How chemistry can help Brown Stock Washing operations

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“Air is our enemy”

**Forms of Air in Pulp & Paper Stock**

- **Dissolved air**
  - 0-20% of the volume

- **Entrained air**

- **Large bubbles**
  - Causes foam
  - Easiest to get rid of
A high air content of pulp and wash water will have a negative effect on washing capacity. Already an air content of a few percent in the pulp will significantly decrease the washing capacity of the washer.
How Defoamer Works
Deaeration

How does Defoamer affect deaeration?

What happens when a bubble meets another bubble?
Mixing of air into stock or liquor!
- Filtration at washers
- Too low vat levels in washing filters
- Too low levels in filtrate tanks.
- Flashing because of too high temperature. (Boyle’s law works also in practice)
- Etc…

<table>
<thead>
<tr>
<th>Softwood</th>
<th>Hardwood</th>
</tr>
</thead>
<tbody>
<tr>
<td>High foaming tendency</td>
<td>Lower foaming tendency</td>
</tr>
<tr>
<td>5 – 8 % extractives</td>
<td>2-4 % overall extractives.</td>
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<tr>
<td></td>
<td>(Maple and aspen 6 -7 %)</td>
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<td>Higher free acid content due</td>
<td>More esterified fattyacids.</td>
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<tr>
<td>to resin acids</td>
<td></td>
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</table>
What are the Recommended Dosing Points?

- Before process point where air can escape from the liquor at atmospheric pressure.
- Dosing to liquor/filtrate is usually better, because consistency of the pulp can be quite high.
- Better to have more feed in dosage to the first washers than at later stages.
- Dose at least 60% to the first washing stages. Mostly 70 - 80 %.
- If there is a problem with shower displacement, dosing can be done to the shower water.
- Dosing point to O2 blow tube.
<table>
<thead>
<tr>
<th>Series</th>
<th>Type</th>
<th>Application</th>
</tr>
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<tbody>
<tr>
<td>AEROTECH 1000</td>
<td>WATER BASED</td>
<td>Paper applications / WWT</td>
</tr>
<tr>
<td>AEROTECH 2000</td>
<td>ESTER BASED</td>
<td>Paper applications / WWT</td>
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<tr>
<td>AEROTECH 3000</td>
<td>OIL BASED</td>
<td>Pulp applications / WWT</td>
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<tr>
<td>AEROTECH 4000</td>
<td>WATER EXTENDED OIL BASED</td>
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<td>AEROTECH 5000</td>
<td>CONCENTRATES</td>
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<tr>
<td>AEROTECH 6000</td>
<td>SILICONES</td>
<td>Pulp applications</td>
</tr>
<tr>
<td>FENNODEFO</td>
<td></td>
<td>Different industrial processes / WWT</td>
</tr>
</tbody>
</table>

Finland | France | Poland | USA | Canada
How to choose a defoamer? Kemira’s FEAT method

TEMPERATURE CONTROL

FOAM CELL

DENSITY MEAS.

CIRCULATING PUMP
Principle of defoamer testing

1. Pumping started
2. Foam generated
3. Defoamer added
4. Foam disappears
5. Foam re-appears

**Graph:***
- **Density, kg/m³**
- **Time, s**

1. 150
2. 200
3. 250
4. 300
5. 350

- **Density, kg/m³**
- **Time, s**
Performance of defoamers

Defoamer chemistry
- Type of defoamer; oil, silicone, waterbase…
- Formulation (raw materials composition)
- Colloidal characteristics (e.g. particle size)

Industrial application
- Pulp mills (black liquor, brownstock)
  - HW / SW liquors – different soaps
  - Temperature and alkali
  - Dissolved solids
- Paper mills
  - Paper grade & furnish type; extractives, dissolved colloids, calcium soaps, dissolved carbonate & microbubbles…

Selection of defoamer:
- always process-specific
- always to be optimized
Development of FEAT method

FEAT provides *responses* of defoamers

- Informative from application point of view, i.e. FEAT provides enough data for comparison of products; "foam killing efficiency"
- The relationship between chemical properties of process liquors and FEAT response curves is incomplete → there is need to measure other properties of liquors

- Dissolved solids
- Conductivity
- Dissolved ions; Na, K, Ca, SO4…
- O2, pH, redox (mainly wastewater applications)
- **Refractive Index**: total concentration of dissolved substances

Optimized defoamers:
- Chemistry
- Formulation
- Colloidal characteristics
From product testing to online control

Foaming

1. Decreased washing efficiency
2. Increased carry-over
From product testing to online control

Defoaming →
1. Measurement of entrained gas
2. Measurement of dissolved substances
3. Online control of defoamer dosage
Brownstock operations are always impaired by
  • Air, which is always present
  • Overrun capacity

Chemistry can help alleviate these drawbacks

Creating a successful chemistry solution is a function of:
  1. Proper chemistry testing protocol and product proposal
  2. Proper system survey with sophisticated control proposal
     ➢ Here proper instruments come into play