The Effect of Fines on Dewatering, Wet and Dry Web Properties

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Topics

- Background
- Experimental setup
- Results:
  - Refining
  - Dewatering
  - Wet and dry web properties
- Conclusions
Background

- Tension and relaxation properties of wet web ➔ critical for runnability
- Runnability can be controlled through tailored wet-end chemistry
- Low solids content: network strength dependent on interfibre friction
- Refining: Improves bonding ability of fibres ➔ strong and smooth dry paper
Relaxation of wet web causes slackness and serious runnability problems

Addition / removal of fines → Refining of kraft pulp Valley/ProLab → Pulp suspension → Sheet former → Wet pressing → Drainage device

- Dewatering time
- Air permeability

Fast tensile strength test rig
- Wet tensile strength
- Residual tension

Dry sheet tests
- Tensile strength
- Density
Refining
Summary: Refining

- Valley beater:
  - High amount of fines
  - Small change in share of long fibres
  - Milder treatment

- ProLab refiner:
  - High amount of fines
  - Less long fibres
  - More fibre cutting
Dewatering and air permeability
Dewatering time

(s)

SR 20 (original)  SR 30  SR 30 fines removed  SR 70  SR 70 fines removed  SR 20 + 15% fines

Valley  ProLab
Air permeability

Valley
ProLab

SR 20 (original)
SR 30
SR 30 fines removed
SR 70
SR 70 fines removed
SR 20 + 15% fines
Summary: Dewatering and air permeability

- Refining: Increased dewatering time and decreased air permeability
- Removal of fines: dewatering time and air permeability close to original
- Addition of fines: increased dewatering time and decreased air permeability
- Valley vs. ProLab:
  - Shorter dewatering times at higher refining using Valley ➔ denser sheets when using ProLab
Wet web properties
ProLab: Tensile strength

(kN/m)

- SR 20 (original)
- SR 70
- SR 20 + 15% fines
- SR 30 fines removed
- SR 70 fines removed
- SR 30

Dry solids content (%)
Valley: Residual tension after 0.475 s at 2% strain

(N/m)

Dry content (%)
ProLab: Residual tension after 0.475 s at 2% strain

Dry solids content (%) vs. (N/m) for different samples:
- SR 20 (original)
- SR 70 fines removed
- SR 20 + 15% fines
- SR 30 fines removed
- SR 30

Sample labels on the graph:
- SR 20 + 15% fines
- SR 70 fines removed
- SR 30 fines removed
- SR 20 (original)
Summary: Wet web properties

- Refining and addition of fines:
  - Decreased dry content after wet pressing
  - Increased wet tensile strength and residual tension

- Removal of fines: Decreased wet tensile strength and residual tension
Valley vs. ProLab:
- Refining using Valley beater resulted in higher dry content after wet pressing
- Slightly higher wet tensile strength at constant dry content
- Slightly higher residual tension at constant dry content

- Fines important for wet tensile strength
- Fibre properties more important for residual tension
Dry web properties
Summary: Dry web properties

- Refining: Increased density and dry tensile strength
- Removal of fines: Decreased density and tensile strength
- Addition of fines: Increased density and tensile strength
- Valley vs. ProLab:
  - External fibrillation when Valley was used → slightly higher tensile strength than for ProLab
  - Shorter fibres when ProLab was used → higher density than Valley
Conclusions

- Refining important for the mechanical properties of paper
- Fines were important for the wet tensile strength
- Fibre properties more important for the residual tension
- Drawback: longer dewatering → further investigation needed