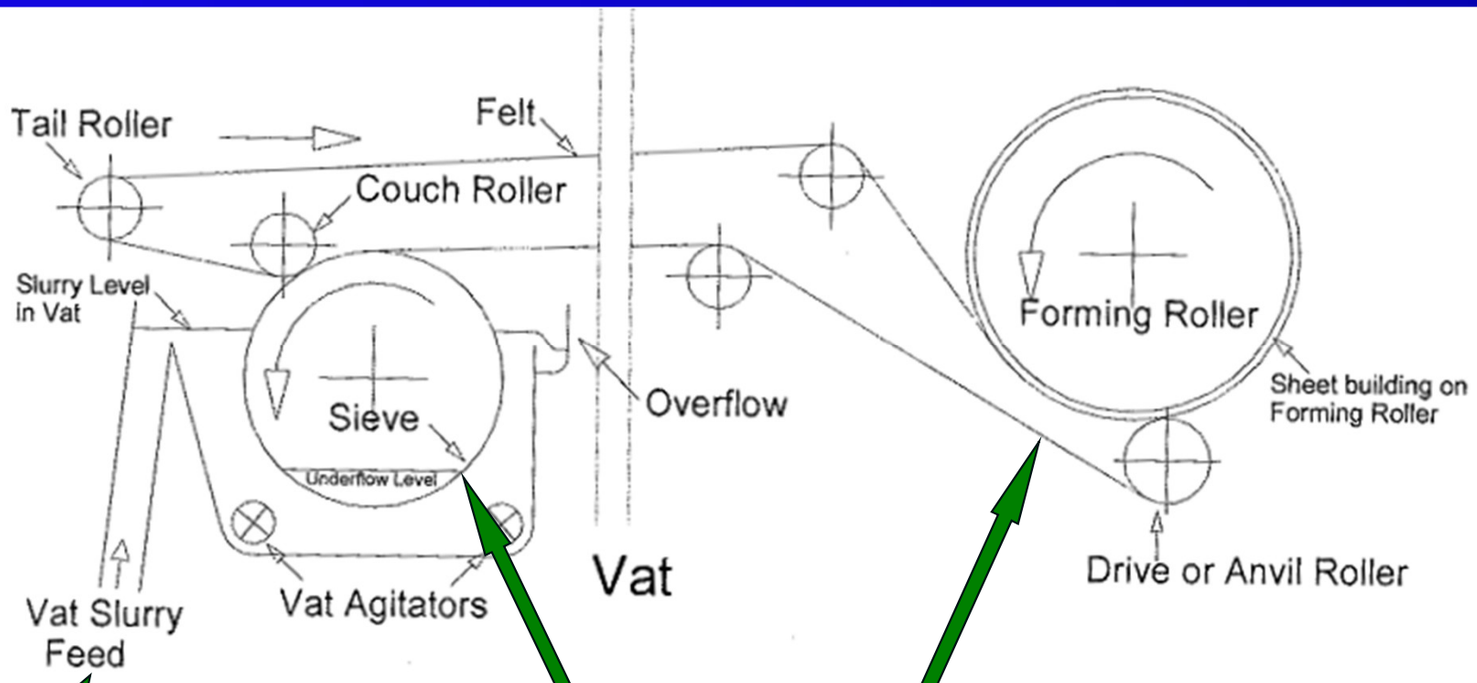
Grade: E620

Dimensional Stability

Flexible in Shaping

Chemical resistance

Fiber Cement Manufacturing Process



Addition of Fybrel® helps in shortening the pulp refining process

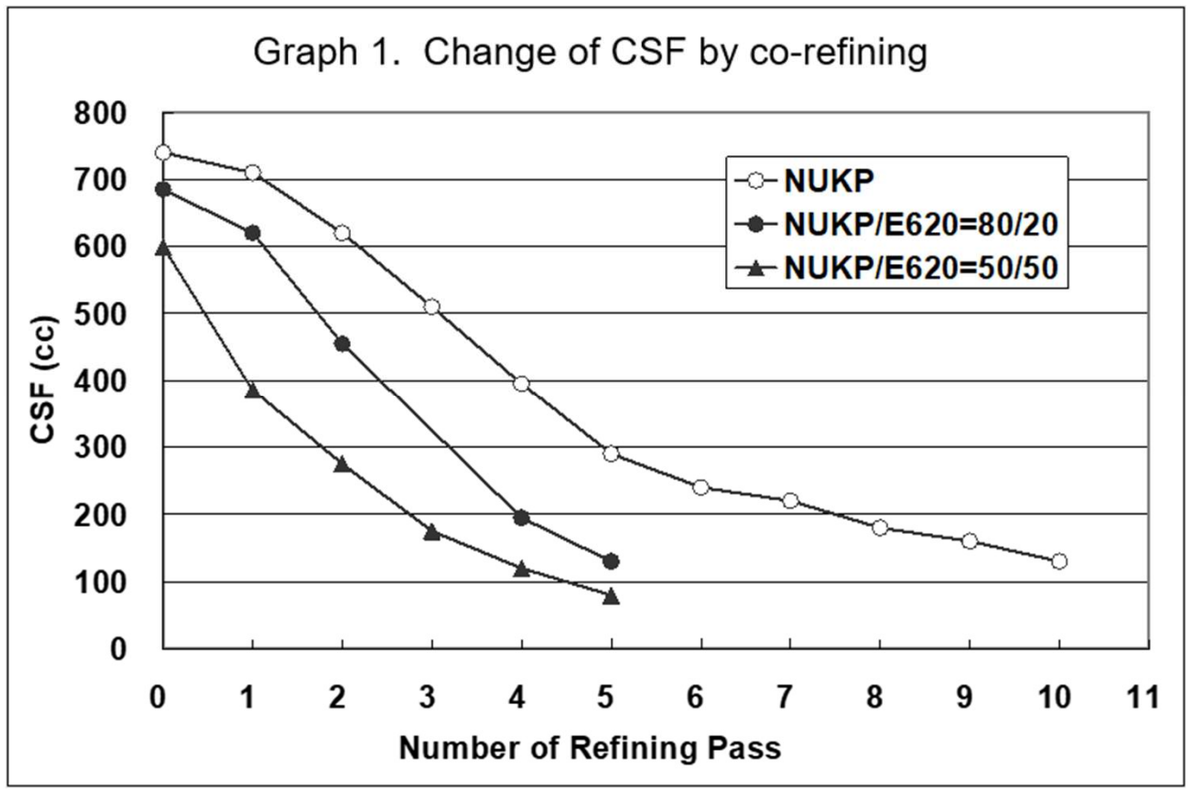
Addition of Fybrel® helps in better cement trapping and in forming uniform fiber film layer

→ **Improvement in Processability (Speed)**

Uniformity of the cement layers prevents cracking during drying process

→ **Improvement in Quality and Yield**

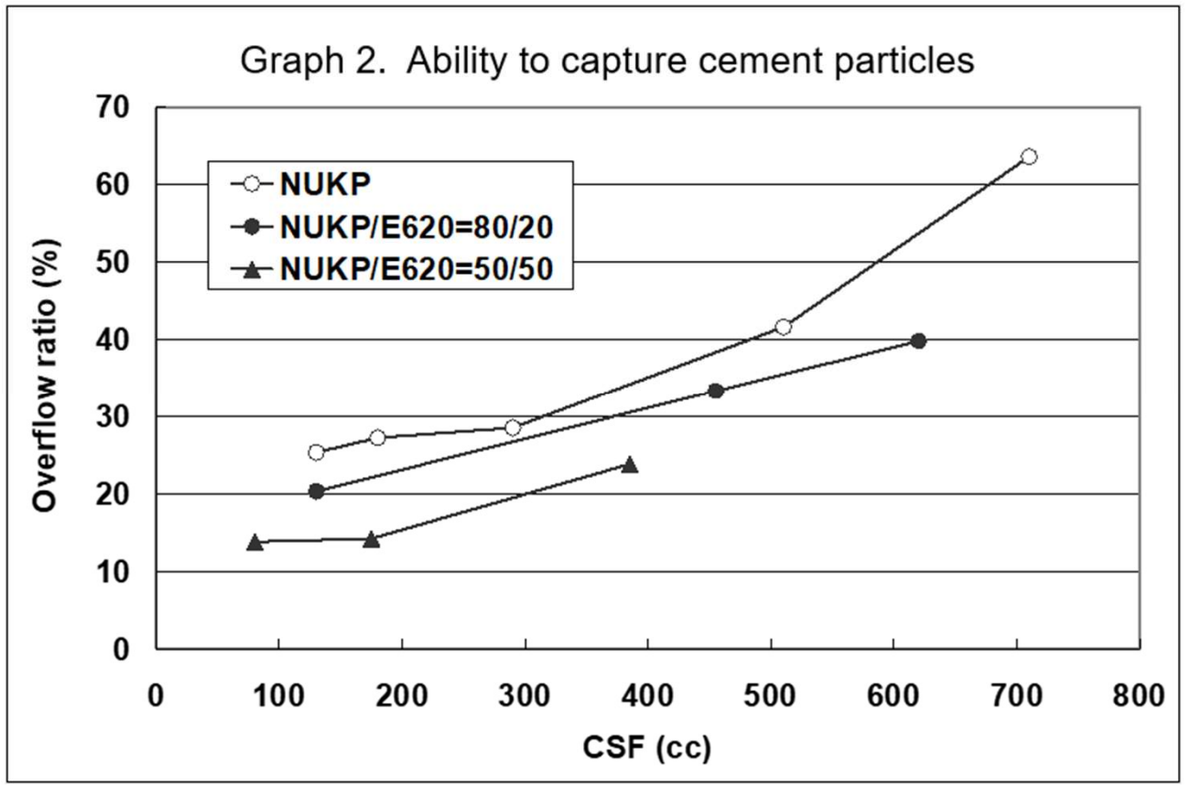
Improving the Refining Process



Effect of Co-refining Fybrel®

Graph 1 shows the change of CSF by co-refining with NUKP (before refining) and E620. The decrease in CSF is accomplished more quickly when co-refining than when refining NUKP alone. Therefore, the refining time to reach the intended CSF can be decreased, resulting in reduced energy cost.

Cement Trapping Test



Effect of Fybrel® on capture of cement particles

Graph 2 shows the ability to capture cement particles. Since Fybrel ® is highly fibrillated, it has higher capturing ability than wood pulp. Co-refining is more effective in capturing cement particles. This can improve the yield of wet-process cement boards.

Mechanical Performance

Effect of Fybrel® E620 on mechanical performance of cement boards (Lab Data)

Table 1 shows the addition of E620 can improve the toughness of the formulation with 17% Silica Filler and 3% NUKP. The addition of Fybrel® E620 to your existing recipe can help improve mechanical performance.

Table 1. Mechanical Performance (NUKP 3%)

Sample	Portland Cement (%)	PVA (%) 4mm	Acrylic Fiber (%) 6mm	E620 (%)	Silica Filler (%)	NUKP (%)	Toughness (J/m^2)	Bending Modulus (MPa)
Control	78.2	1.8	0	0	17.0	3.0	1210	29.1
No. 1	77.0	2.0	0	1.0	17.0	3.0	2467	31.1
No. 2	77.0	0	2.0	1.0	17.0	3.0	2053	28.8
Control vs. No.1	Addition of E620 improves the toughness without affecting the modulus							
No.1 vs. No.2	PVA fiber is superior to Acrylic Fiber Existence of E620 maintain the toughness							

PVA: polyvinyl alcohol fiber

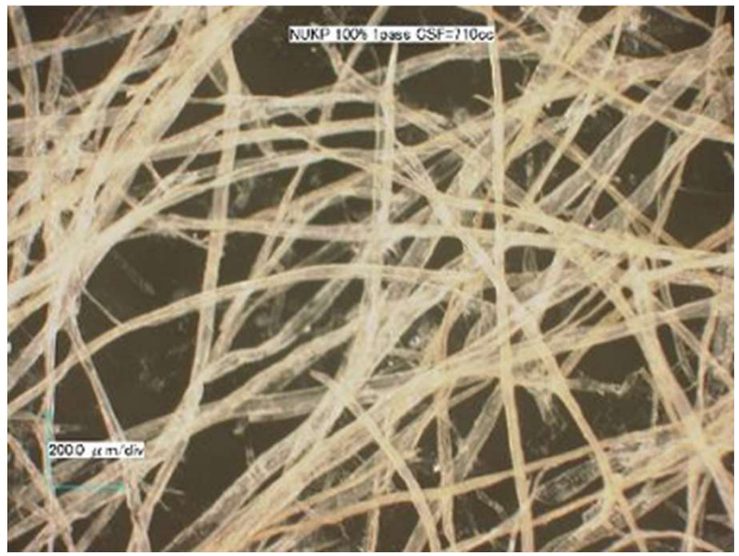
Discussion

Below are some recommended formulations to evaluate Fybrel® E620.

Composition						Cement boards						Remarks
Cement	Filler	PVA	Pulp	E620	TOTAL	Density	Water absorbency	Bending strength	Toughness (IPL20)	Dimension stability	Impact strength	
%	%	%	%	%	%	g/cm3	%	MPa	J/m2	%	J/m2	
78.2	17.0	1.8	3.0	0.0	100.0	1.63	20.4	29.1	1210	0.172	–	Table 1 Control
77.0	17.0	2.0	3.0	1.0	100.0	1.60	18.4	31.1	2467	0.187	–	Table 1 No.1
78.0	17.0	2.0	3.0	0.0	100.0							
77.5	17.0	2.0	3.0	0.5	100.0							
77.0	17.0	2.0	3.0	1.0	100.0							
76.0	17.0	2.0	5.0	0.0	100.0							
75.5	17.0	2.0	5.0	0.5	100.0							
75.0	17.0	2.0	5.0	1.0	100.0							
76.0	17.0	2.0	4.5	0.5	100.0							
76.0	17.0	2.0	4.0	1.0	100.0							

APPENDIX

Improving the Refining Process



NUKP 100% 1 Pass

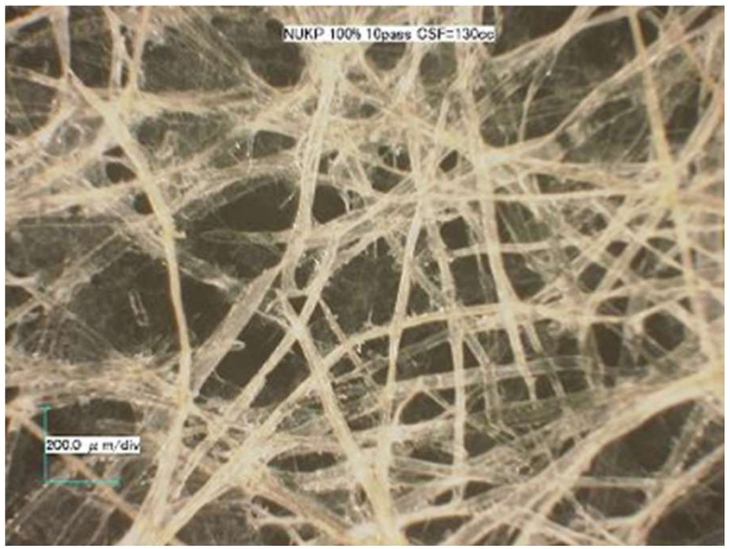
CSF 710ml

NUKP/ E620 = 80/20 1 Pass

CSF 620ml

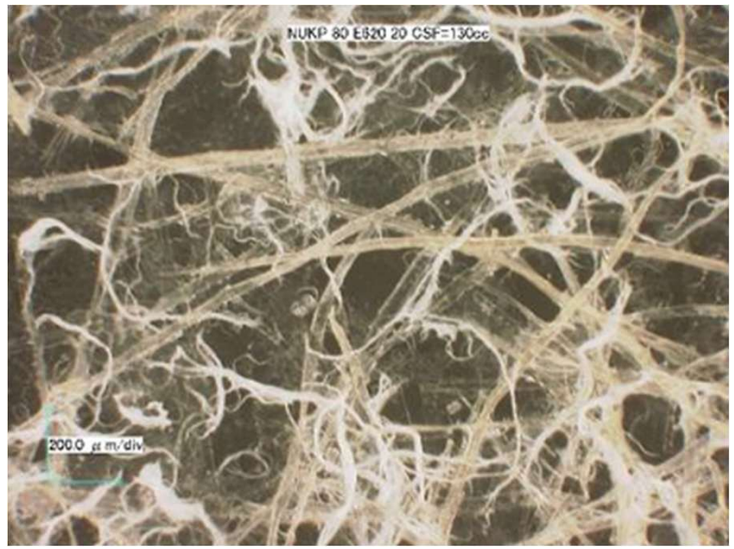
Machine: Single Disk Refiner Clearance: 10 μm

Improving the Refining Process



NUKP 100% **10** Pass

CSF 130ml



NUKP/ E620 = 80/20 **5** Pass

CSF 130ml

Machine: Single Disk Refiner Clearance: 10 μm

THANK YOU!

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