# Impact of Pulpmill Operations on Papermaking

Carryover 1-Black liquor, defoamers, dirt, shives and strategies to minimize


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# Black liquor carry over

- Black liquor carry over is a direct result of poor brownstock washing
- It negatively impacts oxygen delig efficiency, bleach plant chemical consumption, pulp quality, and recovery operations.

- In oxygen delig stage:
  - Decreases efficiency by adding organic matter to the process;
  - Results in higher kappa numbers to bleach plant (if severe it will result in loss of quality-brightness)
  - Lower delig efficiency can also result in higher shives content to bleach plant (if severe it can result in increased contamination to PMs)

# Black liquor carry over

- In D0 bleach plant stage:
  - Black liquor carry over increases ClO2 and acid demand which impacts viscosity and pulp strength.
  - It also increases scale formation as more sulfur is introduced into the system ($BaSO_4$-Barite).

- Black liquor carry over is reduced by brownstock washing optimization which includes proper washing equipment maintenance; vacuum/pressure adjustments; shower water quality/quantity, or equipment upgrades ($).

# Dirt in the pulp

- Presence of dirt has a direct impact on pulp quality to paper machines. Dirt can be divided in woody and nonwood contaminants.
  - Shives are the most common woody type of dirt and are composed of uncooked wood that forms a bundle of fibers.
  - Bark is another common type of woody contaminant that can be present and impact pulp quality.

- Woody types of dirt can be reduced in the woodyard (debarking process optimization, and chip quality), in the pulpmill (cook impregnation, oxygen delig. stage, and screening) and in the bleach plant (D0 stage $ClO_2$ conc, lower temp, lower pH, and longer time).

# Dirt in the pulp

Shives and bark


# Dirt in the pulp

- Nonwood dirt is usually sand, metals, defoamer, oil, and scale.
  - It can be minimized by repairing machinery oil leaks, removing bark and having sand separators, upgrading rusted equip., using screens prior to paper machines and proper defoamer application (type, quantity, and location).
- Removal of dirt prior to bleach plant is always beneficial since a sequence that focus on dirt is not optimal for pulp quality.
  - This non optimal condition will result in over bleaching and will have direct impact on paper machines (ie: stock pH, harsh conditions- loss of strength and yield, lower brightness, and higher costs).

# Dealing with Foam

- There are three main ways to reduce foam in the system
  - Process modifications
  - Specialized equipment
    - Mechanical foam breakers
  - Defoamers (or washing aids)
- Our focus will be on defoamers/washing aids

# History of foam control and drainage aids

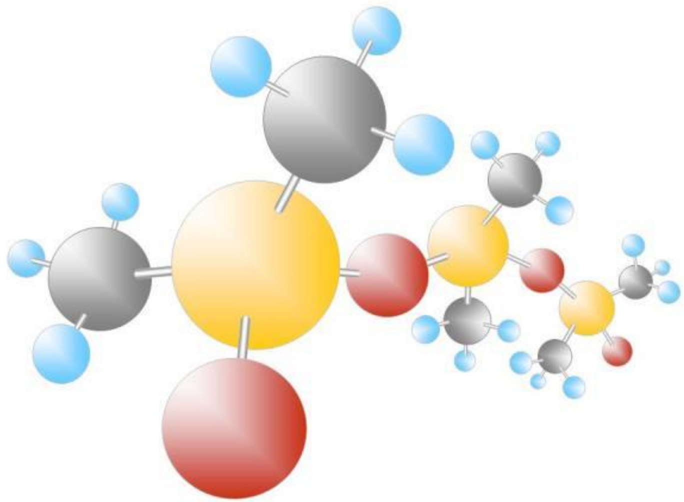
- Past Technology : Diesel, Kerosene
- Present Technology: Paraffinic mineral oil, hydrophobic wax particulates and synthetic esters
- Future Technology : Environmentally friendly Siloxane based products

# Problem Analysis

- Oil based defoamers: dispersion of waxes and/or silicas; dispersants; emulsifiers and a variety of materials to modify the surface activity of the defoamers and/or the process liquors in which they function
- Pitch or dirt deposits: contain large amounts of high molecular weight fractions of oils and insoluble amide waxes causing fouling of wires and felts in subsequent paper making operations

# Problem Resolution

*NEW SILOXANE TECHNOLOGY*





# New SiloxaneTechnology

- New Generation of Defoamers/Drainage aids
- Effective water based products
- Environmentally friendly
- Effective foam control and improved drainage on the BSW

# What is New Siloxane Technology?

It is technology that balances polydimethylsiloxane chemistry, silica chemistry, and organo modified siloxane chemistry with the chemistry and process conditions of the black liquor in brownstock washing

# Chemistry of Foam Control

- An effective defoamer
  - DISPERSES into the system (gets to the foam quickly)
  - SPREADS into the foam (must prefer to be on the surface)
  - Must be HYDROPHOBIC (migrates to the surface)
  - Must be PERSISTENT (keep the foam down)

## Factors that influence Siloxane Defoamer Performance

- surface tension of the siloxane defoamer has to be lower than that of the foaming liquid
- Insoluble in the foaming system, but disperse uniformly and rapidly
- particle or droplet size of the defoamer
- types of emulsifiers employed
- concentration of emulsifiers in the defoamer emulsion

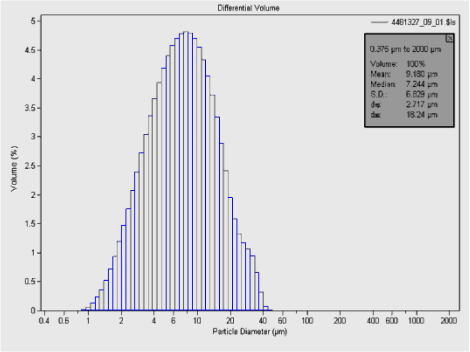
## Factors that influence Siloxane Defoamer Performance

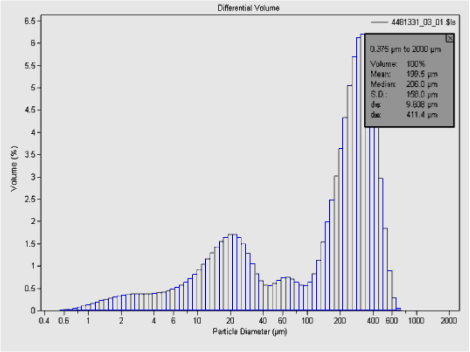
- size, surface area and shape of the silica particle
- hydrophobicity of the silica particle
- molecular weight and molecular weight distribution of the siloxane polymer
- nature of the pendant groups on the siloxane backbone
- temperature of the foaming solution
- presence of other materials in the defoamer which may offer synergy with the siloxane

# Critical Design Characteristics of Silicone Defoamers to prevent Deposition

- Emulsification Techniques

- Benefits of Improving Particle Size Distribution
  - Less Deposition
  - More effective at controlling foam
  - Emulsion Stability
    - Less Viscosity Building
  - Improved performance
  - Less tendency to “sealing” of the wire
  - Improved drainage characteristics
  - Less silicone carryover potential



# Summary

- Silicone Technology is a significant improvement over previous amide wax/oil carrier technology with regards to washing efficiency
- Issues with deposition and carryover can not be applied to all silicone base defoamers
- Defoamer quality is crucial
- Manufacturing details appear to be a factor in silicone carryover

# Thank You