

New Technology for Increased Filler Use and Fiber Savings in Graphic Grades

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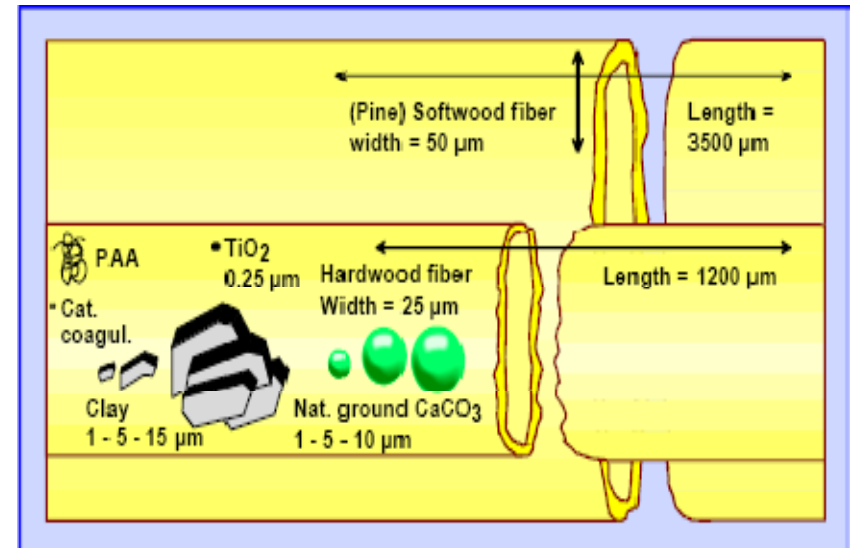
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Outline

- Introduction
 - Impact of Fillers on Sheet Properties
 - Challenges of Increasing Filler Content
- Effects of Filler Preflocculation Technology on Sheet Properties
 - Pilot Machine Study
 - Commercial Application
- Summary

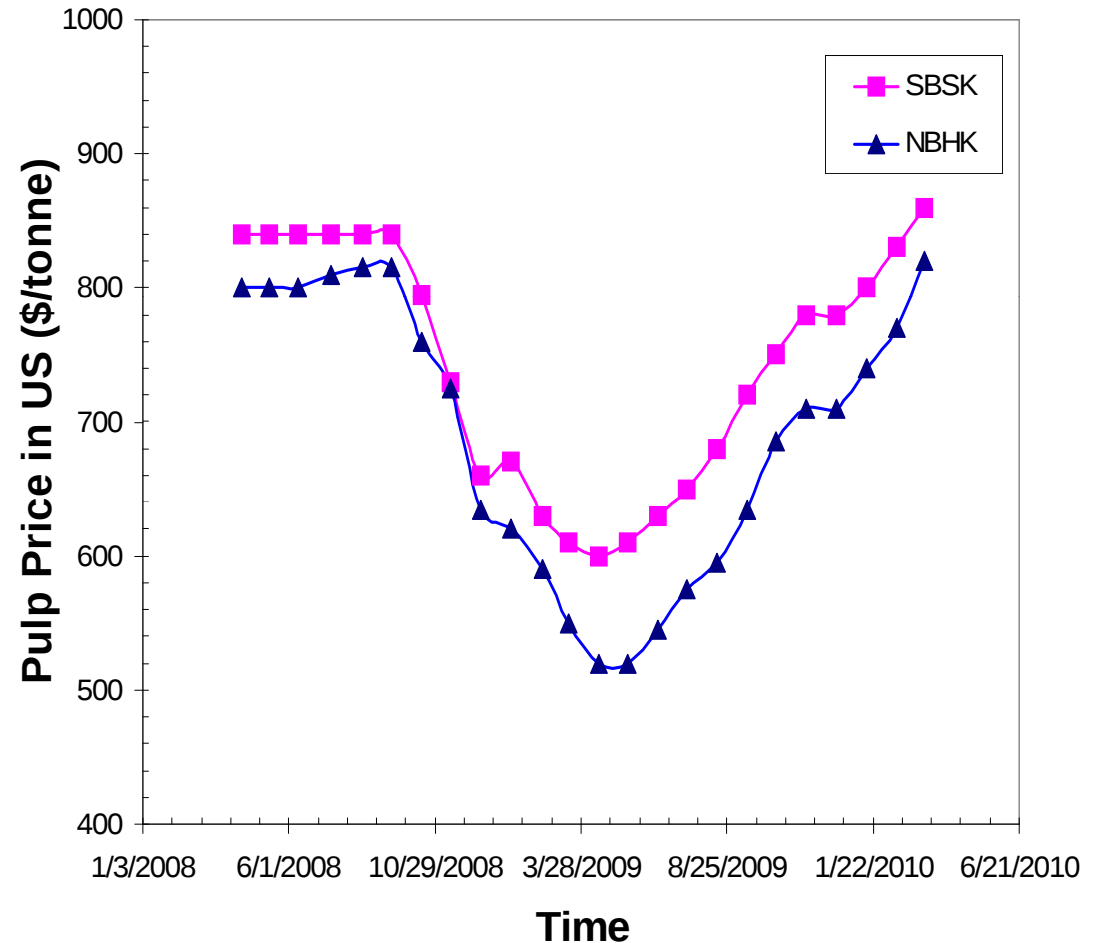
Fillers in Papermaking

- Fillers were introduced into papermaking for improving sheet properties
 - Optical properties, print quality, smoothness
- Filler is much smaller than fiber
 - ✓ Interference with fiber-fiber bonding
 - ✓ Interference with wet-end chemicals
 - Sizing agent
 - Strength agent



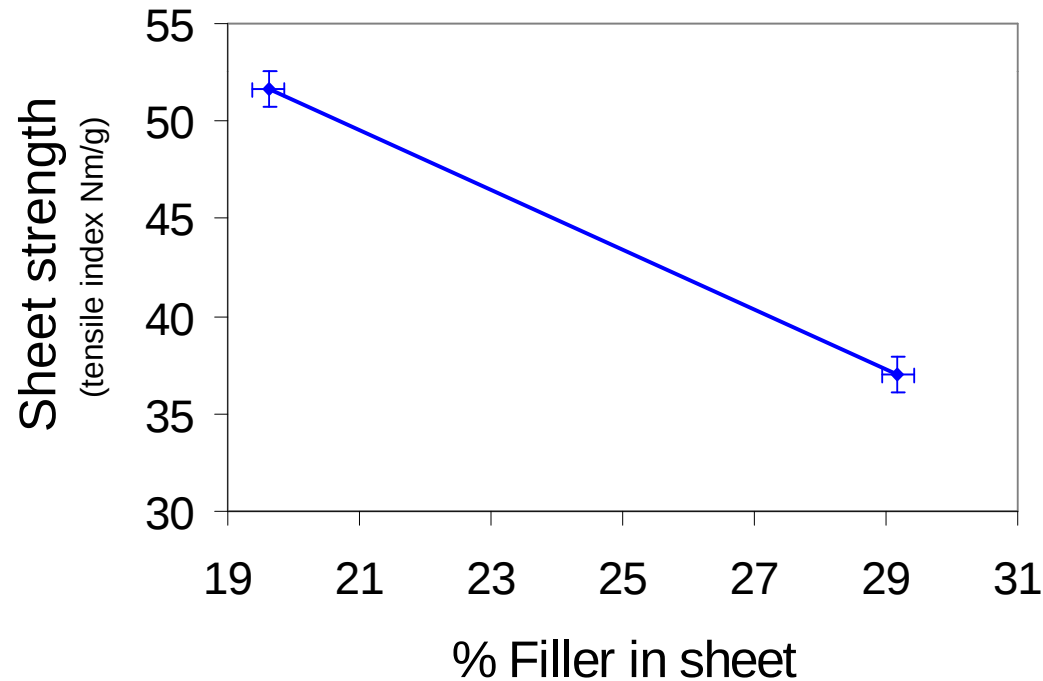
Why Is Higher Filler Content Desired?

- Fiber substitution
 - > cost savings
 - Kraft 850\$/ton;
 - PCC 100\$/ton
- Energy savings

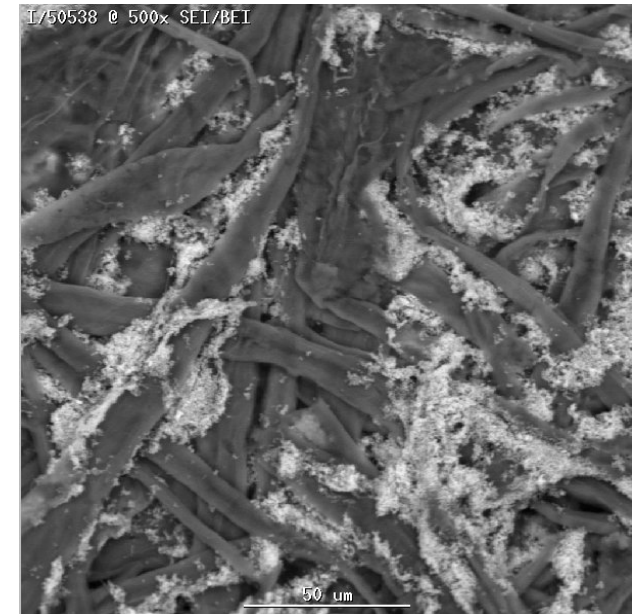


Challenges in Higher Filler Usage

Sheet Strength Reduction



Dusting and Picking



More Challenges in Higher Filler Usage

- **Sheet Properties Loss**
 - Internal sheet strength reduction
 - Surface strength reduction
 - Bulk loss
- **Poor Machine Runnability**
 - Wet web strength reduction
 - Press picking
- **Retention and Sheet Formation**
 - Fillers are harder to retain
 - Increased retention chemicals leads to poor formation

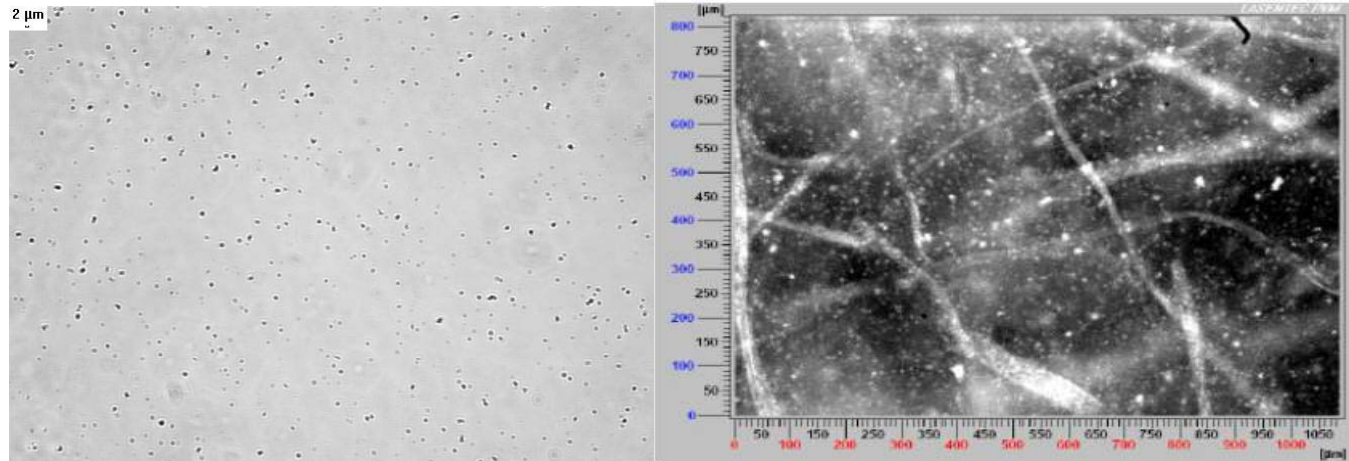
Traditional Methods of Increasing Filler Content

- Furnish Optimization
 - Composition, Refining
- Filler Optimization
 - PCC vs. GCC
 - Size and morphology
- Wet end chemical optimization
 - RDF program
 - Size press formula
 - Dry strength additives

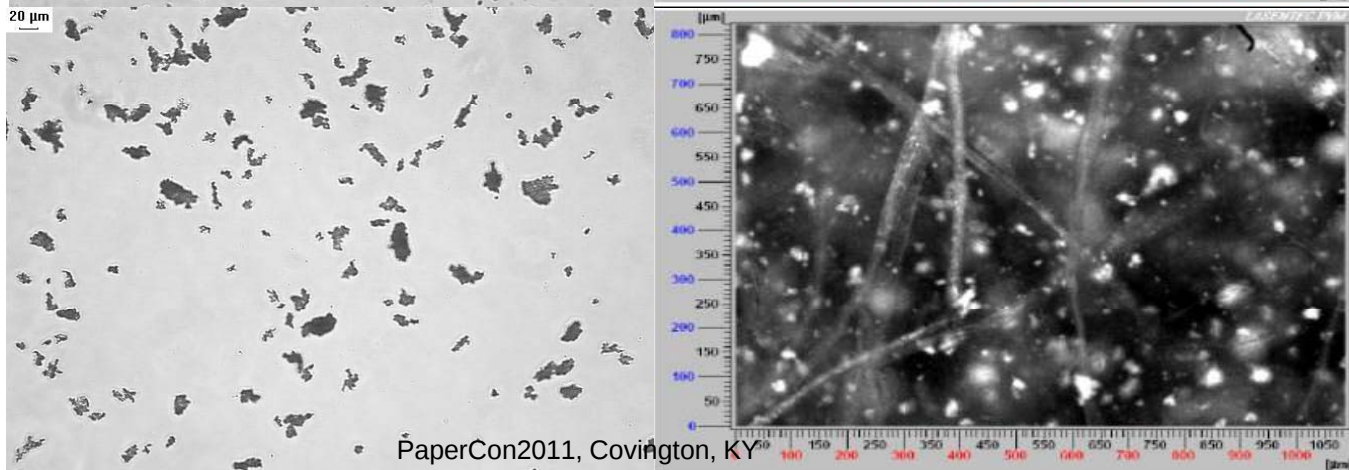
Filler Preflocculation Technology

Increase filler particle size and reduce the interference with fiber-fiber bonding

Untreated
Filler

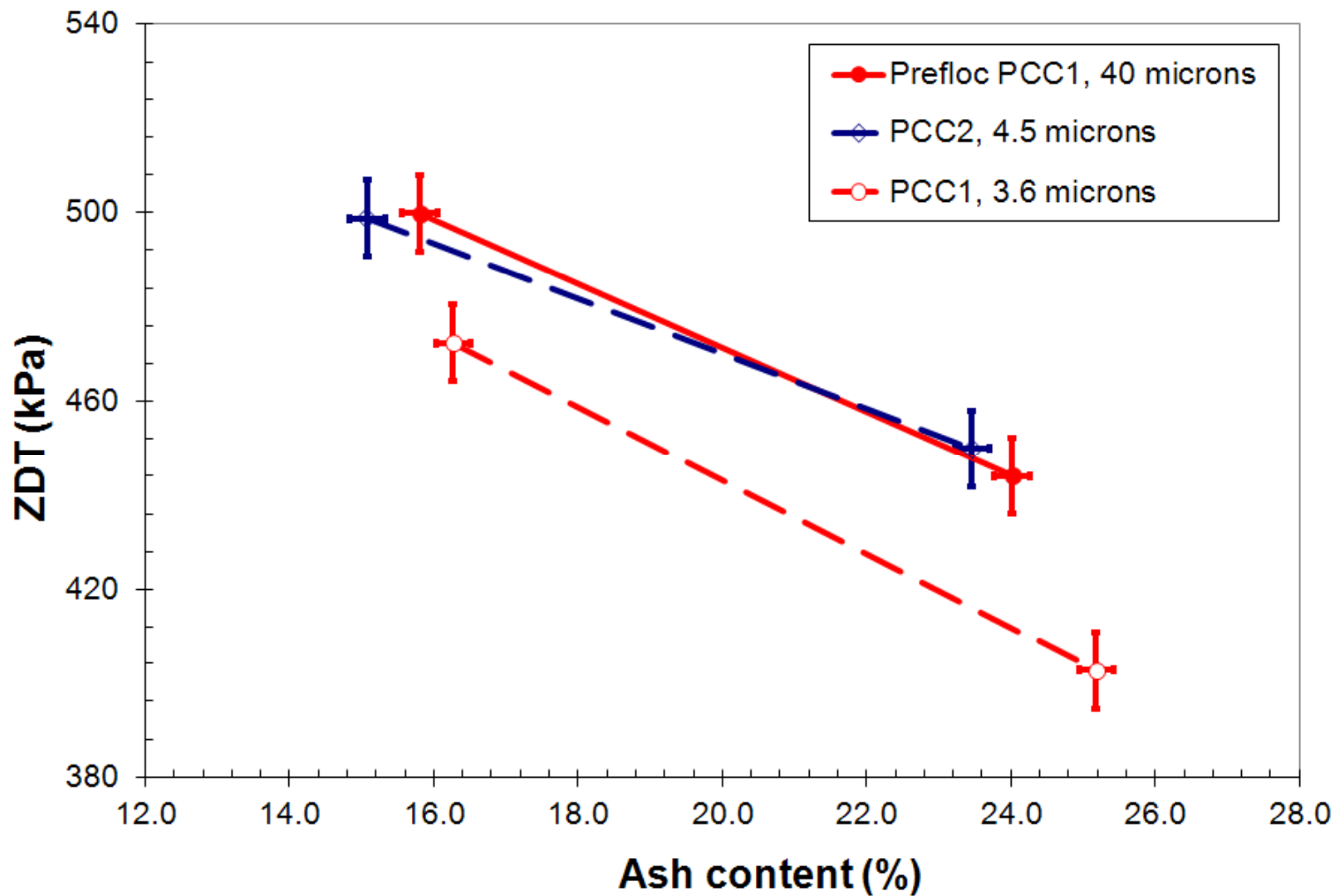


Prefloc.
Filler

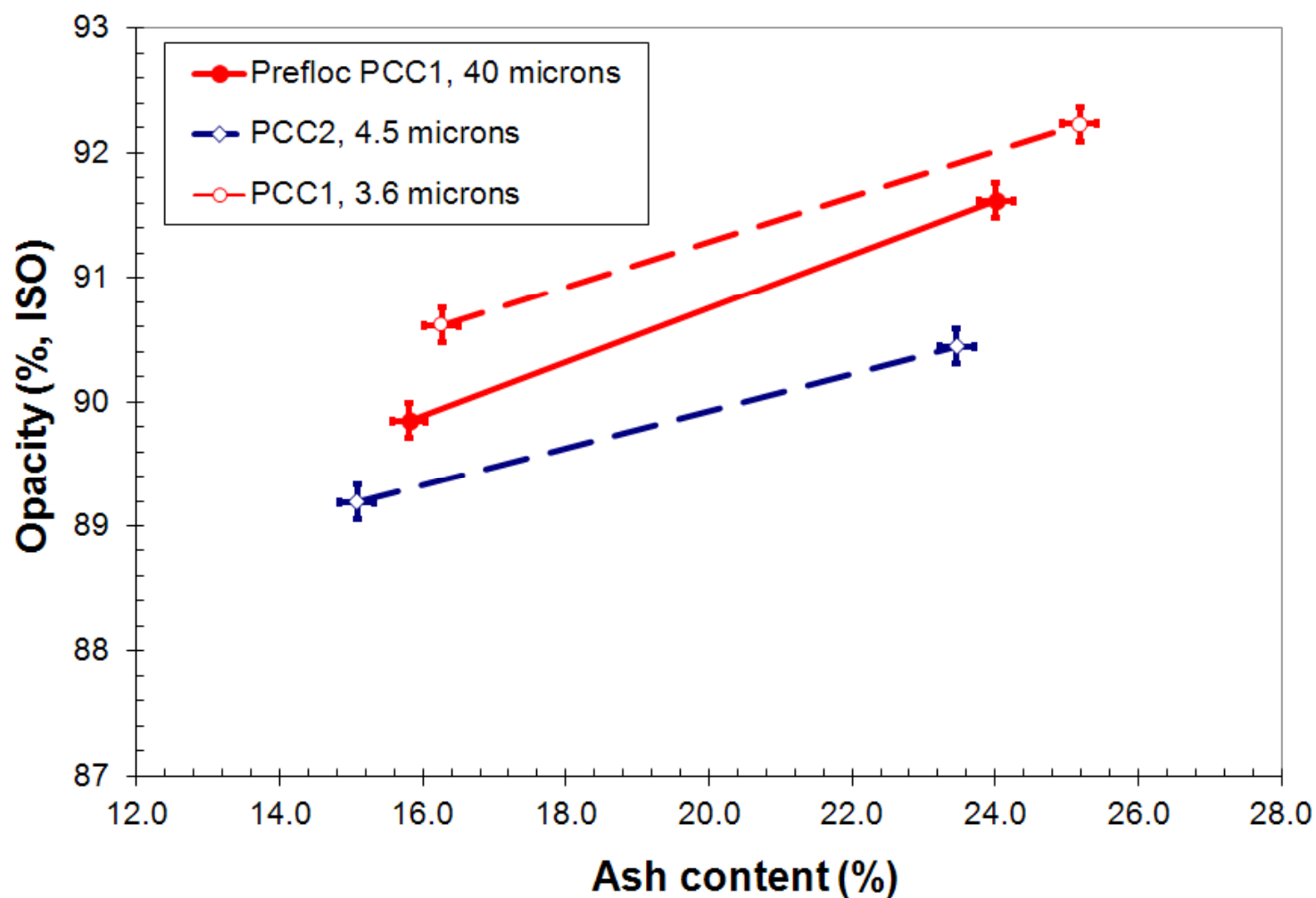


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Why Not Use Larger Sized Filler Particle?

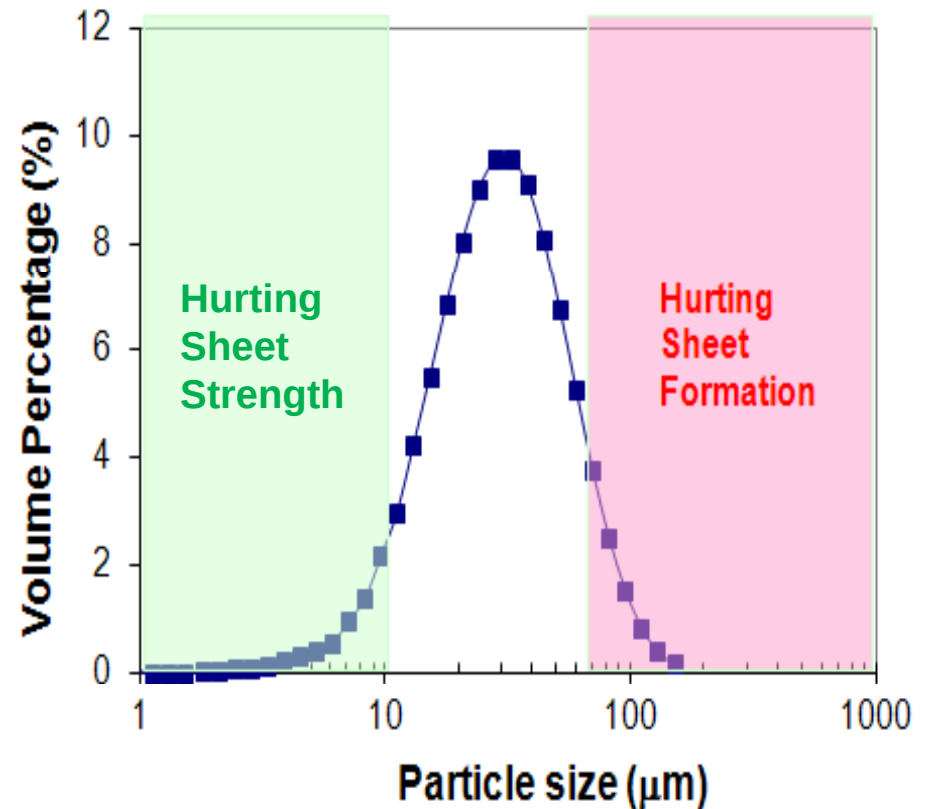


Why not Use Larger Sized Filler Particle?

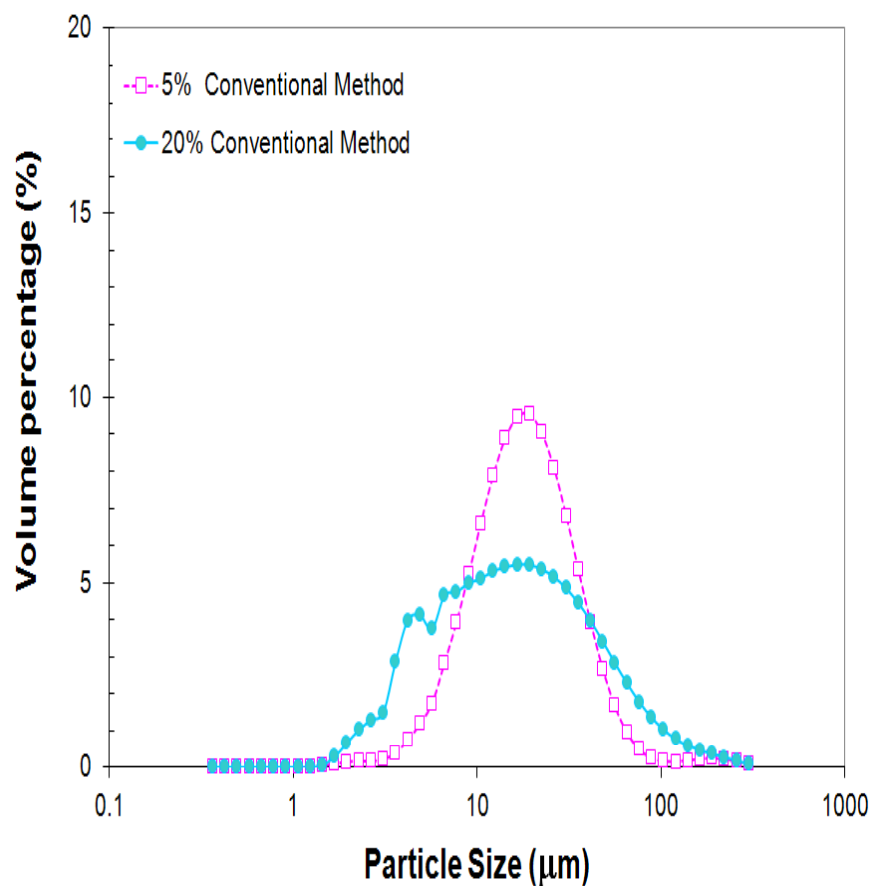


Challenges of Filler Preflocculation

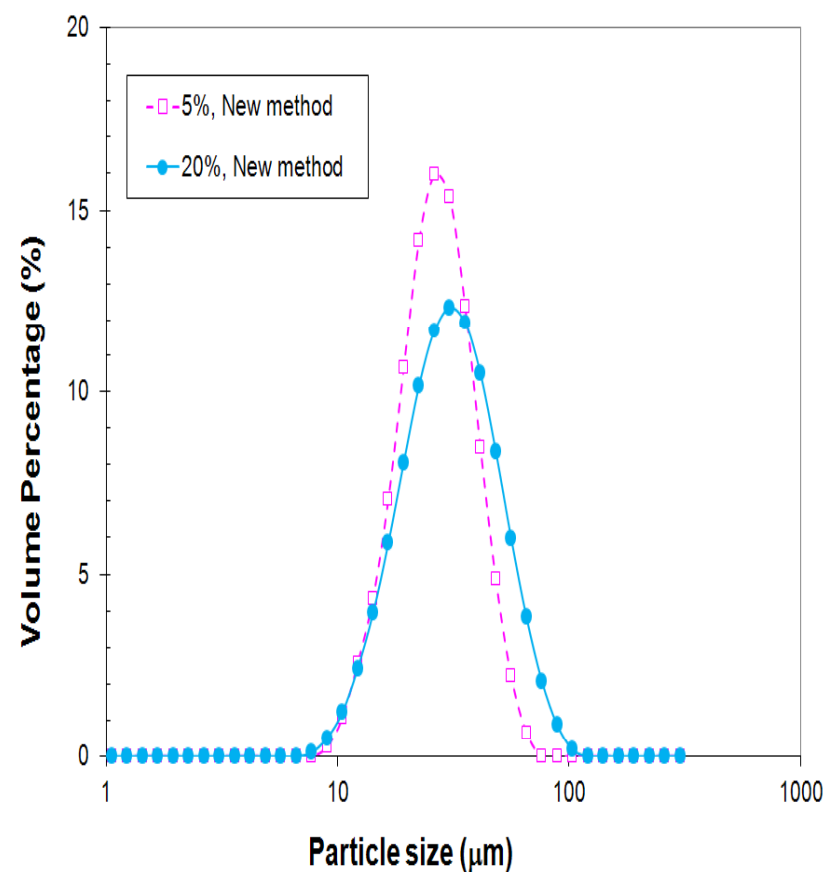
- Proper filler flocs size and size distribution
- Filler flocs to be shear resistant
 - Large shear in modern high speed paper-machine
- Economical



Controllable Preflocculation with Improved Particle Size Distribution

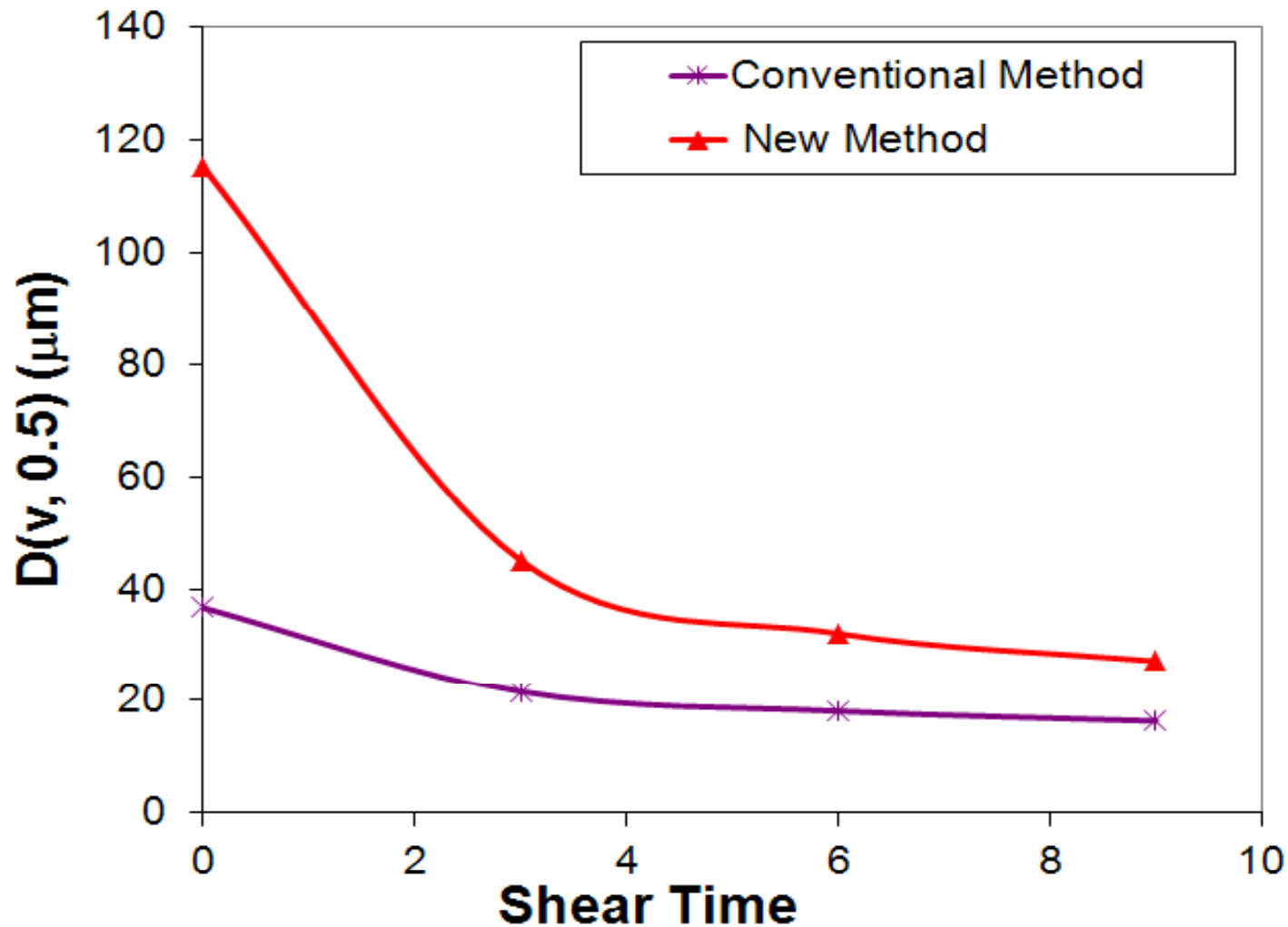


Conventional Method



New Method

Controllable Preflocculation with Improved Shear Stability



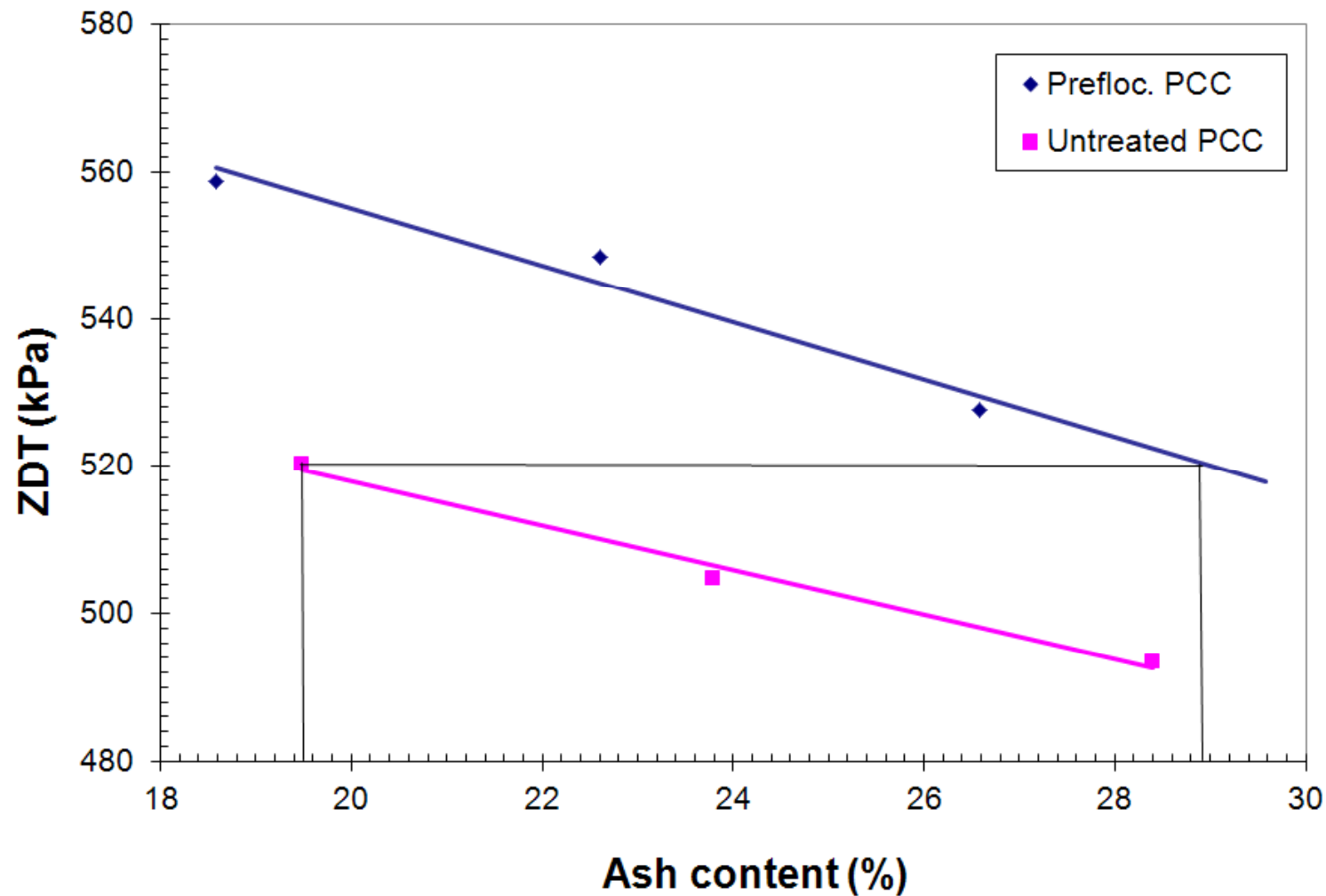
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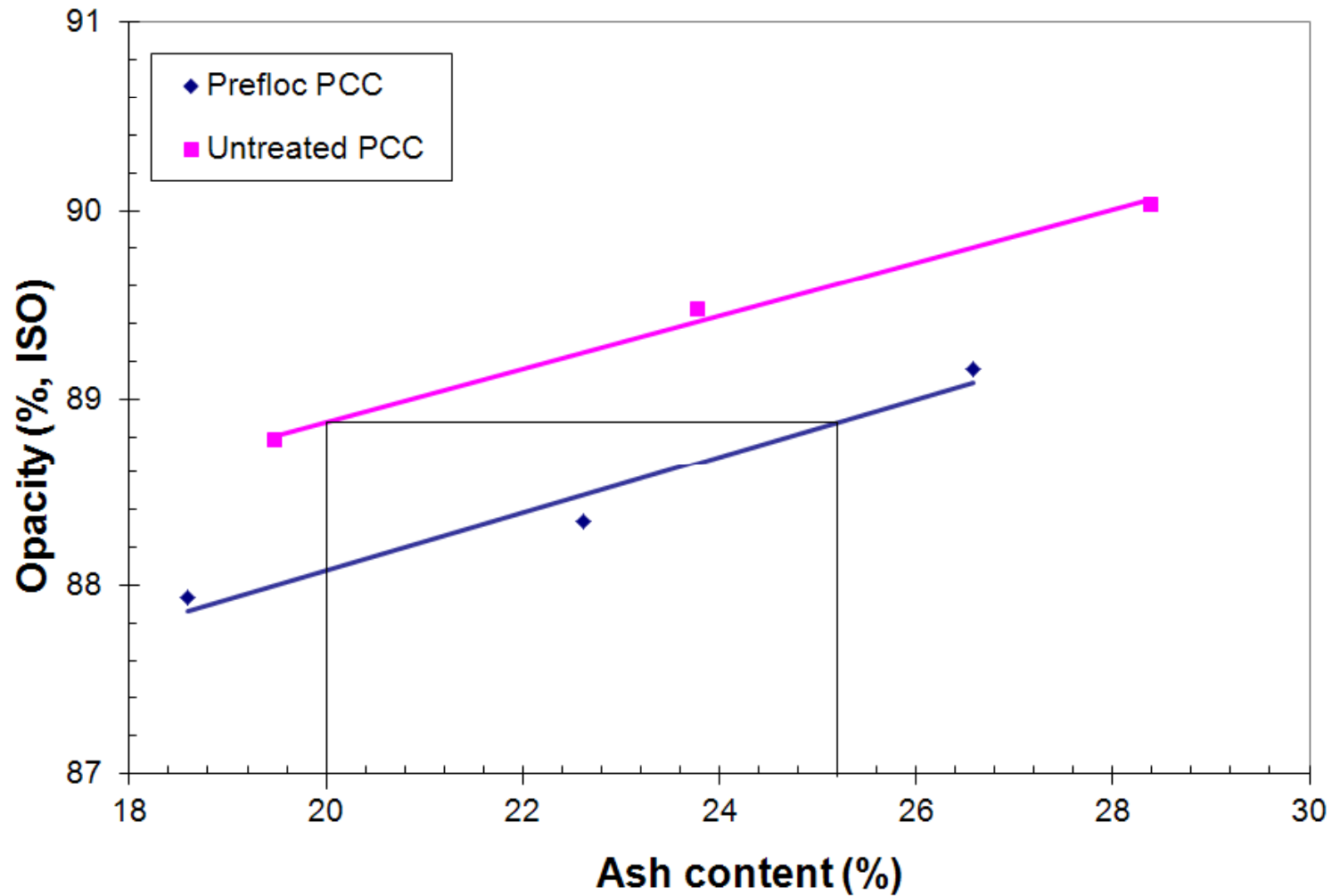
Pilot Machine Trial Conditions

- EuroFEX gap-former pilot machine at Innventia
- Machine speed: 1000 m/min
- Grade: 75 gsm sheet at 20%, 25% and 30% ash
- Furnish: 85/15 eucalyptus (26 SR) / pine (22 SR)
- Filler: Untreated or preflocculated dispersed PCC
- Chemical Additives
 - 7.5 kg/ton starch, 4.5 kg/ton OBA, 6 kg/ton AKD,
 - cationic flocculant (dosage varied), 5 kg/ton microparticle

Effect of Preflocculation on Strength



Effect of Preflocculation on Opacity



Case Study of Commercial Application

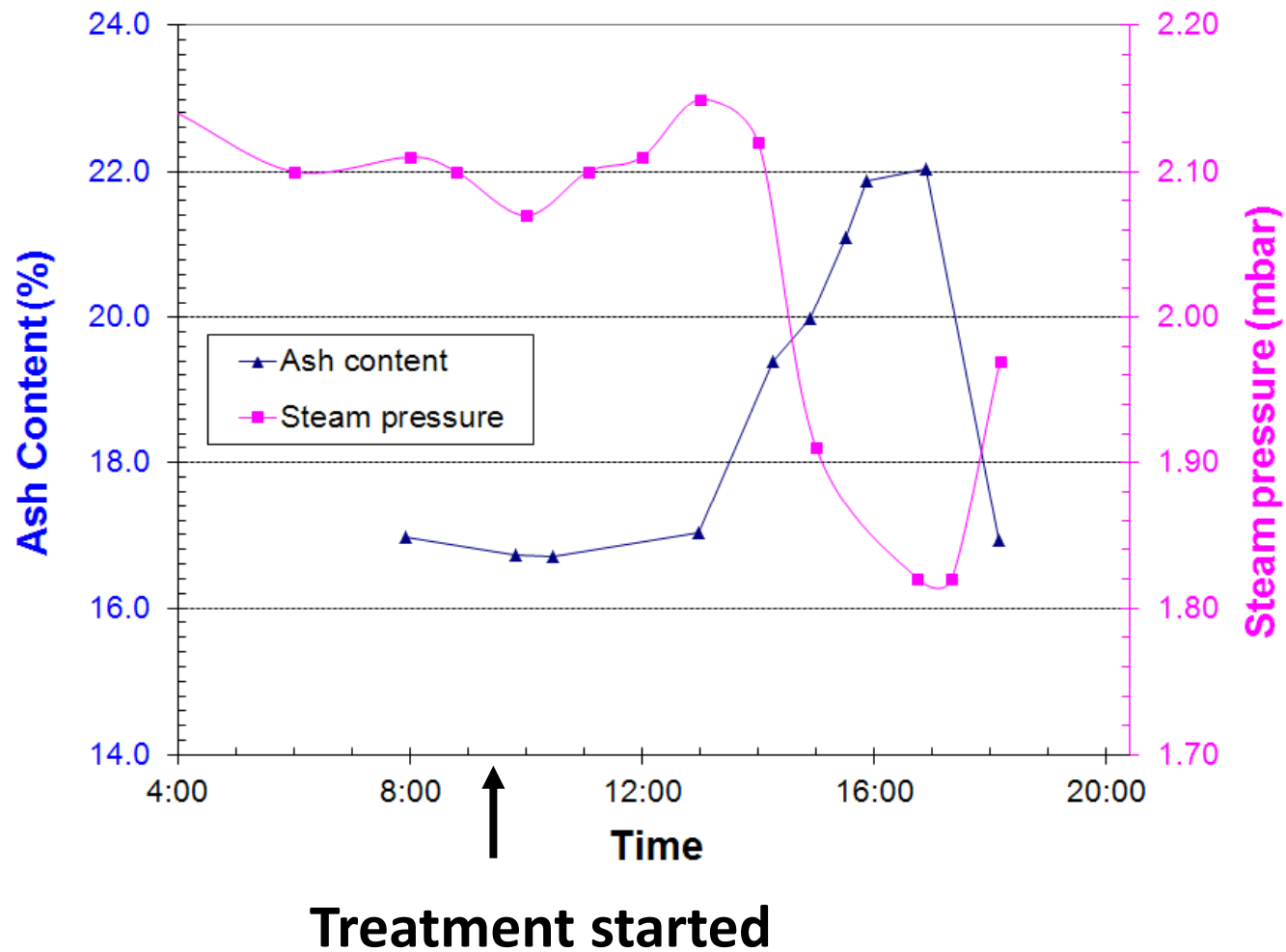
- Grade: Coated freesheet, off-machine coater
- Basis weight of base sheet: 106 gsm
- Machine Speed: 1400 m/min
- Filler
 - Starting ash content: 17%
 - Filler: 100% PCC
- Wet end chemicals
 - 5 kg/ton dry strength agent
 - 9.5 kg/ton cationic starch

Effects of Preflocculation on Sheet Properties

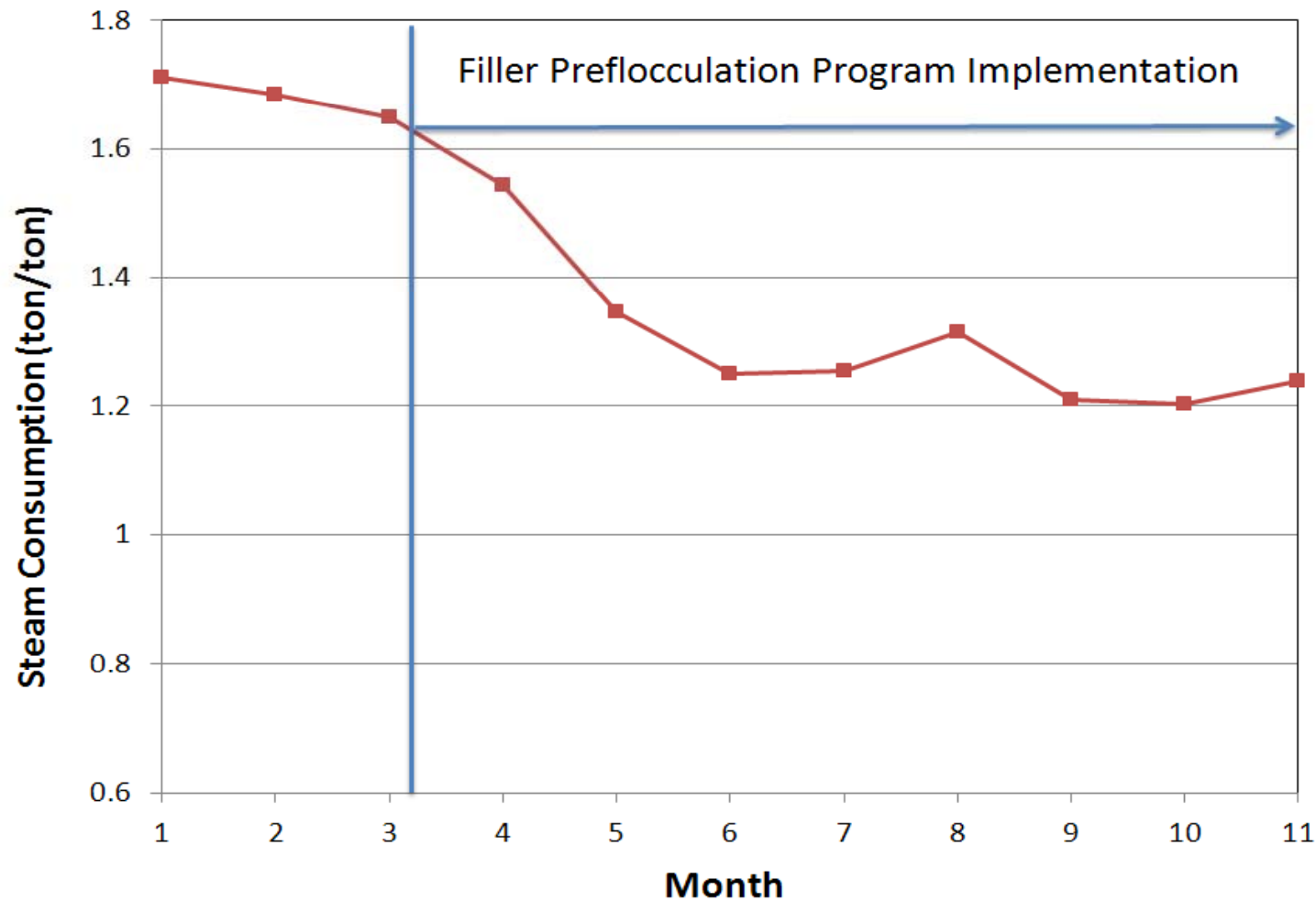
Highlights:

- Ash content increased from 17% to 22%, or 5%
- Critical sheet strength properties were maintained
- Opacity increased
- Bulk loss was 1.5%, which was recovered by furnish optimization
- Tear and stiffness decreased slightly, but within specs
- 400% ROI

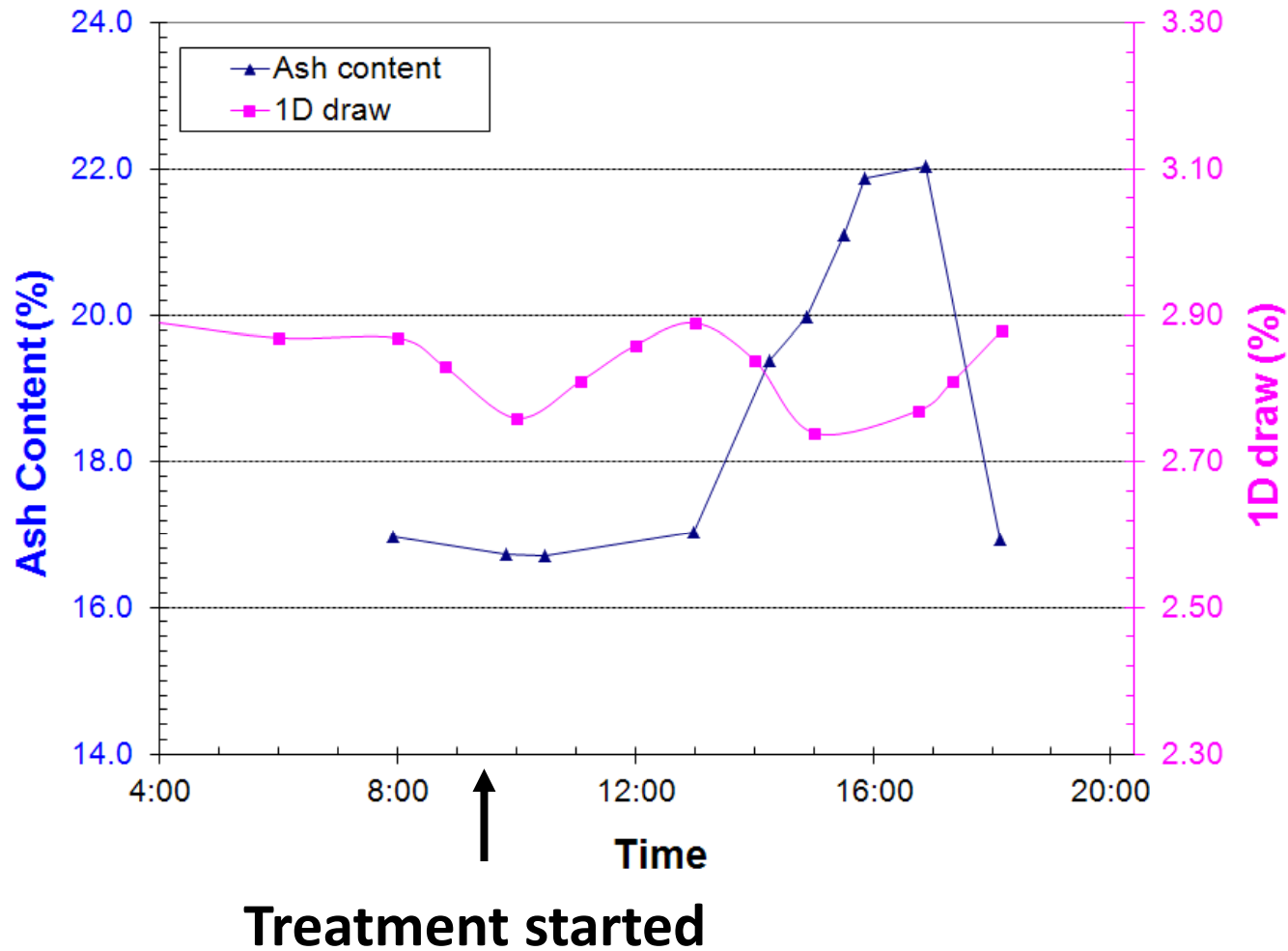
Steam Reduction with Increased Filler Content



Steam Reduction with Increased Filler Content



Impact on First Draw



Summary

- With increasing fiber prices, increasing the ash content in graphic paper can significantly decrease the production costs of papermaking
- Filler preflocculation technology was proven capable of helping papermakers increase filler content by 3% to 5% while maintaining sheet properties
- Filler preflocculation technology has minimal impact on machine runnability
- Steam consumption reduced with increased ash.