European Coated Mechanical Paper Mill Saves €4 Million per year through FillerTEK® Technology Programme

Mill Overview:

- **Paper Grade:** Light Weight Coated (LWC)
- **Machine Type:** Gap former
- **System pH:** Neutral
- **Speed:** 1750-1800 m/min
- **Basis Weight:** 54-65 gm/m²
- **Furnish:** 60% Mechanical, 40% Kraft, 25-30% Broke
- **Filler:** GCC

**Environmental Indicators**

- A reduction of 6,000 tonnes pulp per year through 4-5% additional filler
- Less drying energy required, steam savings of 36,000 tonnes per year
- Steam energy savings equivalent to 12,000 tonnes CO₂

**Economic Results**

- Pulp savings equivalent to €3.8 million per year
- Reduction of Steam usage equates to savings of €900 K per year
- Financial savings based on CO₂ trade market

*Nalco reports eROI values to customers to account for contributions in delivering both environmental performance and financial payback.*
TECHNOLOGY REVIEW

In the current economic environment, customers continue to put emphasis on improving operational margins by reducing the Total Cost of Operation (TCO). Since Kraft fibre is the most expensive component in a paper furnish, one option is to replace it with less costly filler. However, there are technical limitations that preclude this practice, such as the decrease in paper strength and bulk, or the increase of dusting during papermaking and printing operations.

Nalco patented FillerTEK Technology allows the increase of sheet ash content up to 5 points without compromising product quality and machine operations. Although the technology is best suited for the wood-free market grades, it might also be economically attractive for other grades that make use of expensive pulp raw materials. One example is coated mechanical papers that contain typically up to 50% Kraft fibre as re-enforcement pulp.

Increasing the amount of filler in coated mechanical grades is not trivial from a technical standpoint. Weakening of the base paper due to higher filler loading may decrease significantly the coated paper print runnability. Additionally, any change of properties of the base paper will affect coating consolidation and, as a result, its structure, coverage of the base paper and resulting coated paper print quality.

BUSINESS SITUATION

Management at a coated mechanical paper mill in Europe desired to lower the Total Cost of Operation by increasing the ash content of the base paper without affecting its internal strength characteristics (measured as Scott-Bond). Scott-Bond is an important paper quality parameter for offset LWC paper to control its blistering tendency during the offset printing press operations. Blistering of coated papers occurs when the vapour pressure generated inside the paper in the dryer unit of the heat-set offset press exceeds the sheet internal bond strength. The mill reported recurrent blistering issues during previous attempts to increase the base paper ash content. The blisters clearly originated from the base paper rupturing in the middle layer rather than from detachment of the coating from the base paper as observed in Figure 1. Based on the current machine furnish and ash levels, Nalco recommended running a programme to allow for the filler loading increase while maintaining sheet quality properties and machine runnability.

ANALYSIS OF BUSINESS SITUATION

Key Success Factors

• Reduce the Total Cost of Operation through Kraft fibre substitution with FillerTEK treated filler
• Preserve the internal bond strength at increased sheet ash
• Increased steam savings at elevated sheet ash
• No dusting
• Maintain paper machine and printing press runnability
• Maintain print quality (no picking)

Challenges

• Maintain sheet quality and runnability with ash increase
• Maintain the quality of the treated filler

Key Performance Indicators

• Ash content of paper sheet
• Scott-Bond, bulk, and other physical properties
• Surface strength and offset printability
• Overall Machine Efficiency (OME)
PROGRAMME DESIGN

A Nalco FillerTEK Technology trial was recommended to help maintain sheet internal strength and print quality at increased ash levels. FillerTEK technology is an on-site industrial scale method of treating fresh calcium carbonate with an aim to produce agglomerated, strong filler flocs at pre-defined particle size and distribution. The method for this trial included three tailored polymer chemistries to pre-flocculate filler under controllable mechanical actions with specially-designed equipment as seen in Figure 2. The pre-flocculated filler minimises the disruption of fibre-fibre bonding by nature of its larger size and thus enables increase filler loading without the loss in sheet strength.

PROGRAMME RESULTS

Implementation of FillerTEK technology for increasing the base paper ash encompassed a series of steps. The first trials had the objective to assess how high the ash content could be increased. It was demonstrated during production of 60 g/m² coated grades that the base paper ash could be increased by over 5% without sacrificing internal bond strength as shown in Figure 3. In addition, slight improvements in coating weight uniformity, brightness, and gloss of the final coated paper were observed. Opacity and bulk were also maintained. In addition to maintaining sheet performance at increased ash, the steam energy for web drying was substantially reduced leading to additional savings from the fibre replacement. These benefits were successively confirmed in running the FillerTEK technology across all basis weights.

![Figure 2 - Nalco FillerTEK Technology skid that effectively mixes Nalco filler pre-flocculation agents with filler slurry and produces stable filler flocs with a defined particle size distribution.](image)

![Figure 3 - Internal bond strength (bars) and base paper ash (line) of 60 g/m² coated & calendered paper from reels produced with and without FillerTEK Technology treatment.](image)
CONCLUSION

Further optimisation of the programme on the machine showed that the particle size distribution required optimisation to avoiding picking issues of the coated & calendered paper during printing. Continuous application of the FillerTEK technology has confirmed that at a 3% base paper ash increase, the paper machine runnability remains very good, no dusting before the coating or at the reel has been observed, and no picking has been observed during printing press operations as seen in the Table 1 summary. These encouraging results have established a baseline of operation with the FillerTEK technology as the mill continues to increase ash levels to reach the final target of +5% ash increase.

As a result of the successful trials, the company proceeded with the full-time implementation of the FillerTEK technology. This new Nalco customer achieved a remarkable benefit as detailed by the Return On Investment (ROI) listed in Table 2.

Table 1 - Sheet properties at increased ash and impact of FillerTEK treatment.

<table>
<thead>
<tr>
<th>Sheet Property</th>
<th>Impact of Filler Treatment</th>
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<tbody>
<tr>
<td>Sheet Ash</td>
<td>Average +3%</td>
</tr>
<tr>
<td>Bulk</td>
<td>Maintained or Decreased (-2%)</td>
</tr>
<tr>
<td>PPS Roughness</td>
<td>Maintained</td>
</tr>
<tr>
<td>Opacity</td>
<td>Maintained</td>
</tr>
<tr>
<td>D65 Brightness</td>
<td>Maintained or Improved</td>
</tr>
<tr>
<td>Hunter Gloss</td>
<td>Maintained or Slightly Improved</td>
</tr>
<tr>
<td>Scott Bond</td>
<td>Maintained</td>
</tr>
<tr>
<td>Tensile Index</td>
<td>Reduced (1-4%)</td>
</tr>
<tr>
<td>Printability</td>
<td>No Picking</td>
</tr>
</tbody>
</table>

Table 2 - Projected savings to customer at increased base paper ash 4-5% points from base line.

<table>
<thead>
<tr>
<th></th>
<th>Steam Saving</th>
<th>Ash Increase</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer Savings (per tonne)</td>
<td>€2.5</td>
<td>€10</td>
<td>€12.5</td>
</tr>
<tr>
<td>Customer Cost of increased filler loading (per tonne)</td>
<td>€2.5</td>
<td>€2.5</td>
<td>€2.5</td>
</tr>
<tr>
<td>Profit to customer (per tonne of paper)</td>
<td>€2.5</td>
<td>€2.5</td>
<td>€10</td>
</tr>
</tbody>
</table>

Total estimated savings = €10 per tonne x 400,000 tonnes per year = €4,000,000 per year