

How is MFC Revolutionizing Paper, Packaging, Building Materials, and More?

Presented by David Skuse, VP Technology, FiberLean Technologies Limited



International Conference on Nanotechnology for Renewable Materials

Vancouver 1980s & 2023 personal reflections (i): Still interested in high value cellulose products

Research

Hydroxypropyl cellulose/poly(ethylene glycol)-co-poly(propylene glycol) aqueous two-phase systems: System characterization and partition of cells and proteins

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Enzyme Microb. Technol., 1992, 14, 785 - 790

Development

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New Technology Showcase: Take aways

- FiberLean is one of the world's largest producers of MFC
- Proven technology at full-scale in paper and packaging applications
- Three new product lines – two MFC without minerals
- High solids merchant product form to complement on-site satellite manufacturing
- Improved ability to tailor products to get the best from all chemical pulp types
- Wide regulatory clearance
- Surface application technology (FLoT) is proven at full-scale



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Vancouver 1980s & 2023 personal reflections (ii):

The Environmental Imperative is now in full swing and the pulp and paper industry companies are driving. We have helped within our sphere of activities

HOW DOES ENVIRONMENTAL
CAPABILITY DEVELOP IN A FIRM?

Ruth Thomas, PhD thesis, International Centre for the Environment,
University of Bath, UK, 2001

MATERIAL RECOVERY AND RE-USE TECHNOLOGIES FOR THE
PAPER INDUSTRY

J.S.Phipps, D.R.Skuse, D.C.Payton, J.A.Purdey, J.C.Husband and O.Toivonen

ECC International,
John Keay House, St.Austell, Cornwall, PL25 4DJ, UNITED KINGDOM



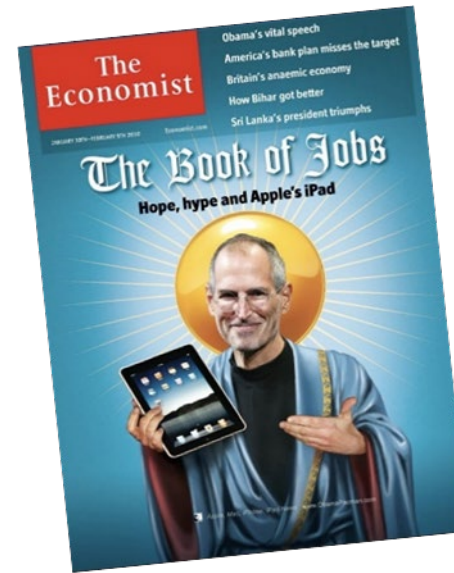
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The birth of FiberLean (i):



Dramatic decrease in demand for printing and writing papers.



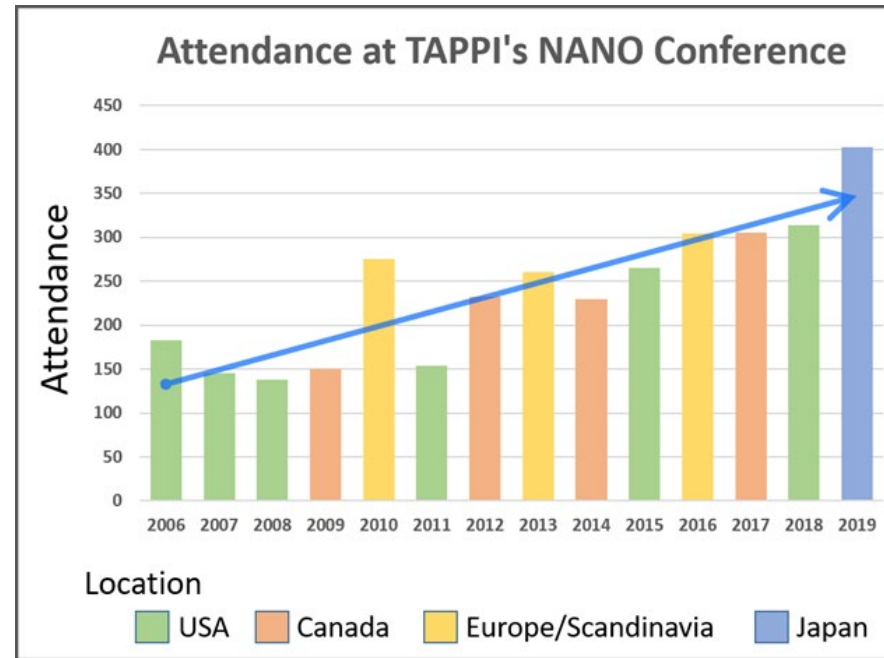
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The birth of FiberLean (ii):



TAPPI Nano 2010 Helsinki panel discussion
“Let’s face it. If we wanted to get a truckload of this material, we couldn’t *anon.*”

2009. FiberLean scientists discover how to make MFC by grinding with mineral: Increased mineral loaded paper.



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Timeline

- Full-scale commercial production of MFC since 2014.
- Public launch in 2014 at TAPPI Nano.
- FiberLean is sold to Werhahn (2021).
- FiberLean scientists learn how to make MFC without use of minerals (2022). This allows much broader commercial scope beyond printing and writing papers.
- Re-brand and re-launch.
- Focus on commercialization.



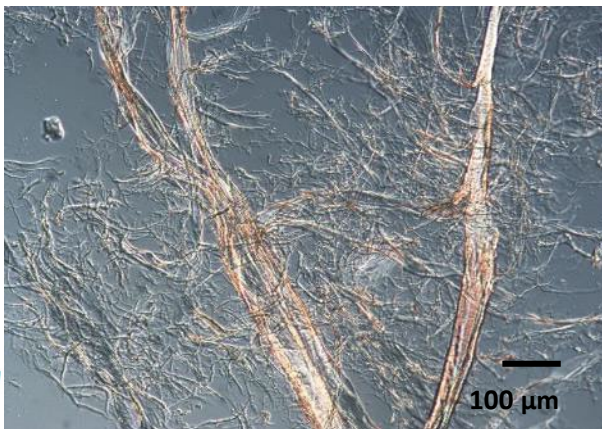
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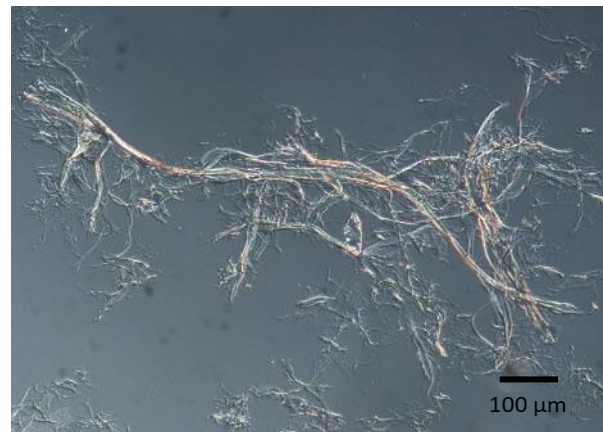
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Technology

- MFC – produced by mechanical treatment of cellulose.
- Highly viscous suspension in water.
- Typically 1-2% solids content.
- Satellite production adjacent to final use location.
- Produced using stirred media mills.
- High solids cake products also available.



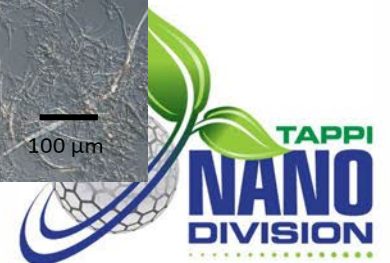
Coarse MFC



Medium MFC



Fine MFC



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Three new product lines – two MFC without minerals



FiberLean MFC Fly[®]
100% MFC for ultimate strength

- Use of virgin fibre in the FiberLean[®] MFC process.
- A wide variety of pulp species can be used.
- Possible with unbleached or bleached fibres.
- Additive/chemical-free process.
- 100% bio-based material.



FiberLean[®]
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FiberLean MFC Flex[®]
MFC blends with mineral

- Achieve greater strength and binding capability when using mineral fillers.
- Maximum particle entanglement is achieved through co-processing of raw materials to yield a composite.
- Compatibility with a broad range of minerals and fibre-types, including recycled.
- Ratio of mineral to fibre can be adjusted and tailored to each application.



FiberLean MFC reFlex[®]
MFC from recycled fibres

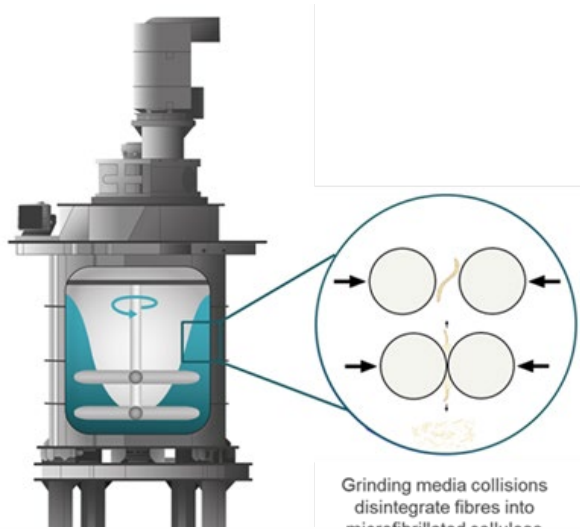
- Conversion of recycled feedstocks into MFC (e.g., OCC, DIP, office waste etc.).
- Sustaining and improving quality of products made from recycled fibre-based materials.
- Giving a new lease of life to recycled materials and closing the loop in circular systems.



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Proven technology at full-scale in paper and packaging applications

Stirred Media Mills



- Highly fibrillated, high performance cost effective products.
- No close tolerances or precision engineered components.
- Robust proven technology, 12 000 dmt installed capacity, operational since 2014 at paper and packaging mills.
- Continuous single stage process.
- Availability > 95%.
- Low Capex and Opex.
- High throughput.
- Small footprint.
- Modular easily-scalable design, ~1000 dmt modules.
- No additives or pre-treatments.



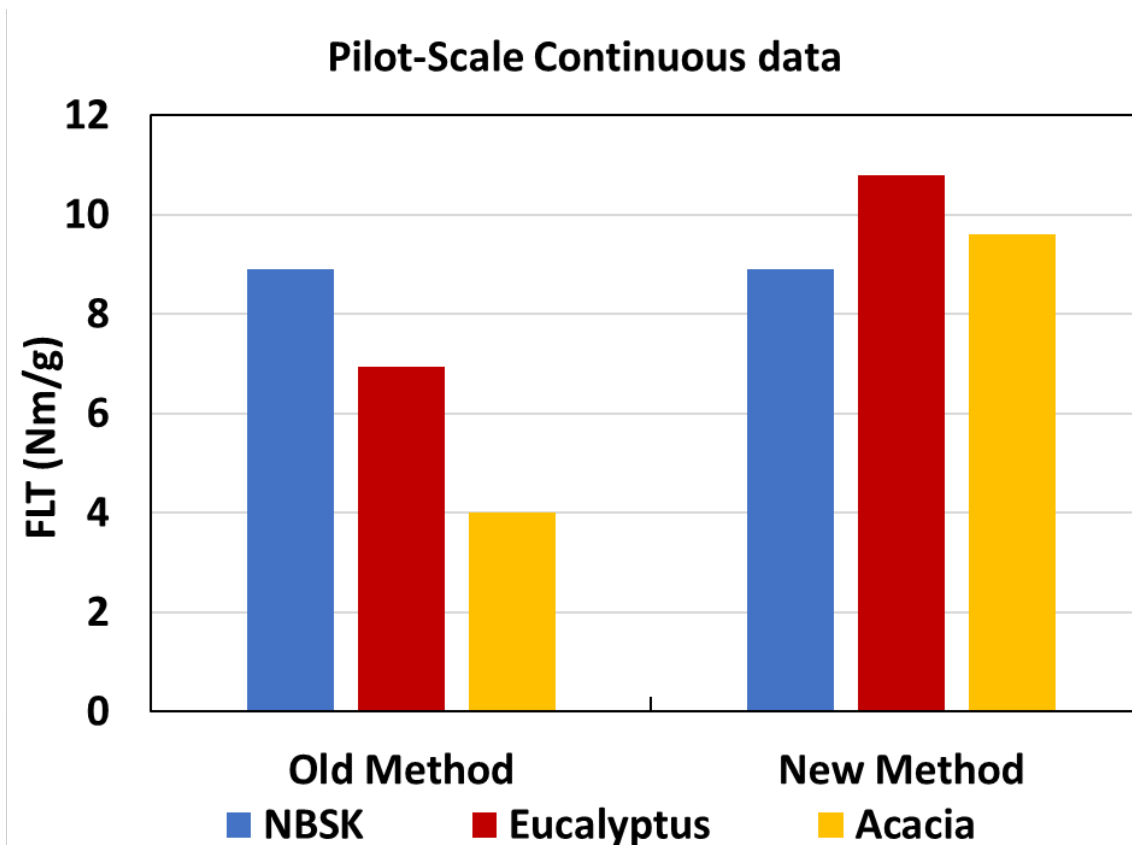
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Improved ability to tailor products to get the best from all chemical pulp types



Tuneable nature of stirred media mills allow process to be optimised for the feed pulp and the application.



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Wide regulatory clearance

USA

EPA – existing substance under TSCA. Not subject to reporting under EPA nano rule

Food contact clearance through FDA (5wt.% fibrils in packaging), FCNs 1582 and 1887

Covers all ratios of mineral: MFC including mineral-free

FDA GRAS – in progress, part of Vireo led consortium. For food use

Canada

Environment and climate change Canada – existing substance under CEPA

Health Canada opinion – “...we see no reason to object...to the use of FiberLean in food contact packaging, under conditions as described on the FDA website in the FCN 1582”

Covers all ratios of mineral: MFC including mineral-free

China

The National Health Commission of the People’s Republic of China approved microfibrillated cellulose pulp (CAS 65996-61-4) as an additive in paper and paperboard used for contact with all types of food, subject to a maximum usage of 5% (based on the dry weight of fiber) and no specific migration level requirement

Covers all ratios of mineral: MFC including mineral-free

Germany

Acceptance confirmed for BfR XXXVI and XXXVI/2 at up to 5 wt.% fibrils when produced with minerals at between 50% and 83% mineral content

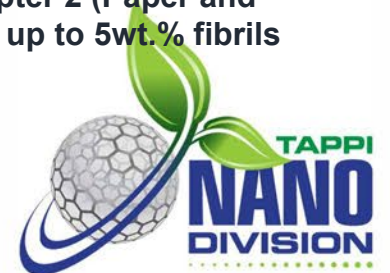
Mineral-free application has been filed with BfR

Netherlands

Cellulose microfibrils produced with calcium carbonate, kaolin and/or other permitted mineral fillers are included in Chapter 2 (Paper and board) of the Dutch commodities act regulation at up to 5wt.% fibrils



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High solids merchant product form to complement on-site satellite manufacturing and for trials.



- Press-cake product form.
- Approx. 15 – 20 % fibril solids.
- Shelf-life approx. 1 year.



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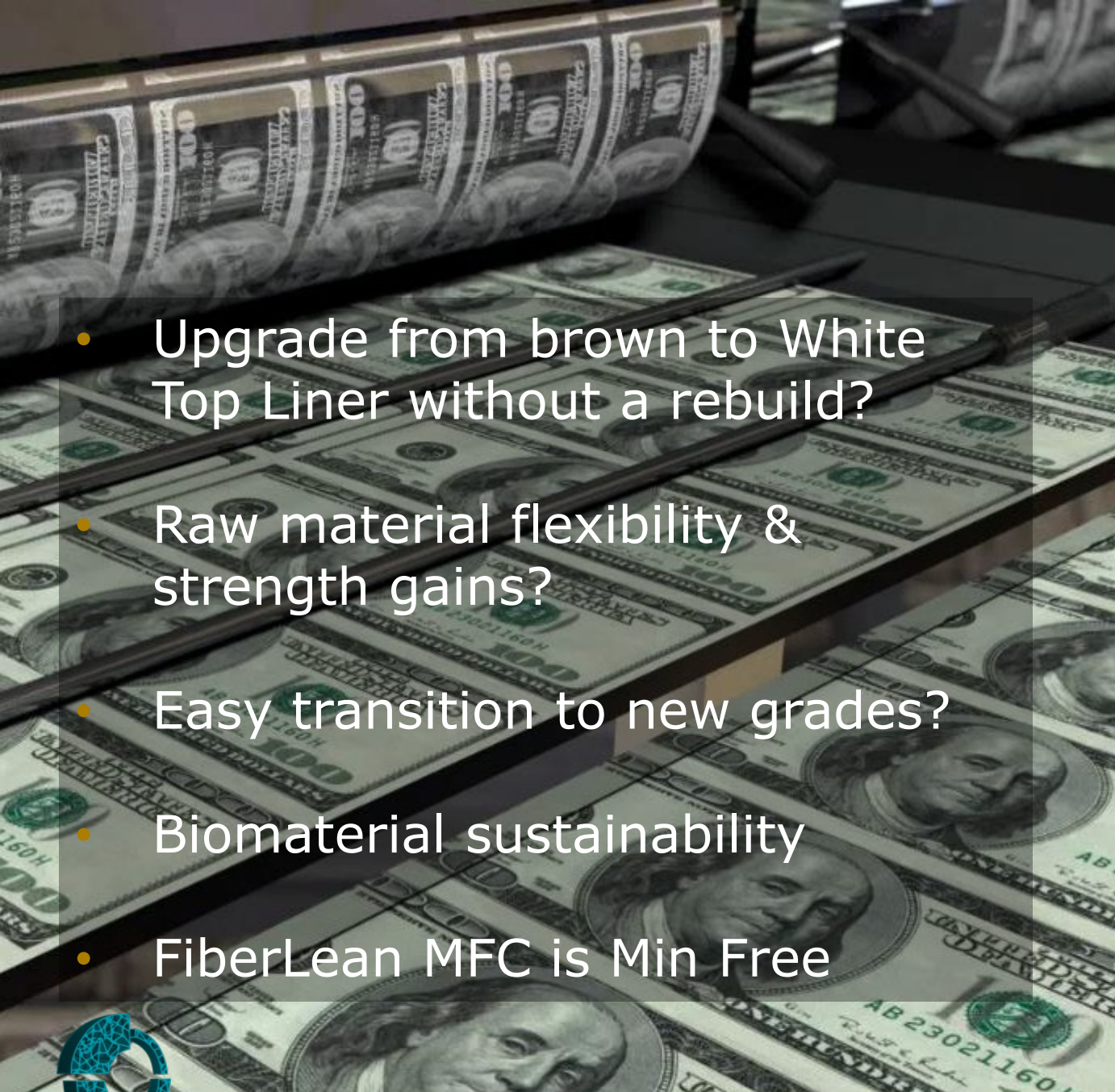
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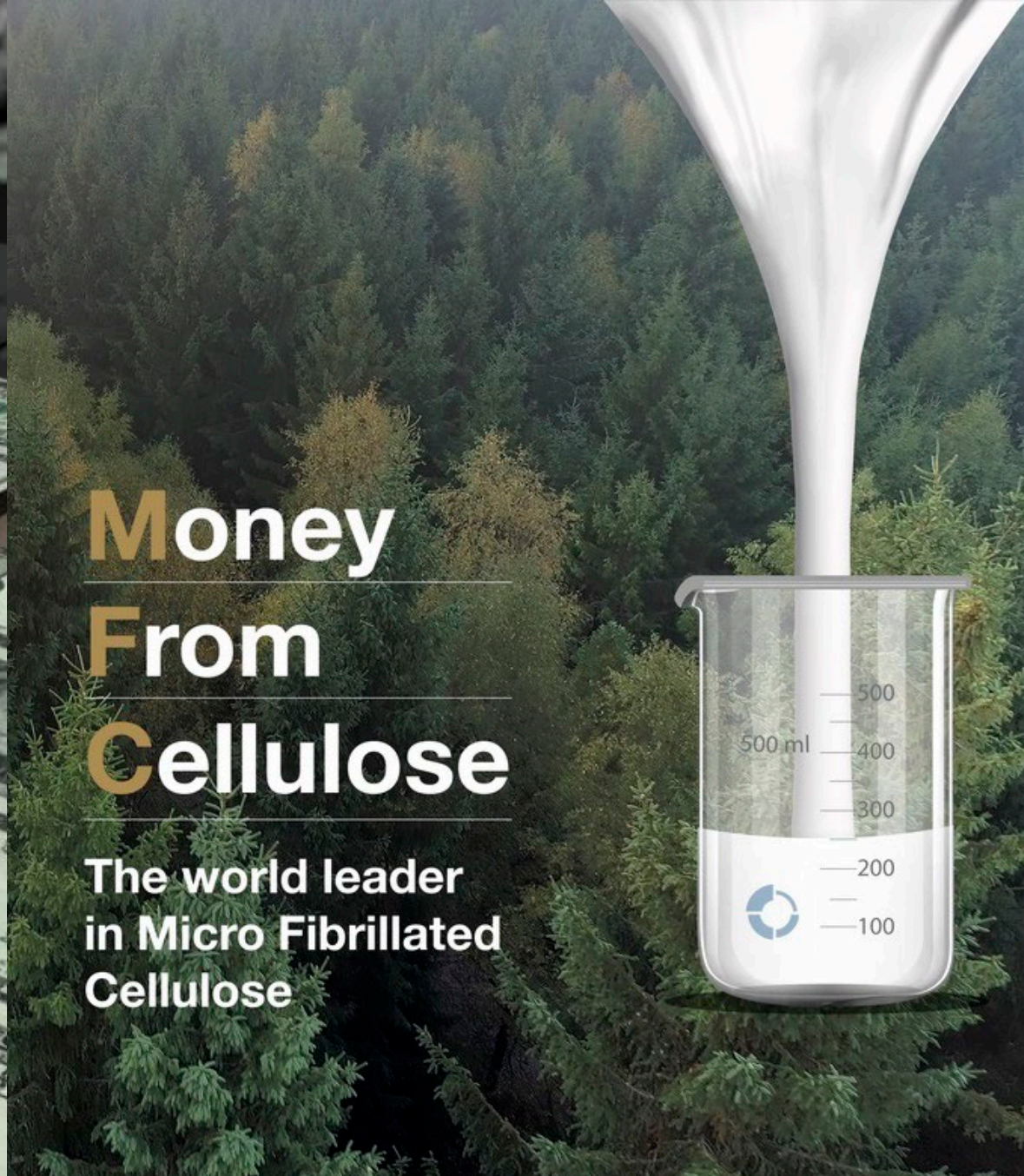
MFC Applications

Use of MFC generally allows:

- Increased bonding in web-based structures.
- Increased viscosity, highly shear thinning.
- Formation of barrier layers.
- Reinforcement (of green polymers).
- Printing and writing paper.
- Packaging.
- Building materials.
- Paints and coatings.
- Functional materials.
- Adhesives.
- Food.
- Nonwovens.
- Medical materials.

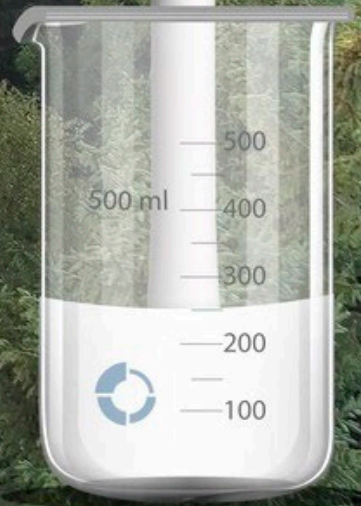


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- Upgrade from brown to White Top Liner without a rebuild?
 - Raw material flexibility & strength gains?
 - Easy transition to new grades?
 - Biomaterial sustainability
 - FiberLean MFC is Min Free



Money From Cellulose

The world leader
in Micro Fibrillated
Cellulose



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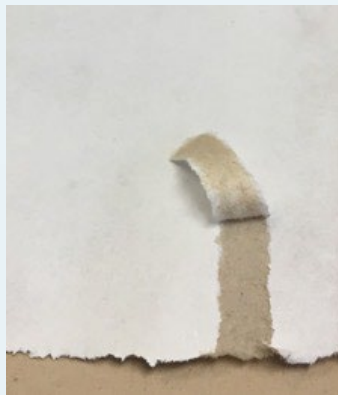
Surface application technology (FiberLean On Top)

MFC applied at the paper machine wet end:

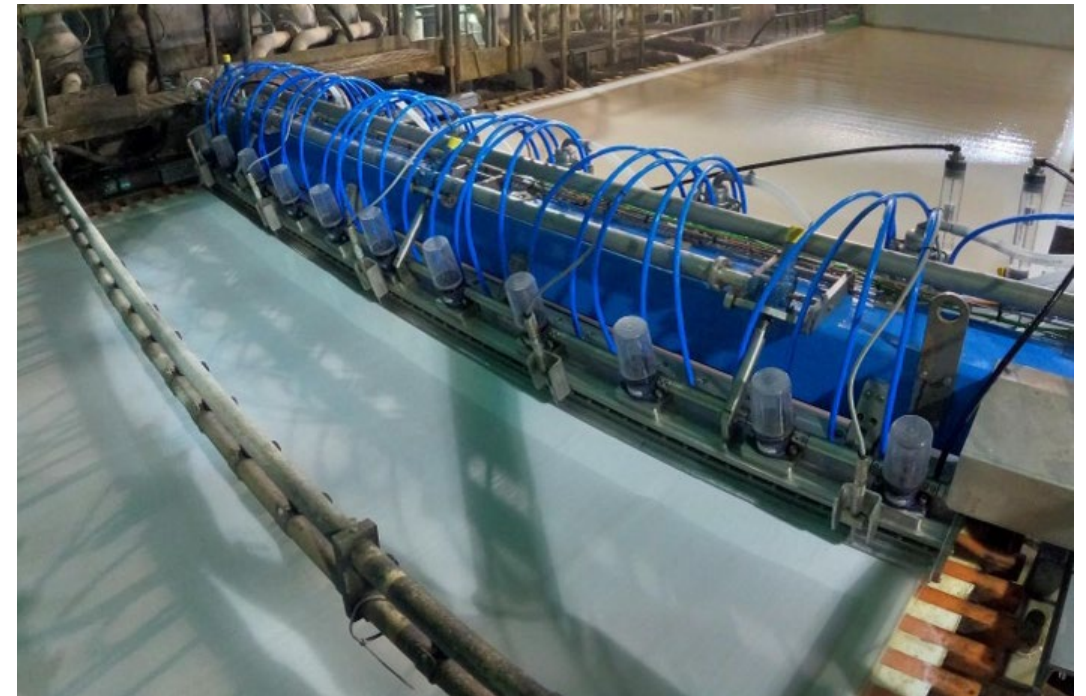
- Drain, press and dry using existing paper machine equipment.
- Low CapEx requirement.
- 2-layer sheet functionality achieved with 1 forming section and no coaters.
- Convert existing production lines to new grades.
- FiberLean are the inventors & patent owners globally of this exciting technology.

Multiple application uses:

**White
Top Liner**



Barrier

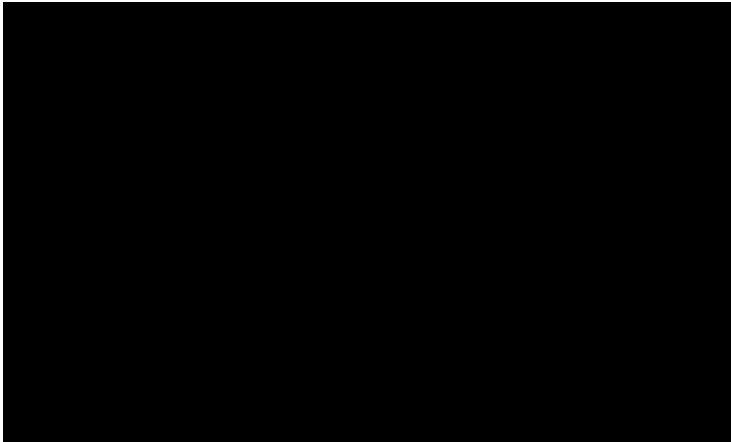


**Commercial-scale application of MFC:
3 m wide paper machine operating at 500 m/min.**

**3 m wide applicator available
now for trials**

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Surface application for barrier in action

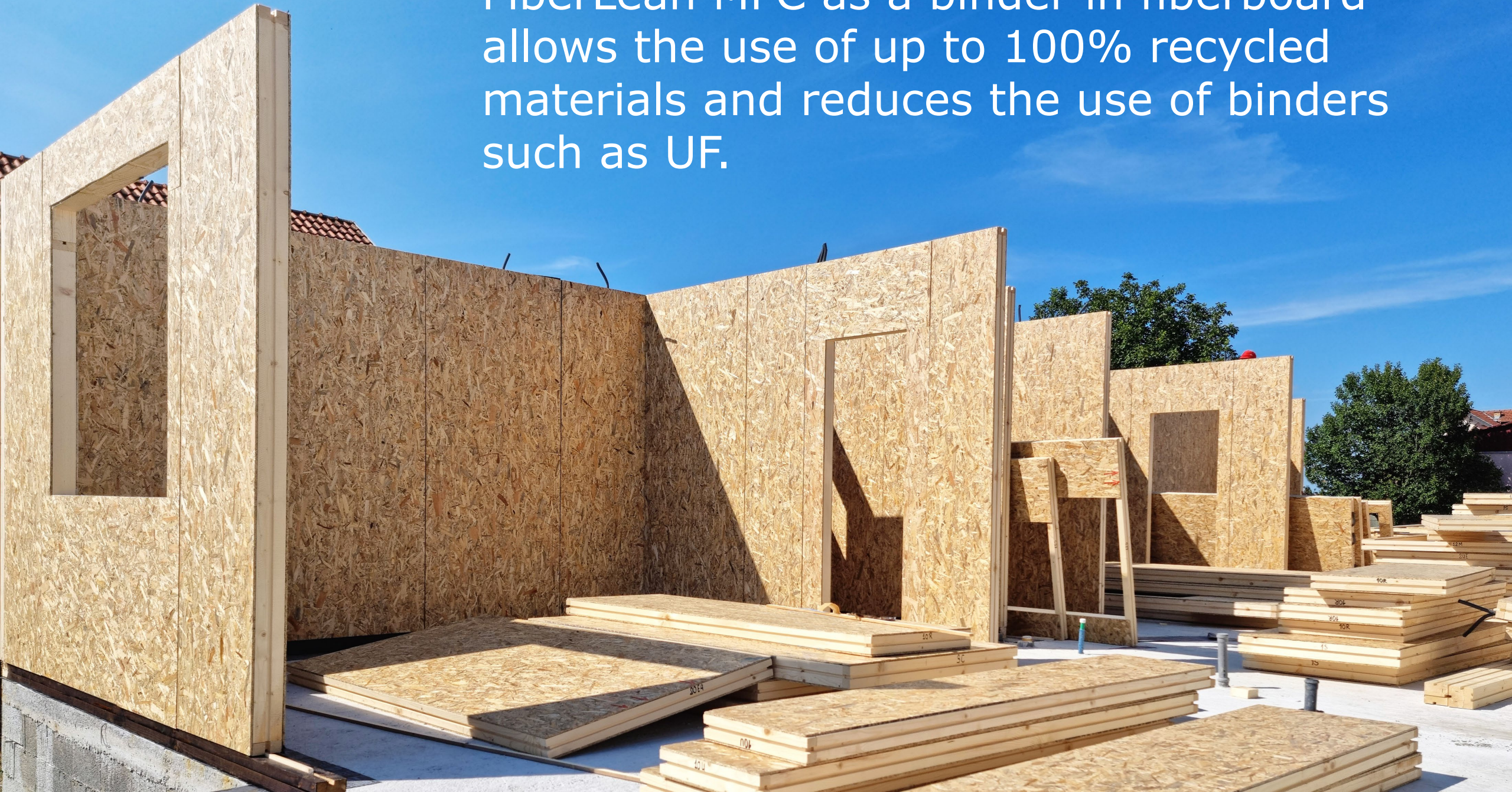


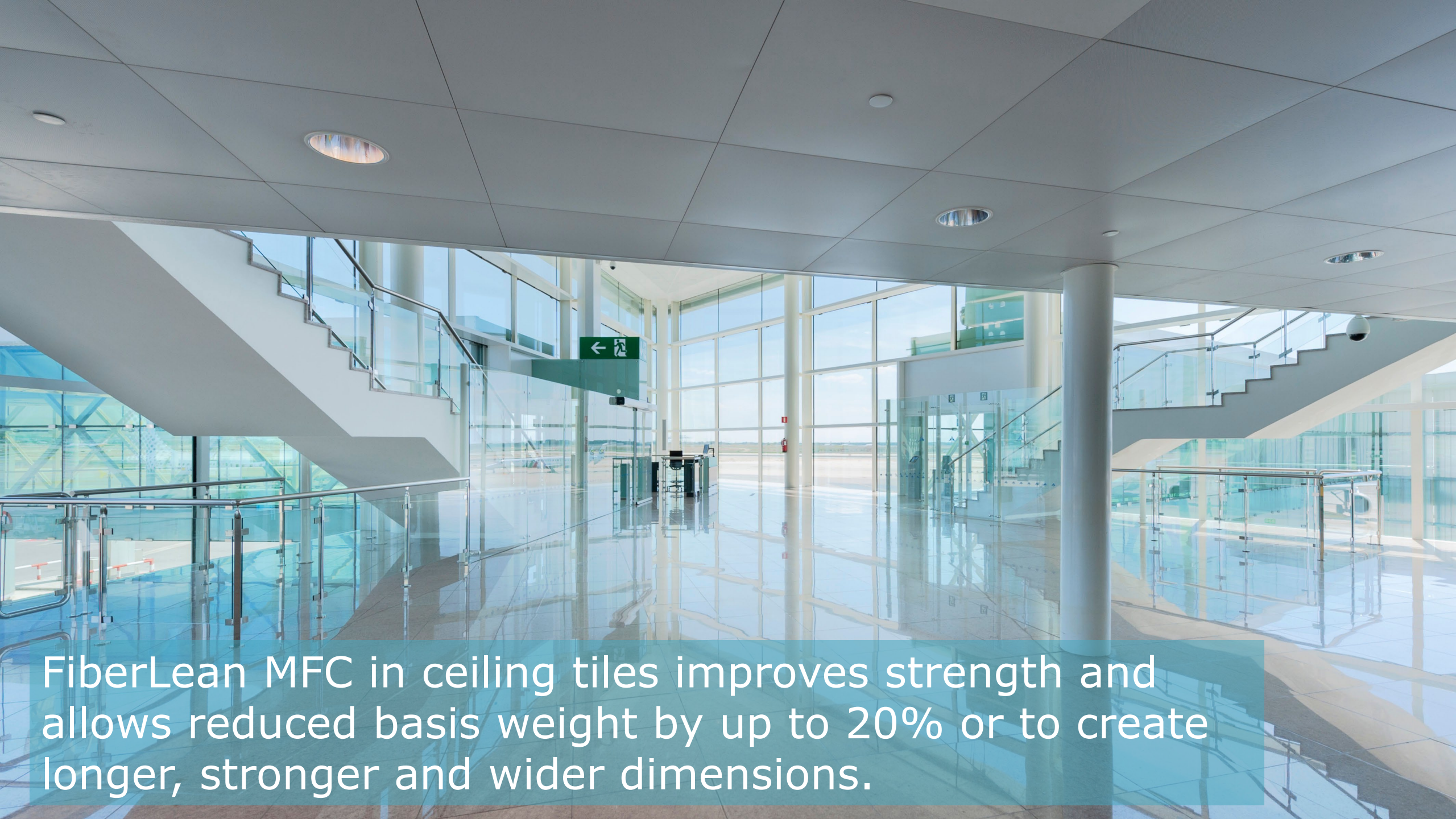
KIT 12 oil solution being applied to paper surfaces.

- ✓ Oil & Grease resistance.
- ✓ Oxygen & Aroma barrier.
- ✓ Mineral oil barrier.
- ✓ Very smooth & closed surface.
- ✓ Excellent substrate for coatings.
- ✓ High-strength & durable layer.
- ✓ High bio-based content, sustainable packaging.
- The MFC layer has a very closed structure, preventing penetration of oil and permeability of air.
- The surface serves as an excellent substrate (primer) for subsequent coatings.



FiberLean MFC as a binder in fiberboard allows the use of up to 100% recycled materials and reduces the use of binders such as UF.





FiberLean MFC in ceiling tiles improves strength and allows reduced basis weight by up to 20% or to create longer, stronger and wider dimensions.

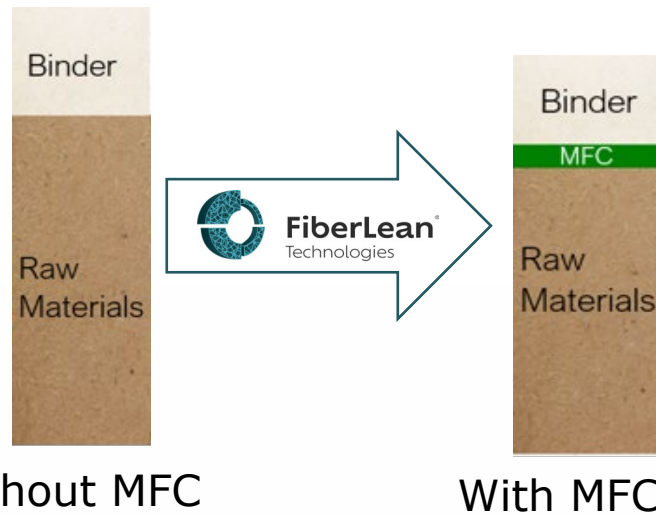
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FiberLean MFC in ceiling tiles improves strength to reduce basis weight up to 20% or to create longer, stronger, wider ceiling tiles.



FiberLean® MFC in ceiling tiles improves all technical parameters:

- Creates up to a 30% strength increase.
- Improves sag resistance by more than 50%.
- Decouples strength from acoustic performance.
- Increased brightness.



Cost Savings approach

Reduce basis weight up to 20% and reduce coating and maintaining performance requirements .



New/better products

Manufacture stronger, **wider/longer ceiling tiles** and enter new market segments.



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Take aways

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- Proven technology at full-scale in paper and packaging applications.
- Three new product lines – two MFC without minerals.
- High solids merchant product form to complement on-site satellite manufacturing.
- Improved ability to tailor products to get the best from all chemical pulp types.
- Wide regulatory clearance.
- Surface application technology (FLoT) is proven at full-scale. MFC for barrier is in scale-up.
- Building materials applications in both construction boards and ceiling tiles.

Thank you to TAPPI for the opportunity to present



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