Operation of multi-stage Drum Displacer and optimization possibilities with continuous process measurements
DD Washer main features

- Compact and efficient
- Environmentally friendly
- Fractional washing - enables innovative circulation of filtrates with different properties
- Enables a wide variety of washing configurations in a single Drum Displacer®
- Wide inlet consistency range
- Low power consumption
- Low filtrate fiber content
- Wide product range
- High unit capacity
Operation principle (3)

2-stage DD Washer

- **Wash animation**
- **Pulp animation**
Washing Efficiency (1)

Washing efficiency with refractive index measurement

- The modified Nordén efficiency factor

\[ E_{10} = \frac{\ln \left( \frac{L_0 (x_0 - y_1)}{L_1 (x_1 - y_2)} \right)}{\ln \left( 1 + \frac{DF (y_1 - y_2)}{Z} \right)} = \frac{\ln \left( 1 + \frac{DF (y_1 - y_2)}{L_1 (x_1 - y_2)} \right)}{\ln \left( 1 + \frac{DF}{Z} \right)} \]
### Washing Efficiency (2)

#### DD Washer efficiencies

<table>
<thead>
<tr>
<th>Number of Washing Stages</th>
<th>Feed consistency %</th>
<th>Discharge consistency %</th>
<th>E10 value at DF 2.5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LC-Feed</td>
<td>MC-Feed</td>
<td></td>
</tr>
<tr>
<td>1-Stage</td>
<td>4–6</td>
<td>8–10</td>
<td>12–16</td>
</tr>
<tr>
<td>1,5-Stage</td>
<td>4–6</td>
<td>8–10</td>
<td>12–16</td>
</tr>
<tr>
<td>2-Stage</td>
<td>4–6</td>
<td>8–10</td>
<td>12–16</td>
</tr>
<tr>
<td>3-Stage</td>
<td>4–6</td>
<td>8–10</td>
<td>12–16</td>
</tr>
<tr>
<td>4-Stage</td>
<td>4–6</td>
<td>8–10</td>
<td>12–16</td>
</tr>
</tbody>
</table>
Washing Efficiency (3)

Case 1: Feed box

Cake formation in the feed box is the base for efficient washing.

Main targets
- pocket totally filled with pulp
- air lead through the end valve to exhaust system
- porous cake with high wash consistency

Optimal feed pressure/consistency combination can be found with online washing efficiency calculation.
Washing Efficiency (4)

Case 2: Wash Sector

Right drainage demand is the key for efficient displacement washing.

Main targets:
- pressure difference over the cake on desired level at every section including wash filtrate circulation

Optimal dilution factor can be found with online washing efficiency calculation.
Washing Efficiency (5)
Case3: Monitoring

Despite following the recommended operating procedures, malfunctions may occur, due to wear and tear or other mechanical faults.

Main targets:
- notice hidden faults as ASAP

Possible mechanical faults and consequent changes in the operation of the washer can be seen immediately with online washing efficiency calculation.
DD Washer Efficiency with online measurements

Conclusions

- The modified Nordén efficiency factor for DD Washers can be calculated online based on the refractive index measurement.
- The result can be used to achieve optimal running conditions by changing operating parameters and monitoring the changes.
- Possible mechanical faults and consequent changes in the operation of the washer can be seen immediately with online washing efficiency calculation.
- Online measurement of washing efficiency has positive impact both economically and environmentally.
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Any questions?

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