General Introduction to Antifoam Industries

Internal Presentation
03.2013 / Istanbul
Agenda

• What is foam & why is it undesirable
• Foam Control: De-foaming, Anti-foaming & De-aeration
• Antifoam requirements & performance testing
• Antifoams formats; performance & compatibility
• Which antifoam to use
• De –aerators
• Competitors
• Market Position
What’s foam?

A dispersion of a gas in a liquid...

Food processing, chemical manufacturing, fermentation, textile, adhesive manufacturing, printing inks, paints, coating and resins, wastewater management...
What’s foam & Antifoam?

Foam is a complex system;

- Water
- Surfactant
- Air
What is Foam Control?

- **DE-foaming** = knock-down of existing foam
- **ANTI-foaming** = prevention of foam formation
- **De-aeration** = coalescence of (micro)bubbles
De-foaming (knock-down)
Anti-foaming (durability)
Why is foam undesirable?

Excessive foam reduces productivity and quality by:

• Process fluctuations
• Poor washing, filtration and drying
• Reduced pumping efficiency
• Thermal insulation – poor temperature control
• Floatation of solids
• Reducing vessel capacity
• Preventing distillations
• Increasing packaging (bottling) times ….etc

Foaming is inherent to many manufacturing processes, for which effective foam control is a ‘must have’ because without it many processes are seriously restricted or do not function at all.
A Perfect Antifoam Agent must be;

Rapid knockdown (for ‘spot’ dosing).
- Long durability (fewer dosing points, lower consumption).
- Good de-aeration
- Low viscosity (ease of pumping & dosing)
- Stability
  of the product as supplied (for storage)
  of the product as dispersed into the foamant (for effectiveness)
- High activity (low dosing = minimal residues)
- Performant in non-ionic, cationic & anionic surfactants
- Effective at low & high temperatures (Cloud Point effect)
- Effective at low & high pH
- Effective in high salt concentrations etc...
- and competitive cost-performance
The mechanism of antifoams means they must be INcompatible with the foam.
The more performant an antifoam, the lower its compatibility.
The more compatible an antifoam, the lower its performance.
The appropriate antifoam is a balance between these needs.
Antifoam Selection Guide

There are, however, some physical and chemical factors consistent among observations made while studying antifoams and their functionality under different conditions.

**DESIGN AND SELECTION** (Physical Parameters of the Foam in the System:)

- What is the pH?
- What is the temperature?
- What is the viscosity?
- What is the solids content?
- What is the volatile content?
- What is the dissolved organic content, or chemical composition of the foam?
- Exactly which type of process is generating foam?
Antifoam Selection Guide

• PROCESSING PARAMETERS OF THE FOAMING SYSTEM
  ▪ What is the flow rate of the liquid?
  ▪ Is the foam mechanically generated?
  ▪ Is the foam chemically produced?
  ▪ Is the foam being generated during the application of your product?
  ▪ How will the defoamer be introduced into the foaming system?
  ▪ What is the starting medium of the process involved?

• OTHER CONCERNS
  ▪ Are there any Kosher or Passover requirements?
  ▪ Are there any FDA food clearances?
  ▪ Are there any EPA or other environmental restrictions?
  ▪ Are there any undesirable ingredients, for example silicone?
  ▪ Is there any chemistry incompatible with your process/product?
Silicone Based Antifoam Format

Compounds
• 100% actives
• For non-aqueous systems
• Commonly diluted into solvent for dosing because they are so powerful & they may be high viscosity

G 520
OG 150

Emulsions
• Typically 10-30% active
• Used in aqueous systems (compounds are water insoluble)
• Easier to dose and disperse.

Denraw SE 680
Safe 820
Safe 620

Compatible concentrates
e.g. a compound dispersed into a surfactant
Mineral Based Antifoam Format

Emulsions
- Typically 10-30% active
- Used in aqueous systems (compounds are water insoluble)
- Easier to dose and disperse.

NSE 416

NSE 408

(1 ppm silicone) x (Amount of Solution to be Defoamed) = Antifoam to be Added

(% Active Ingredient in Foam Control Agent) x (10.000)

______________________________________________ = Added
De-Foamers & Antifoams

De-foaming, which is the speed & extent of knock-down of existing foam, is the immediate & often dramatic visual `wow`effect, and so influence product selection although it is rarely the key factor.

Overall in-use cost is generally determined by antifoam durability, i.e. how frequently the antifoam needs to be re-dosed. This may require longer-term plant trials to determine.

<table>
<thead>
<tr>
<th>Antifoam</th>
<th>Safe 620</th>
<th>Safe 820</th>
</tr>
</thead>
<tbody>
<tr>
<td>% actives</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Knockdown second</td>
<td>20</td>
<td>30</td>
</tr>
<tr>
<td>Durability minutes</td>
<td>3:30</td>
<td>9:00</td>
</tr>
</tbody>
</table>
Competitors

![Graph showing the comparison of Foam Height over Shake Time for different antifoam agents: Competitive Antifoam, Competitive Antifoam, SagTex DSA, and No A/F. The x-axis represents Shake Time (mins), and the y-axis represents Foam Height (mm). The graph illustrates the effectiveness of each antifoam agent over time.]
Competitors

Dispersibility of 3% Antifoam in water

50°C Stability

Compatiblility with concentrated surfactants
# Sagtex DSA & Safe 820

<table>
<thead>
<tr>
<th></th>
<th>SAFE 820</th>
<th>SAGTEX DSA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>White - milky</td>
<td>Milky- soft yellowish</td>
</tr>
<tr>
<td>Viscosity</td>
<td>250 mPAS</td>
<td>310 mPAS</td>
</tr>
<tr>
<td>pH</td>
<td>7,6 (7-8)</td>
<td>7,3 (7-10)</td>
</tr>
<tr>
<td>Solubility</td>
<td>Soluble in water easily</td>
<td>Soluble in water easily</td>
</tr>
<tr>
<td>Solid content( 160 C)</td>
<td>30,5%</td>
<td>21.8 %</td>
</tr>
</tbody>
</table>
Sagtex DSA & Safe 820

Sagtex DSA 0,4g/L
Safe 820 0,4g/L
Deaerator & Antifoam
Sagtex SWA

<table>
<thead>
<tr>
<th>Target Application</th>
<th>Foam control in bleaching &amp; scouring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Key Advantages &amp; Benefits</td>
<td>Deaeration/wetting &amp; bleaching stability; Helps even dyeing</td>
</tr>
<tr>
<td>Silicone Actives</td>
<td>33%</td>
</tr>
<tr>
<td>Alkaline Stability at pH 12</td>
<td>Excellent</td>
</tr>
<tr>
<td>Stability in a typical bleaching condition</td>
<td>Excellent</td>
</tr>
<tr>
<td>Storage Stability</td>
<td>Good; May need to re-mix if necessary</td>
</tr>
</tbody>
</table>

**Formulation A**

- 3.5% Isotridecyl Alcohol 8 ethoxylated (TDA-8)
- 5% acrylic thickener dispersion
- 0.3% NaOH
- 10% SagTex SWA Silicone Antifoam
Deaerator & Antifoam

Control: No Antifoam

Air bubbles stick to cotton fibers

0.1% SagTex SWA Silicone Antifoam

Air bubbles removed through excellent deaeration; Fibers are wet and Completely soaked

Measure volume change
Deaerator & Antifoam

- **Process:** Cold-Pad Batch
  - Fabric speed in padding: 50m/min
  - Fabric Type: 16/12 garbadine, 100% cotton woven, 400g/m²
  - Treated fabric: 2,000 meters

<table>
<thead>
<tr>
<th><strong>Bleaching &amp; Oxidative Desizing</strong></th>
<th><strong>Washing</strong></th>
<th><strong>Fabric Winding</strong></th>
<th><strong>Wrapping</strong> of the wound fabric with plastic film to avoid uneven drying on outer layers in the wound fabric</th>
</tr>
</thead>
<tbody>
<tr>
<td>- 9g/Lt mixture of wetting agent, stabilizer, sequestering agent</td>
<td>Check fine bubbles on fabric surface</td>
<td>Check dyeing evenness &amp; color yield</td>
<td>Check deaeration by hydrophilicity &amp; wicking test</td>
</tr>
<tr>
<td>- 2g/Lt stabilizer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 35g/Lt caustic soda (48 Be')</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>- 27g/Lt H₂O₂ (50% solution)</td>
<td></td>
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</tr>
<tr>
<td>- 5g/Lt NaHSO₄</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>- <strong>0.2% SagTex SWA</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Bath pH: 12.5~13.0</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>- Bath temperature: 25°C</td>
<td></td>
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</tbody>
</table>

| **Dyeing** with reactive dyes by cold-pad batch | **Drying** at room temperature for minimum 16 hours (Complete bleaching) | |
|------------------------------------------------|-------------------------------------------------|
Deaerator & Antifoam

<table>
<thead>
<tr>
<th>Trial Results</th>
<th>Control: No antifoam</th>
<th>0.2% SagTex SWA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foam height on padding bath (Bleaching &amp; Desizing)</td>
<td>~5 cm</td>
<td>Perfectly no foam; No foaming while running for 20min</td>
</tr>
<tr>
<td>Fine bubbles on fabric surface while winding of the bleached fabric</td>
<td>Easily observed</td>
<td>Not observed</td>
</tr>
<tr>
<td>Hydrophilicity by water drop testing for the dried fabric</td>
<td>Water absorbed after 4 seconds</td>
<td>Water absorbed after 2 seconds</td>
</tr>
<tr>
<td>Wicking test for the dried fabric</td>
<td>2 cm in 15 seconds</td>
<td>4.5 cm in 15 seconds</td>
</tr>
<tr>
<td>Visible observation for the dyed fabric after dyeing</td>
<td>Partially uneven dyeing: Low color yield with lighter color</td>
<td>Even dyeing: High color yield with darker color</td>
</tr>
<tr>
<td>D65 1.68 dE value difference in spectrometer</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Improve Productivity of Bleaching/Desizing & Ultimately Dyeing**
Market Position

Within a series of emulsions, cost per kg antifoam active generally decreases with increasing concentration, so more concentrated seems to make sense.

But:
- is the dosing equipment in place to avoid wastage by overdosing?
- cost per kg antifoam product (as supplied) increases with concentration. The Purchaser may be focused only on cost/delivery whereas the Plant Manager is more likely to be concerned with overall in-use cost.

When foam is generated only intermittently, allowing spot dosing `as needed`, a dilute emulsion may be best.
Prevention is better than Cure!

Foam can often be prevented by appropriate system design e.g. an effluent pipe that empties sub-surface rather than pouring into a pond.

Where antifoams are required, they should be dosed before the point at which foam is created and in a way that they are dispersed as uniformly as possible through-out the liquid.

Anti-foaming is best, De-foaming is too late! (except where foam is only generated intermittently)

Just imagine a good foam control 😊
Thanks...