Starch for surface sizing

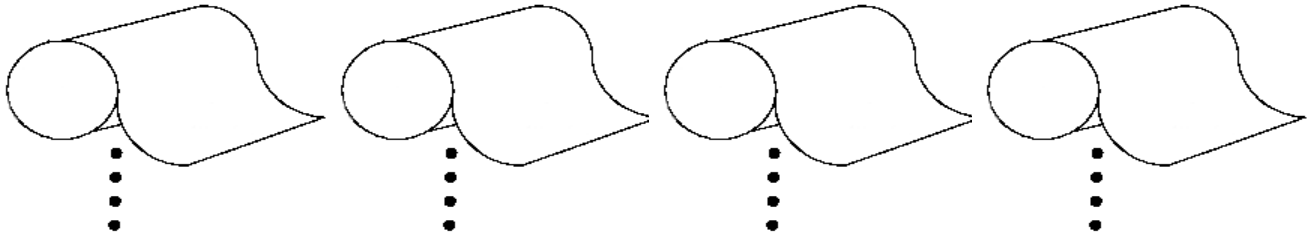
Topics

Enzyme conversion for surface sizing application

- Batch process
- Continuous process
- Critical control points
- Important starch parameters
- Stability in storage
- Troubleshooting
- Paper properties

Starch in Papermaking

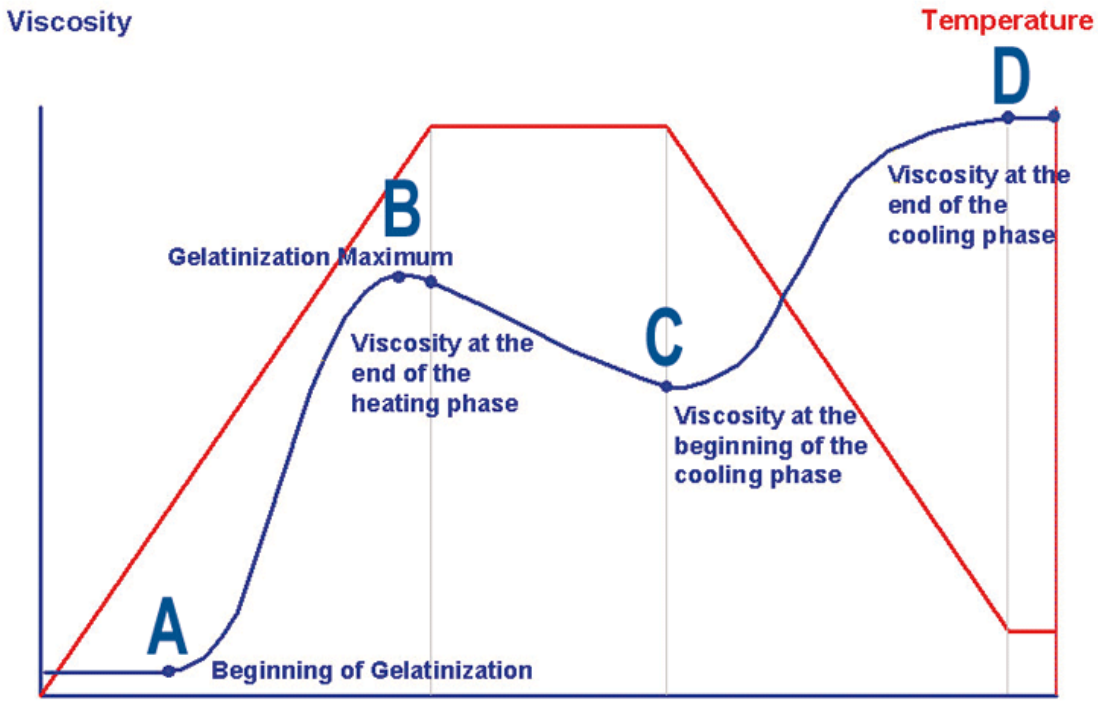
Cellulose
Fillers
Starch
Additives



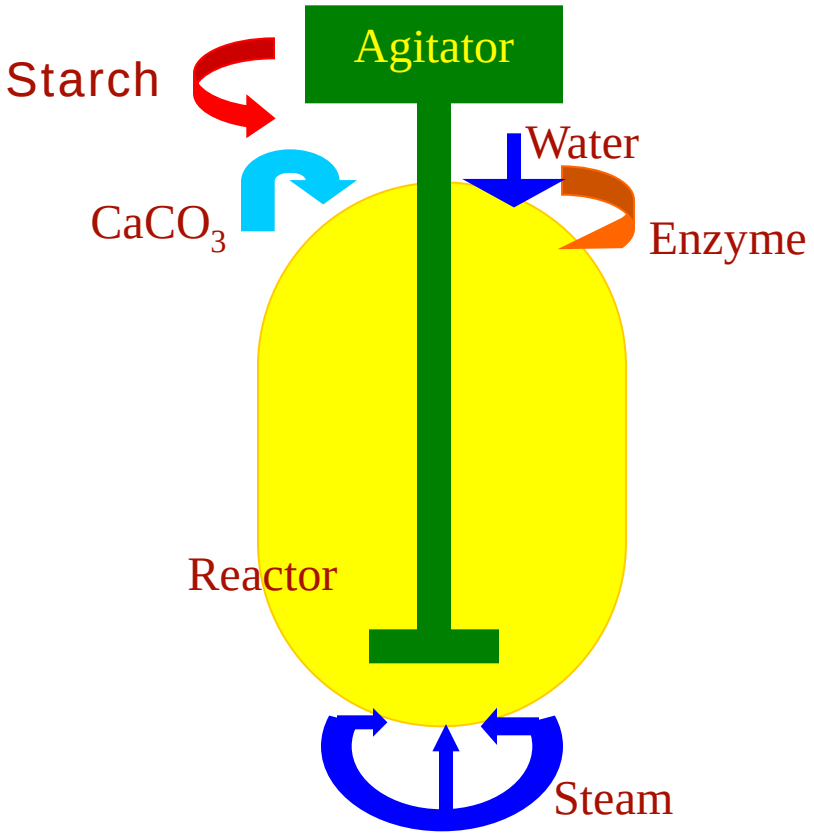
	Wet End	Spray Starch	Surface Starch	Coating
Process	•Paper Formation •Retention •Dry Strength	•Improve Surface Strength •Improve Ply Bond •Improve Internal •Bond	•Improve Printing •Improve Surface Strength Fill voids	•Improve Optical, •Printing and •Functional Properties
Starch	•Cationic •Amphoteric	•Unmodified Starch •Polymers	•Oxidized •Enzyme Converted •Other Modified •Specialty	•Starch and Latex Mixtures with Fillers
Typical Uptake	0.3 – 2%	1-4%	2-6%	0.5 – 2.0%

Surface sizing starch

- Paper makers use native starch which is converted in-situ for the surface sizing application using alpha amylase enzymes
- The viscosity develops during the cooking and the enzymes assist in reducing the final cooked starch viscosity

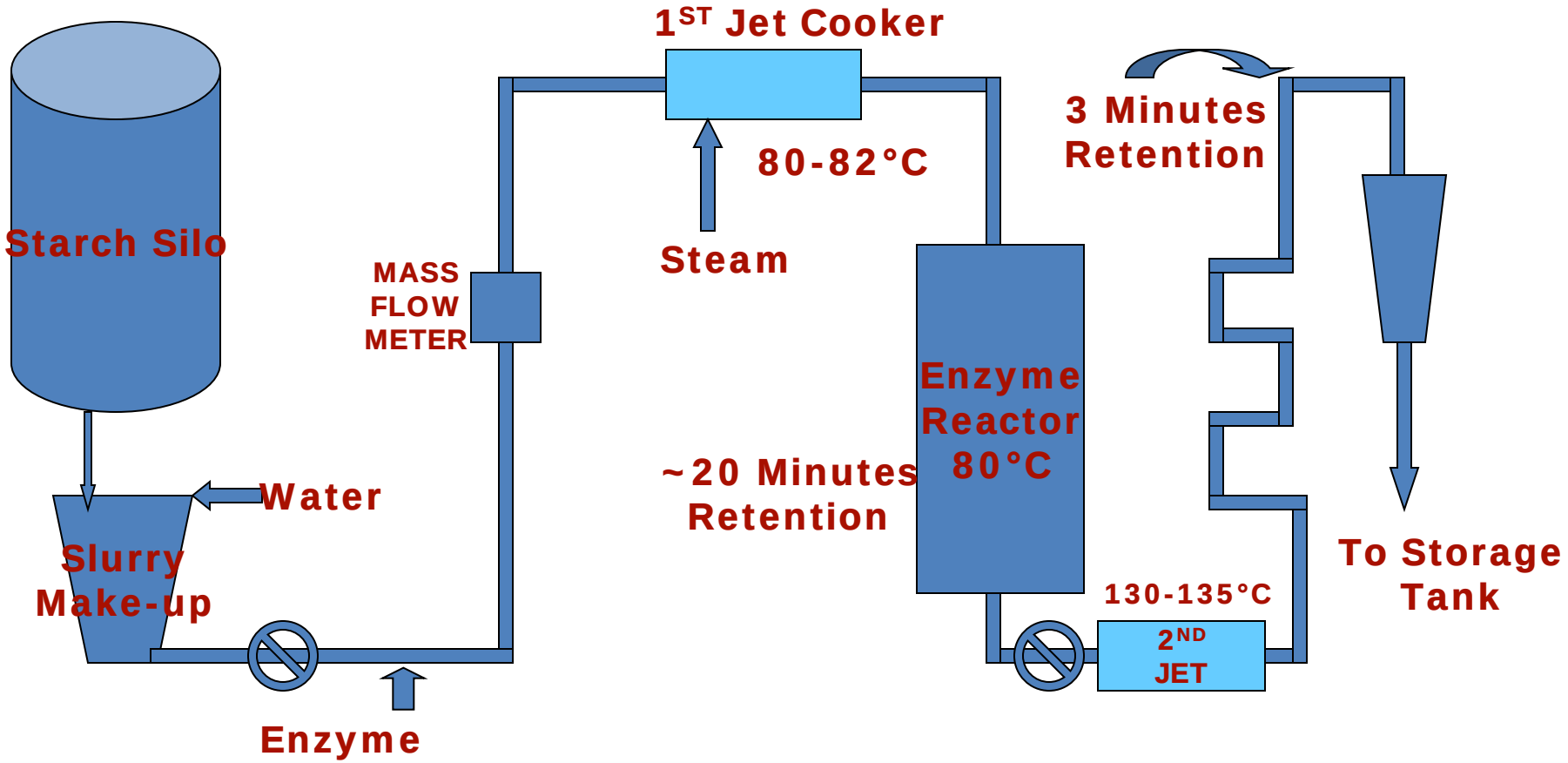


Batch Enzyme Conversion



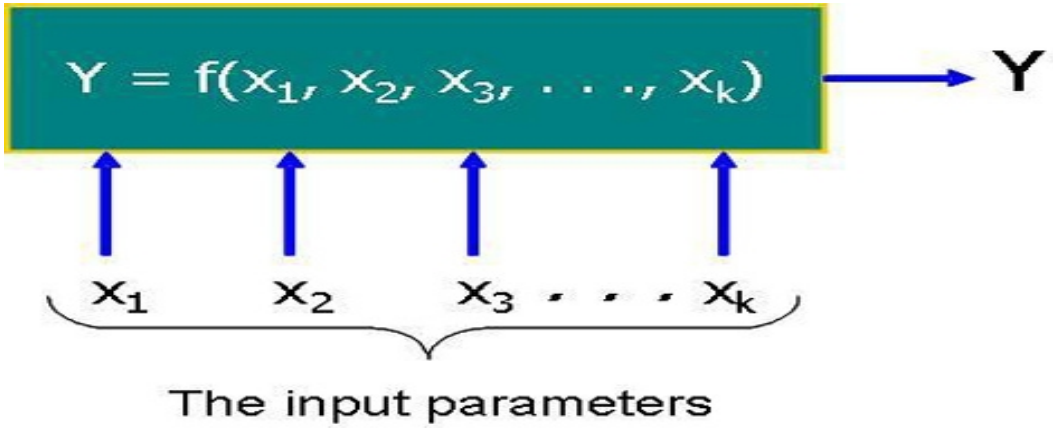
- Fill Reactor with 1st Water
- Add 0.05% Calcium Carbonate on Starch
- Add Starch
- Add 2nd Water to Wash Dome and sides
- Heat to 55°C
- Add Enzyme
- Heat to 80°C and hold for 15 minutes
- Heat to 110°C and hold 10 minutes

Continuous Enzyme Conversion



Critical Control points

- Make – up: affects starch solids
- Enzyme dosage: affects the final viscosity
- Mass flow meters: Controls retention time in the convertor
- Jet 1 temperature: affects the enzyme activity – starch gelling
- Jet 2 temperature: denatures the enzymes – stop breakdown of viscosity in the storage tank
- Variables are interdependent to produce quality starch



Starch important parameters

Viscosity

- Starch solids (make down and dilution)
- Enzyme dosage
- Cooking (temperatures)
- Temperature (storage and measurement)
- Shear rate – pump speeds and mixing
- Setback

Factors Affecting Storage Stability

- pH – 7 – 7.5 to prevent RAPS
- Temperature (avoid 65°C to 90°C for long time)
- Gentle agitation required
- Cleanliness of storage tank – any existing crystals will grow bigger and contaminate new starch

Factors Affecting Day Tank Viscosity

- Temperature
- Solids content
- Fibre – return from paper
- Sludge formation
- Setback

Troubleshooting the size press

Variable hold out

- Wet-end sizing efficiency*
- Retention of size on the paper
- Variation in filler and fines surface area
- Surfactants

High hold out

- Low cobb
- Low sheet density
- Low starch solids
- Low starch viscosity
- High paper moisture into size press

*Tests for sizing efficiency and fines and filler content:

- Percent active sizing agent
- Test pre-size press cobb
- White water consistency
- Headbox or machine chest furnish ash
- Headbox or machine chest furnish fines

Starch Solids/Viscosity
Paper Property Relationship

Property	Low Viscosity High Solids (more penetration)	High Viscosity Low Solids (stays on surface)
Surface Strength	Good	Better
Internal Strength	Better	Good
Porosity	Decrease	Decrease
Ink Hold Out	Good	Better
Opacity	Slight loss	Least Loss
Stiffness	Increase	Most Increase

CONTACT DETAILS

FOR MORE INFORMATION PLEASE CONTACT

NKULI KHANYEZA

TECHNICAL SERVICES MANAGER

011 458 5000

nkuli.khanyeza@tongaat .com