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FiberLean®MFC –Cost Saving through Innovative Product

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Apt narration

The Printing and Writing producers are forced to improve their cost situation due to overcapacity and strong competition. The main target is to increase the filler load to replace expensive virgin fibres.For the board producer the sustainability is getting more and more important, the market is looking especially for light weighting with the target to maintain bulk and stiffness.

This paper describes FiberLean® MFC as a breakthrough technology for highest filler loads to achieve significant cost savings. The MFC addition to the paper making process creates improved strengthwhich opens the room for increasedfiller loads. A different approach for board(FBB) is light weighting, which is requested by the market. The MFC creates increased internal bond which offers the option to use less refined pulp in the middle ply. This leads to increased stiffness and bulk which can be used to reduce the grammage of the board.

Introduction

FiberLean® Technologies Ltd, as a company, was established in May 2016. What used to be major projects within Imerys and Omyathen became a 50/50 technology Joint Venture. The purpose of the JV is to combine the knowledge base of the two companies to proliferate the use of Micro and Nano Cellulosics. Imerys and Omya are separately and independently introducing FiberLean products to their wide range of customers across different industries.

At the core of FiberLean® Technologies lies the proprietary co-grinding process for making Micro-Fibrillated Cellulose (MFC) as a composite with mineral. The mineral plays an essential role in the all-mechanical process, where it aids transfer of mechanical energy when processing regular pulp to MFC. The presence of mineral also allows for use of low cost, robust and reliable industrial equipment.

FiberLean® MFC is the brand name for a range of composites produced through the co-grinding process. A wide range of standard chemical pulps and minerals, such as calcium carbonate and kaolin can be used. No additives are required.

FiberLean® MFC – innovative concept to replace expensive fibers

The paper and board producers are under high cost pressure with the target, to replace expensive fibres by mineral. The challenge is of course to maintain the important properties, which are requested from the market, such as strength, bulk, stiffness and so on. In addition, a good runabilityand convertibility is necessary.

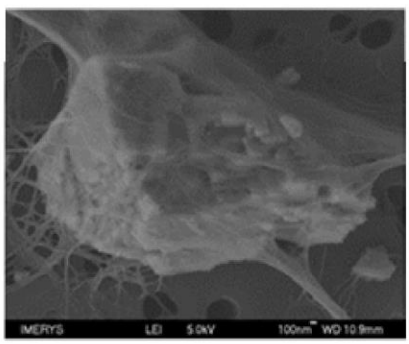

Figure 1. *Micrograph of composite with MFC fibrils and GCC particle*

The addition of MFC to the paper making process offers the possibility to increase the filler loadsignificantly. By adding a small amount of MFC, 1% to 2%, MFC provides an improvement in strength due to a lot ofhydroxyl groups, providinga very good fibre-fibre bonding.The MFC addtion reduces the dewatering without filler increase. When the filler load is increased in parallel, the dewatering is no big issue and can bemanaged with small adjustments. The benefits of adding MFC to the wet-end are:

- Increase in initial wet web strength to allow good runnability.
- Increase in dry paper strength properties to allow meeting paper specification and fit-for-purpose at elevated levels of filler.
- Cost savings: Gained strength allows to increase filler loads significantly and/or reduce weight at constant strength properties
- Positive impact on filler retention and press solids when combined with moderate adjustment of existing retention/drainage aid schemes (increased filler load).
- Improved surface smoothness.
- A synergistic effect with filler increase to give exceptionally good opacity.
- Reducing the permeability of the paper.
- FiberLeanTechnologies has applied for FCN (FDA, BfR, China Regulation) and doesn't need any chemical or enzymatic treatment

FiberLean® MFC is a proven technology, as evidenced by dozens of successful trials. The following graph showsUCW and CWF mill trials. To be able to increase the filler load by 5-6% it was added around 1% MFC. With the addition of 2% MFC a filler load increase was achieved between 9% - 13%.

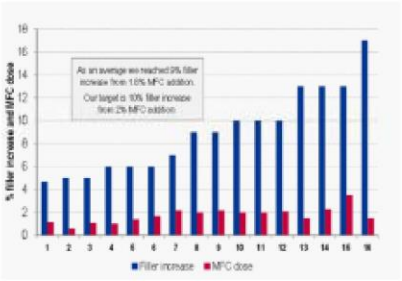

Figure 2. *UCW and CWF mill trials – addition of MFC and achieved filler load increase*

The following graph shows the general development of paper properties from our mill trial experience. Starting with a basis of 100% at a filler load of 20%(GCC) without adding MFC.The filler load was increased stepwise, for every 5% filler increase one 1% MFC was added.

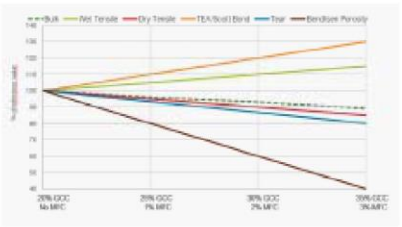

Figure 3. *UCW and CWF mill trials – development of the paper properties*

- TEA and Scott bond could be maintained or even improved
- Bulk, dry tensile and tear are reduced slightly
- The porosity is mainly influenced, the sheet ismore closed

Besides a lot of advantages, there are some challenges and adjustment necessary, to maintain for example bulk & stiffness. Due to improved strength, internal bond, elongation, opacity and smoothness there are options to regain bulk & stiffness:

- Reduced refining
- Adjusted furnish
- Lower machine calender load
- Adjusted filler
- Adjusted PCC filler particle size (onsite plant)

For coated papers, where the porosity reduction also results in improved coating hold out, it is further possible to calender at lower line load or in fewer nips and still reach specified gloss and smoothness.

At the end, the main driver is to realize cost savings. The cost saving potential depends on the fiber, filler and the MFC cost. The MFC cost depends on the FiberLean plant size and circumstances to build on onsite plant. However, the target is to achieve cost savings of 10 to 20 USD per ton of paper.

Fiber based packaging applications

The use of MFC has many appealing applications in packaging. Following our FDA clearance for using FiberLean® MFC in food contact applications at the end of 2015 our efforts to prove concepts in lab, pilot and full scale have been stepped up.

Two different applications for MFC in Folding Boxboard have been proven in full scale. One is similar to the filler increase application for paper. By adding MFC and increasing filler loading in Folding Boxboard outer plies it is possible to substantially increase the layer´s opacity, allowing a reduction in basis weight while keeping the same level of optical coverage. Practical experience shows that also the physical coverage after coating can be maintained, or even improved. This is attributed to the improvement in coating hold out resulting from reduction in top layer porosity. The overall reduction in chemical fibre usage will be the combination of filler replacing fibre and reduction in basis weight. The net result is a very favourable impact on economics. This concept also works for White Top Linerboards.

The other application, also in Folding Boxboard, is to use MFC and as little filler as possible (bearing in mind that FiberLean is a composite) to enhance strength of the middle ply. The higher strength allows for reductions in refining of the mechanical pulp. The impact of adding MFC at constant mechanical pulp quality can be seen in figure 2 below. The impact from 2% MFC addition is around +100% in Scott Bond, despite also adding 2% mineral filler.This makes it possible to reduce mechanical pulp refining to improve the bulk of the middle ply at maintained delamination strength. Obviously, the aim is improved board stiffness which could be used for light weighting. We have also seen possibilities to remove reinforcement chemical pulp, wet-end starch and even spray starch. The latter is of particular interest from an overall operational efficiency point of view.

The first couple of mills using the technology in Printing & Writing papers are running and trials in Packaging are ongoing. The process is designed in a modular way enabling construction of smaller and bigger plants.

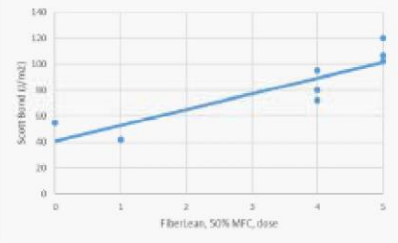

Figure 4. *Folding Boxboard mechanical pulp middle layer Scott Bond vs % FiberLean dosage, full scale results.*

Conclusion:

FiberLean® MFC is a breakthrough technology for highest filler loads. The MFC provides additional strength which opens the possibility forincreased filler load to realize cost savings. A different approach for board(FBB) is light weighting, where the increased strength offers the option to use less refined pulp in the middle ply to maintain bulk and stiffness.

There are also other MFC suppliers on the market, however the key is to produce the FiberLean MFC onsite. This is important to eliminate the logistic cost. The presence of mineral during the production process, which is patented, plays an essential role when processing regular pulp to MFC. The mineral works in addition as a grinding media which reduces the energy demand.

Besides a lot of advantages, it is very important to maintain bulk and stiffness. There are several options to maintain bulk and stiffness due to improved strength, smoothness, opacity and elongation:

- Reduced refining
- Adjusted furnish
- Reduced machine calender load
- Adjusted filler
- Adjusted PCC particle size