Outline

• Introduction
• Objectives
• Experimental
• Results
  – Laboratory flotation column at mill site
  – Mill flotation column
• Conclusions
• Acknowledgements
Introduction
Kruger, Place Turcot — Paperboard Recycling Plant Flow Chart

- LC Pulper
- Coarse Screens
- Fine Screens
- Cleaners
- Thickener
- HD Tower

- Combination Cleaner (Cleanpac)
- DAF (Krofta)
- Process Reject Tank
- Excess White Water Tank
- Heavy rejects
- Solid rejects

- Land fill (~7.5 t/day)

- Reject Tank 1
Paperboard Recycling Process

• Flotation is not used in board mills
• But there is a definitive trend to include it in the separation steps:
Limitations of Installation of Flotation Cells in OCC Recycling Process

- High flotation loss
- Large floor space requirement
Column Flotation

- Little fibre loss
- Less floor space
- Lower capital cost

Washing water

Accepts

Rejects

Feed

Air
Objectives

• Use column flotation technology in the pulp and paper industry to recover fibres from reject streams
• Explore its applicability to clean pulps
Experimental

• 10 cm x 4.65 m (lab) / 0.6 m x 6 m (mill)

• Operations

• Characterizations
  – Macrostickies and waxes
  – Extractives
  – Flotation loss
  – Fibre length distribution
  – Strength properties

• Control of flotation column
Results
Laboratory Flotation Column at Mill Site
OCC Recycled Pulp

Relative Macrostickies and Wax Content in OCC

- **Before flotation**
- **After flotation**

Graph showing the relative macrostickies and wax content in OCC before and after flotation from November 3 to November 29.
OCC Recycled Pulp

Before flotation

Flotation accepts

Flotation rejects

White spots represent macrostickies and wax in 1 g handsheet
## Column Performance on OCC pulp

<table>
<thead>
<tr>
<th>Characterization</th>
<th>Removal, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Macrostickies and wax</td>
<td>70-85</td>
</tr>
<tr>
<td>Filler</td>
<td>15</td>
</tr>
<tr>
<td>Chloroform extractives</td>
<td>30-35</td>
</tr>
<tr>
<td>Flotation loss</td>
<td>&lt; 2</td>
</tr>
</tbody>
</table>
## Column Performance on OCC Pulp

<table>
<thead>
<tr>
<th>Physical Properties</th>
<th>Changes, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSF</td>
<td>+4</td>
</tr>
<tr>
<td>Burst</td>
<td>+3</td>
</tr>
<tr>
<td>Tensile</td>
<td>+2.3</td>
</tr>
<tr>
<td>Scott Bond</td>
<td>+5</td>
</tr>
</tbody>
</table>
Larger particles of macrostickies and waxes were less floatable than smaller ones.
Control of Laboratory Flotation Column

- Feed flow
- Disturbance
- Froth height
- Shower flow
- Output to rejects
- Sensor 1
- Air content
- Sensor 2
- Manipulated variable
- Accepts flow
- Air flow
Model Predictive Control (MPC)

1. Bump manipulated variables
2. Estimate models for MPC controller
3. Run MPC controller
4. Performance satisfactory?
   - Yes: Implementation done!
   - No: Go back to estimate models for MPC controller

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Performance of MPC Controller

Feed increased by 20%
Feed decreased by 40%

MPC controller
In operation

Air Content, % and Froth Level cm

Time (sec)
Summary of Laboratory Column

- Column flotation was very effective for removal of macrostickies, wax, fillers, and organic extractives
- Fibre loss was low
- Improved pulp physical strength
- Developed control system to reduce variations in froth heights and air content in the column.
Mill Flotation Column

(0.6 m x 6 m)
Construction & Start-up of Mill Column

• Collaborative work between Paprican and the mill
• Paprican supplied column designs, P & I diagrams, mill training and automatic control
• Mills supervised the construction and ran the tests
Progress

• Successful start-up in March 2006
• Automation in May 2006
• Evaluation of macrostickies removal efficiency and flotation loss in OCC pulp and reject stream
Mill Flotation Column Performance

Macrostickies and Waxes Removal Efficiency, %

- OCC pulp
- Krofta Rejects
- Krofta Rejects + Cleanpac heavy rejects

Test No.

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Mill Column Flotation OF OCC Pulp
Macrostickies

FEED

ACCEPTS

REJECTS
## Summary of Mill Flotation Column

<table>
<thead>
<tr>
<th></th>
<th>OCC Pulp</th>
<th>DAF Rejects</th>
<th>Process Rejects</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Experimental</strong></td>
<td>20 tests + 5 trials</td>
<td>15 tests + 5 trials</td>
<td>14 tests</td>
</tr>
<tr>
<td><strong>Efficiency, %</strong></td>
<td>60 - 90</td>
<td>55 - 85</td>
<td>45 - 75</td>
</tr>
<tr>
<td><strong>Ash removal, %</strong></td>
<td>25</td>
<td>27</td>
<td>19</td>
</tr>
<tr>
<td><strong>Fibre loss (%)</strong></td>
<td>2-4</td>
<td>5-10</td>
<td>5-10</td>
</tr>
</tbody>
</table>
Control of Mill Flotation Column
Status of Mill Flotation Column

• Used as R&D unit
  – To establish long-term performance of the column
  – To better determine the impact of returning treated rejects in the main OCC pulp line

• Currently, full time operation for the recovery of 2.5–3.0 t/d of fibres from Krofta rejects.
Conclusions

• Mill built a flotation column (0.6 m x 6.0 m)
• Mill already achieved design target on stickies removal and material loss
• The recovered materials from Krofta rejects had no negative impact on paperboard machine operation
• The column is operating full-time to recover 2.5-3.0 t/d of fibres from Krofta rejects
• Automatic control of froth level and air content greatly improved operation
Acknowledgments

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