ABTCP 2015 48º CONGRESSO E EXPOSIÇÃO INTERNACIONAL DE CELULOSE E PAPEL

48º CONGRESSO INTERNACIONAL DE CELULOSE E PAPEL
1ª CONFERÊNCIA IBEROAMERICANA SOBRE BIOECONOMIA

EFEITO DA ADIÇÃO DE FIBRAS DE BAGAÇO DE CANA DE AÇÚCAR NAS PROPRIEDADES DE FOLHAS FORMADAS EM LABORATÓRIO

Effect of the Addition of Sugarcane Bagasse Fibres on the Properties of Laboratory Sheets

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REALIZAÇÃO ABTCP

CORREALIZAÇÃO IPEF

MAIN OBJECTIVE

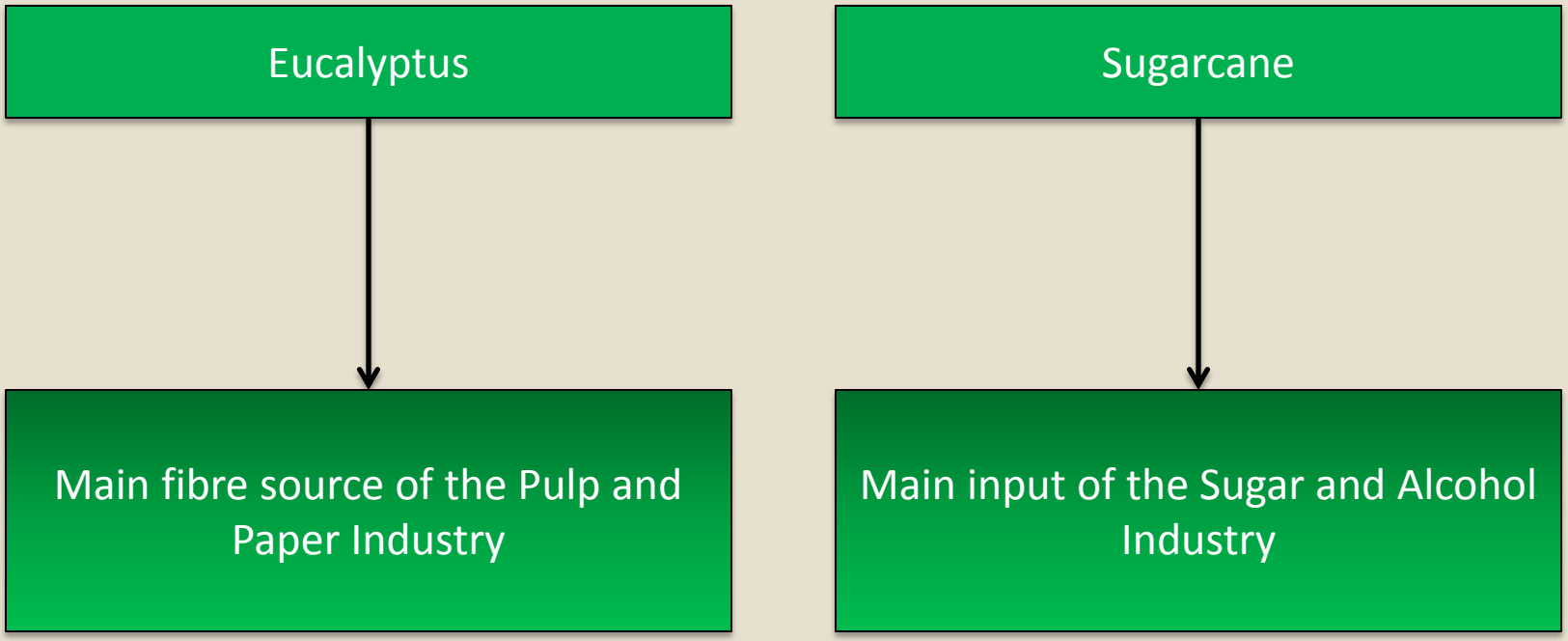
- To analyse the influence of sugarcane bagasse fibres on laboratory sheet quality when blended into eucalyptus fibres using a 50-50 blend.

INTRODUCTION

- Fibre blends are used for:
  - ✓ improving the quality of a pulp;
  - ✓ utilizing fibrous raw material surpluses;
  - ✓ reducing costs of the final product.

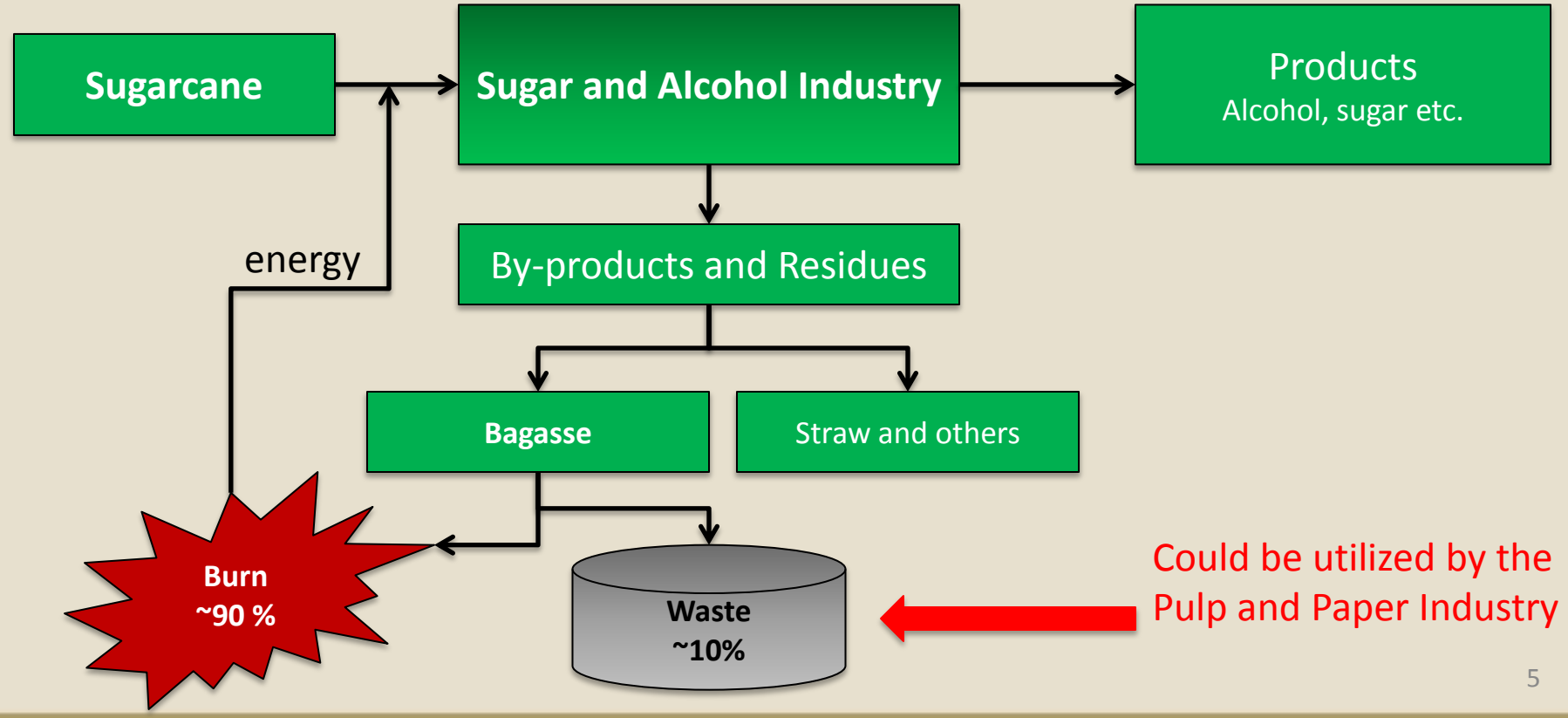
INTRODUCTION

- In Brazil:



INTRODUCTION

❖ In Brazil:



INTRODUCTION

- Around the World:
  - ✓Many countries generate great amounts of sugarcane bagasse
  - ✓Just a few use it in the Pulp and Paper Industry. Examples:
    - Argentina
    - Colombia
  - ✓Brazil does not have a sugarcane-based pulp factory.

INTRODUCTION

Sugarcane Bagasse in the Pulp and Paper Industry

- Main advantages:
  - ✓Low cost
  - ✓Easy acquisition
  - ✓High carbohydrate content
  - ✓Low refining energy consumption
- Main disadvantages:
  - ✓Low process yield
  - ✓High ash content

MATERIALS AND METHODS

Pulps

- Two different pulps.
- Main features:
  - ✓Bleached;
  - ✓Virgin;
  - ✓Appropriate for the Paper Industry.

MATERIALS AND METHODS

Pulps

Fibre Source	Cooking Process	Origin
Eucalyptus Wood	Sulfate	Brazil
Sugarcane Bagasse	Soda	Argentina

MATERIALS AND METHODS

Pulps

Nomenclature	% of eucalyptus fibres	% of sugarcane bagasse fibres
Pulp B	0	100
Pulp E	100	0
Pulp BE	50	50

MATERIALS AND METHODS

Characterization

- ✓**Pulp B**
- ✓**Pulp E**

Test	Method
Photography	Microscopy
Average fibre length	ABNT NBR 15066
Viscosity	ISO 5351
Extractives soluble in acetone	ABNT NBR 14578
alpha, beta and gamma celluloses	ABNT NBR 14032
Ash content at 525 °C	ABNT NBR 13999

MATERIALS AND METHODS

Optical Properties

- ✓Pulp B
- ✓Pulp E
- ✓Pulp BE

ISO Brightness
ABNT NBR 14528

→ **Brightness Reversion**
ABNT NBR 14530

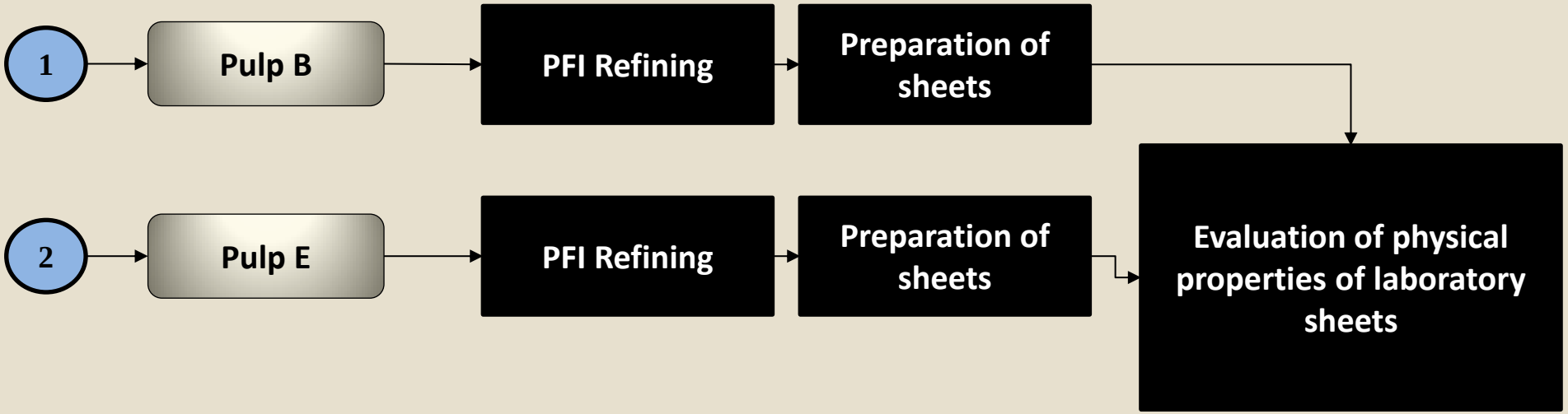
Accelerated Ageing
4 h @ 105 °C

CIELAB Colour Space
ABNT NBR 14999

→ **Colour Difference**
CIE 15

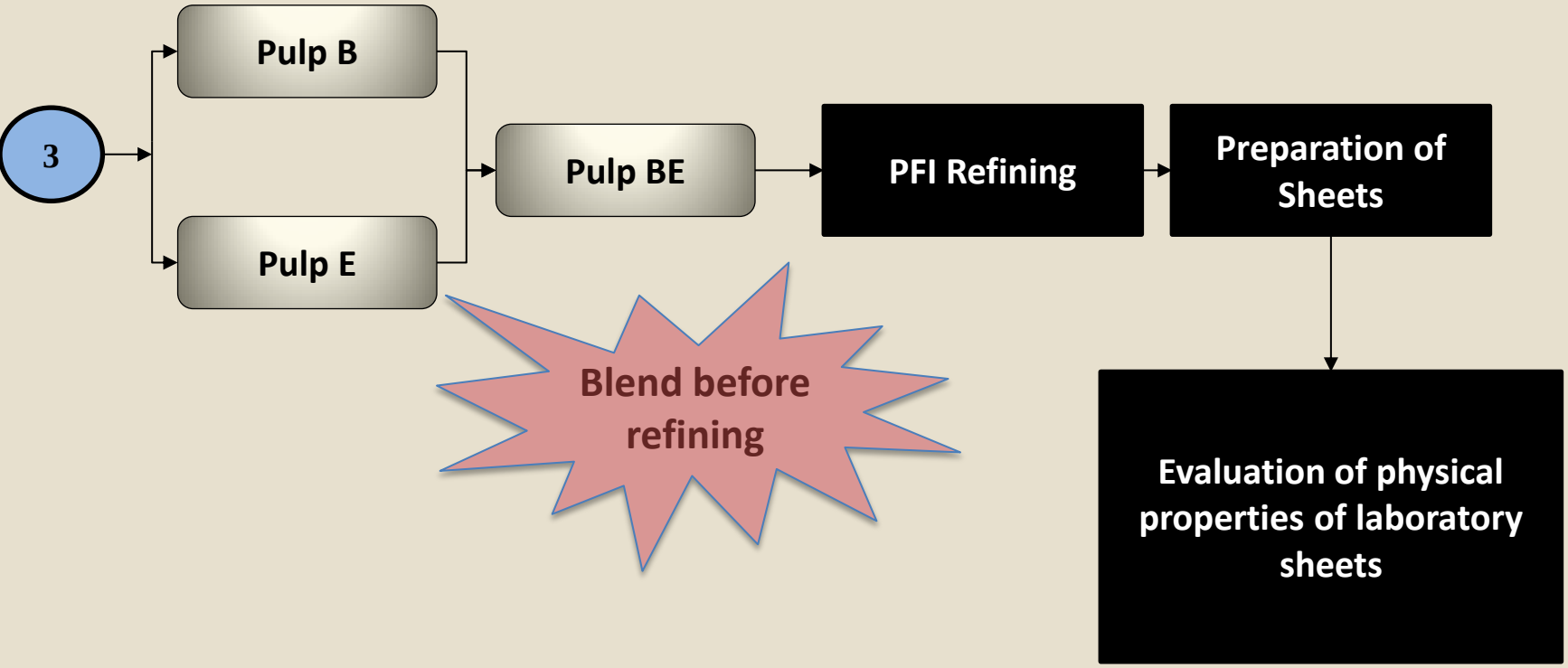
MATERIALS AND METHODS

Refining and Preparation of Laboratory Sheets



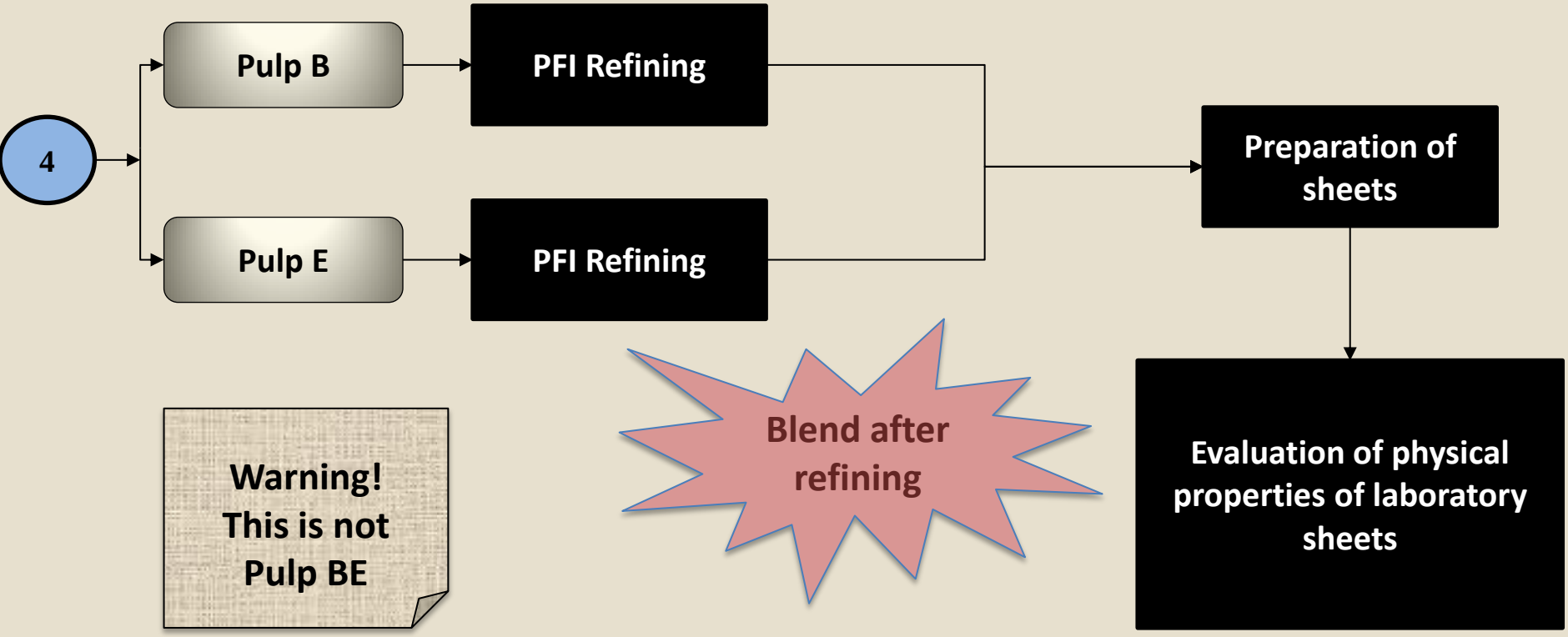
MATERIALS AND METHODS

Refining and Preparation of Laboratory Sheets



MATERIALS AND METHODS

Refining and Preparation of Laboratory Sheets



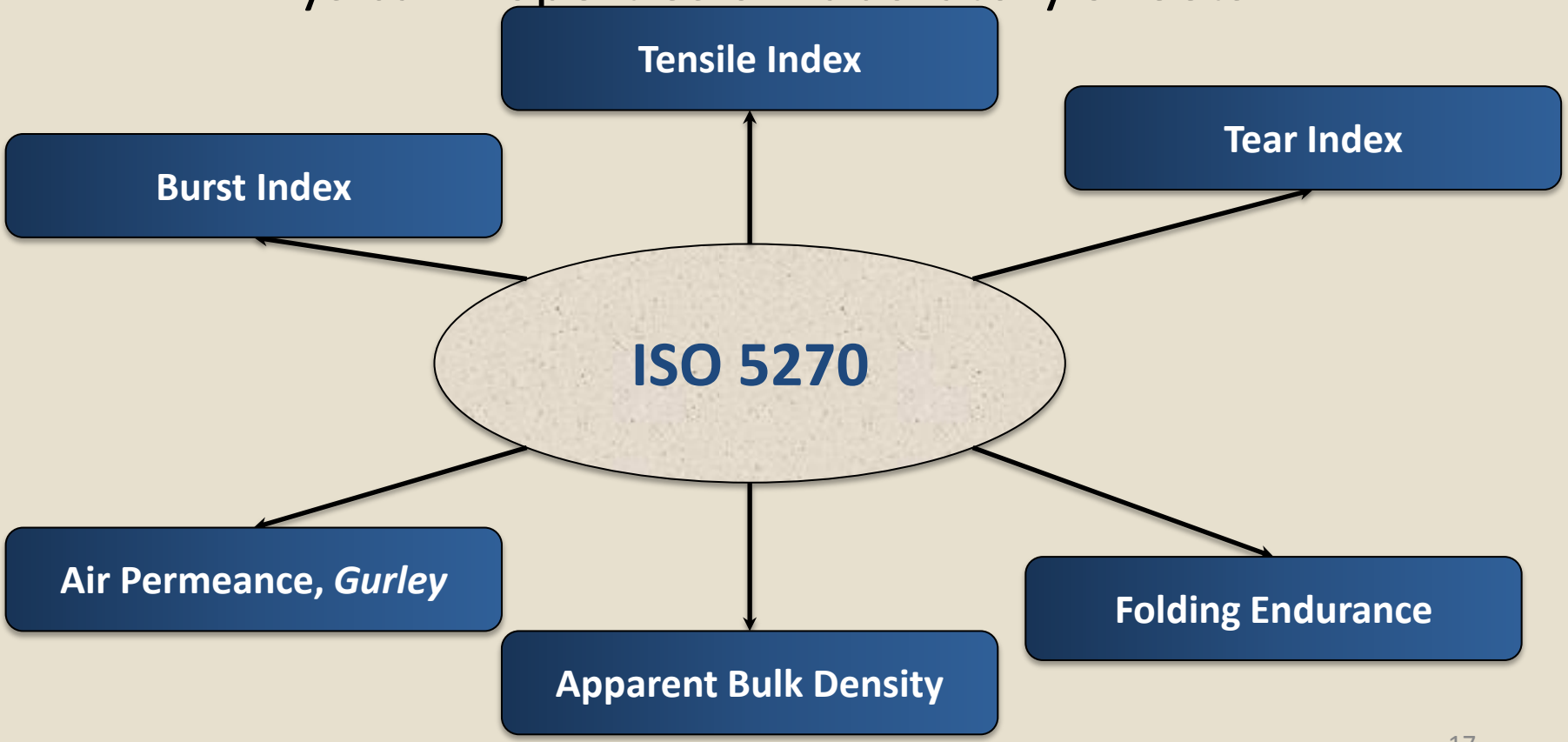
MATERIALS AND METHODS

Refining and Preparation of Laboratory Sheets

Test	Standard
PFI Mill Refining	ISO 5264-2
Drainability, *Schopper-Riegler*	ISO 5267-1
Preparation of Laboratory Sheets	ISO 5269-1

MATERIALS AND METHODS

Physical Properties of Laboratory Sheets



MATERIALS AND METHODS

Physical Properties of Laboratory Sheets

- Tensile Index
- Tear Index
- Burst Index
- Air Permeance, *Gurley*
- Folding Endurance
- Apparent Bulk Density

ISO 5270

Tests for low grammage sheets (60 g/m² oven-dry basis)

MATERIALS AND METHODS

Scanning Electron Microscopy (SEM)

Used a Scanning Electron Microscope for analysing the surfaces of laboratory sheets

RESULTS

Microscopic Characterization

Sugarcane bagasse

Eucalyptus

More heterogeneous

RESULTS
Microscopic Characterization

Sample	Fibre Length (mm)			Standard Deviation (mm)
	The shortest	The longest	Average	
Pulp B	0.21	3.96	**0.80**	0.48
Pulp E	0.25	1.21	**0.78**	0.20

- Same fibre length averages
- Variation of sugarcane bagasse fibre lengths is greater

RESULTS
Chemical Characterization

Property	Pulp B	Pulp E
Soluble in acetone (%)	0.14	0.11
Ash content at 525 °C (%)	0.82	0.22
Viscosity (mL/g)	680	700
Alpha Cellulose(%)	79.4	91.1
Beta Cellulose (%)	17.4	6.0
Gamma Cellulose (%)	3.1	2.9

RESULTS
Accelerated Ageing

Sample / Property	ISO Brightness(%) Before	ISO Brightness(%) After	Brightness Reversion (%)
Pulp B	85.67	84.45	**1.22**
Pulp E	91.70	90.09	**1.62**
Pulp BE	88.33	86.92	**1.41**

❖Decrease of brightness reversion in relation to eucalyptus pulp

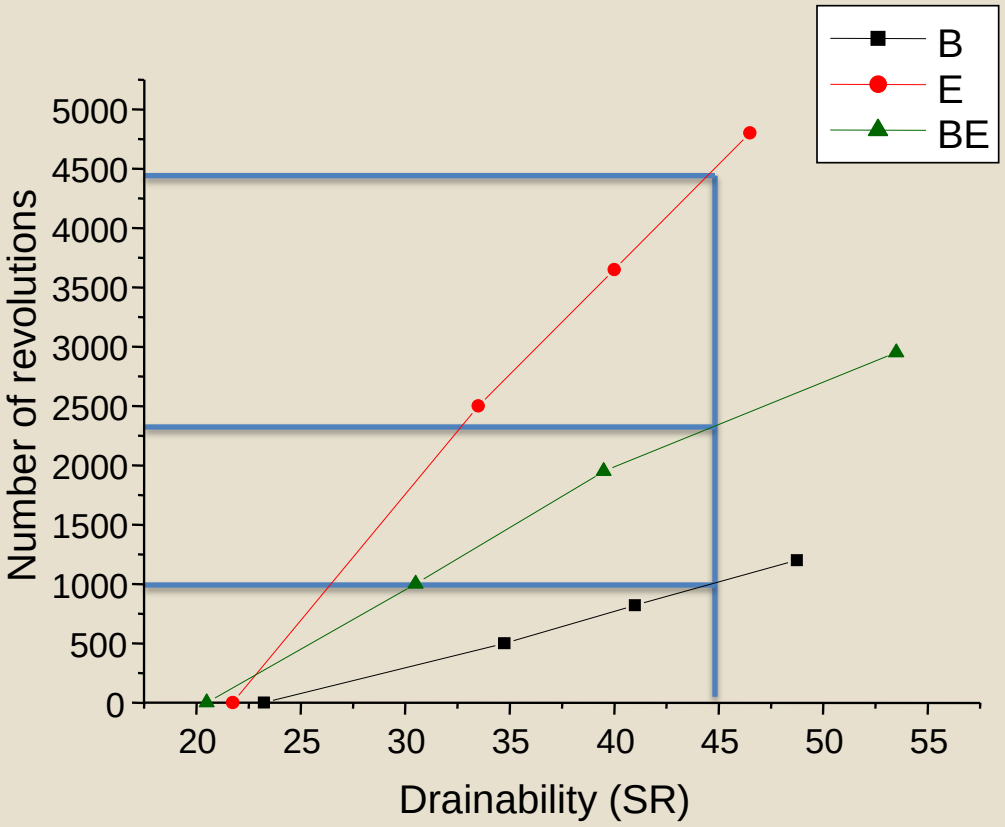
RESULTS
Accelerated Ageing

Sample	CIELAB Colour Space						**Colour Difference**
	L*		a*		b*		
	Before	After	Before	After	Before	After	
Pulp B	95.71	95.49	-0.31	-0.47	2.81	3.36	**0.61**
Pulp E	98.14	97.83	-0.68	-0.80	2.65	3.30	**0.73**
Pulp BE	96.73	96.49	-0.43	-0.57	2.62	3.28	**0.71**

❖Colour difference is not perceptible to the unaided eye

RESULTS

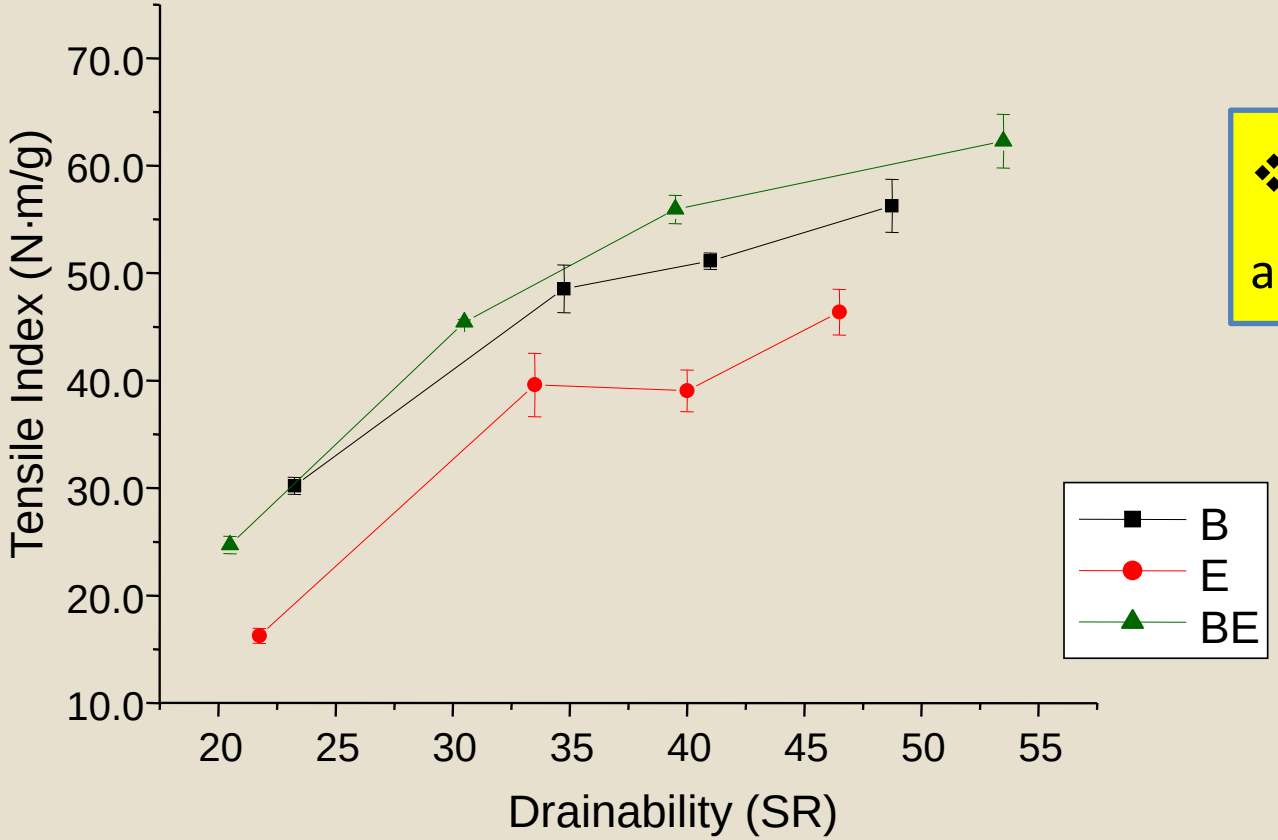
Number of Revolutions vs. Refining Degree



❖Severe decrease of number of revolutions

RESULTS

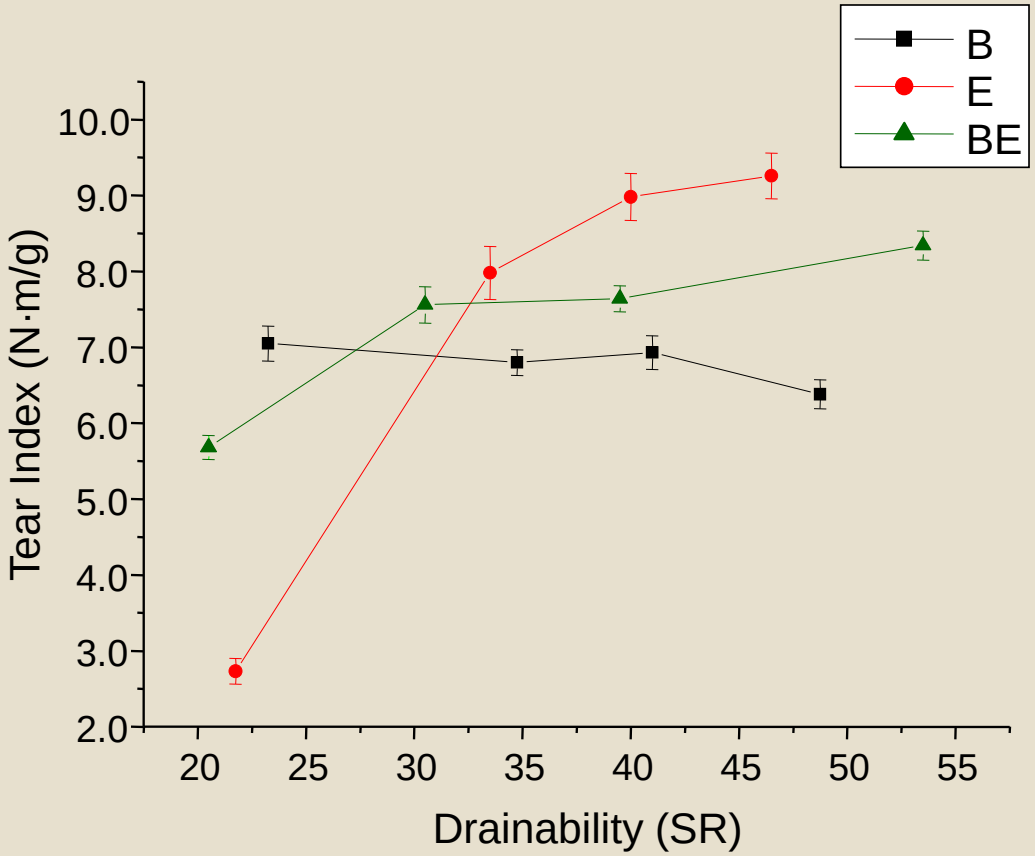
Tensile Index vs. Refining Degree



❖Tensile Index rise for all refining degrees

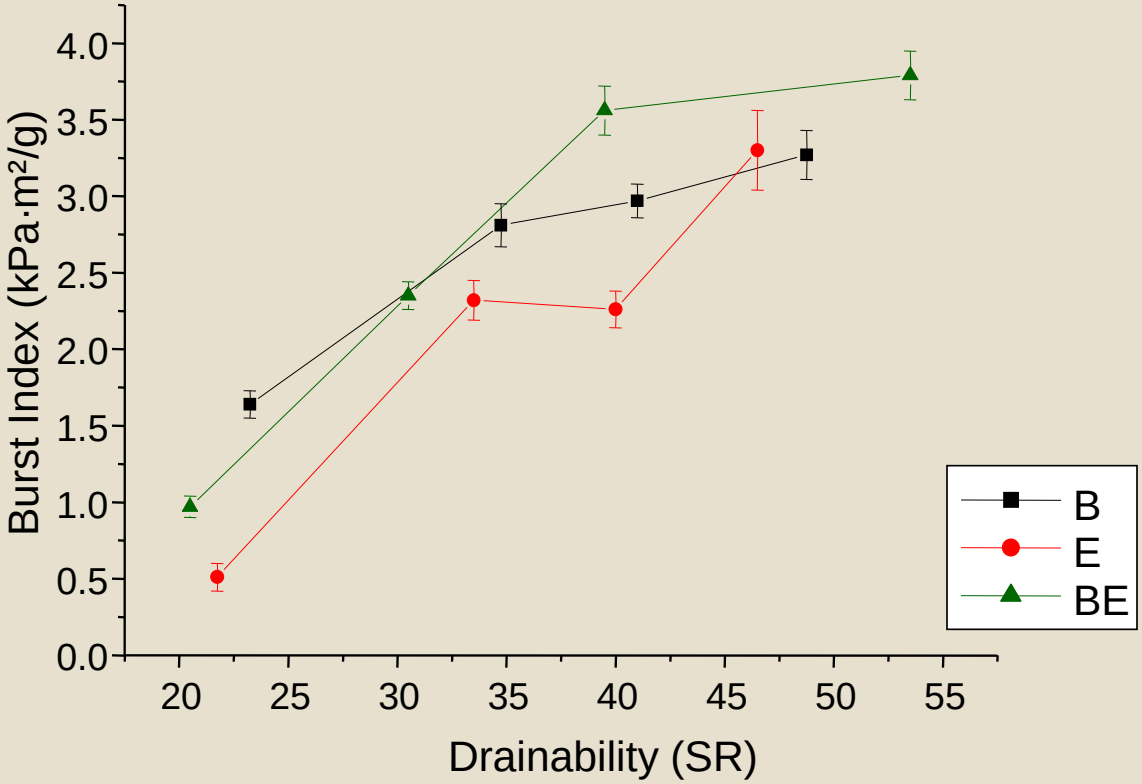
RESULTS

Tear Index vs. Refining Degree



❖Tear Indices are lower for high refining degrees

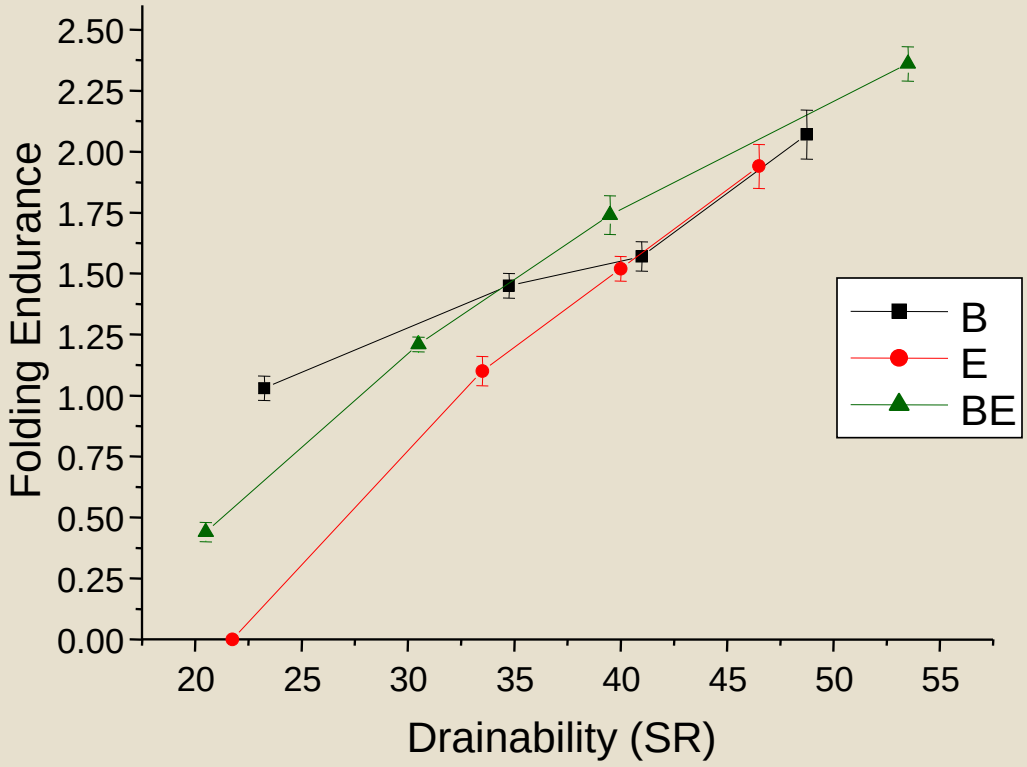
RESULTS
Burst Index vs. Refining Degree



❖Burst Index rise for all refining degrees

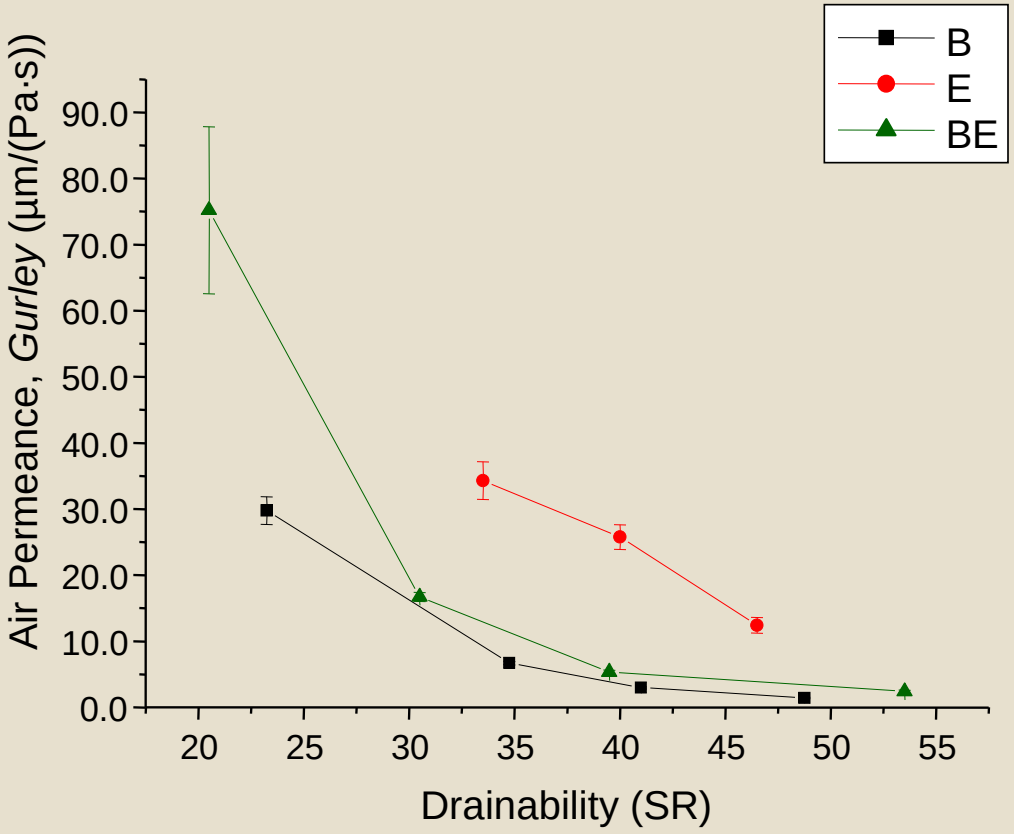
RESULTS

Folding Endurance vs. Refining Degree



❖Folding endurance rise for all refining degrees

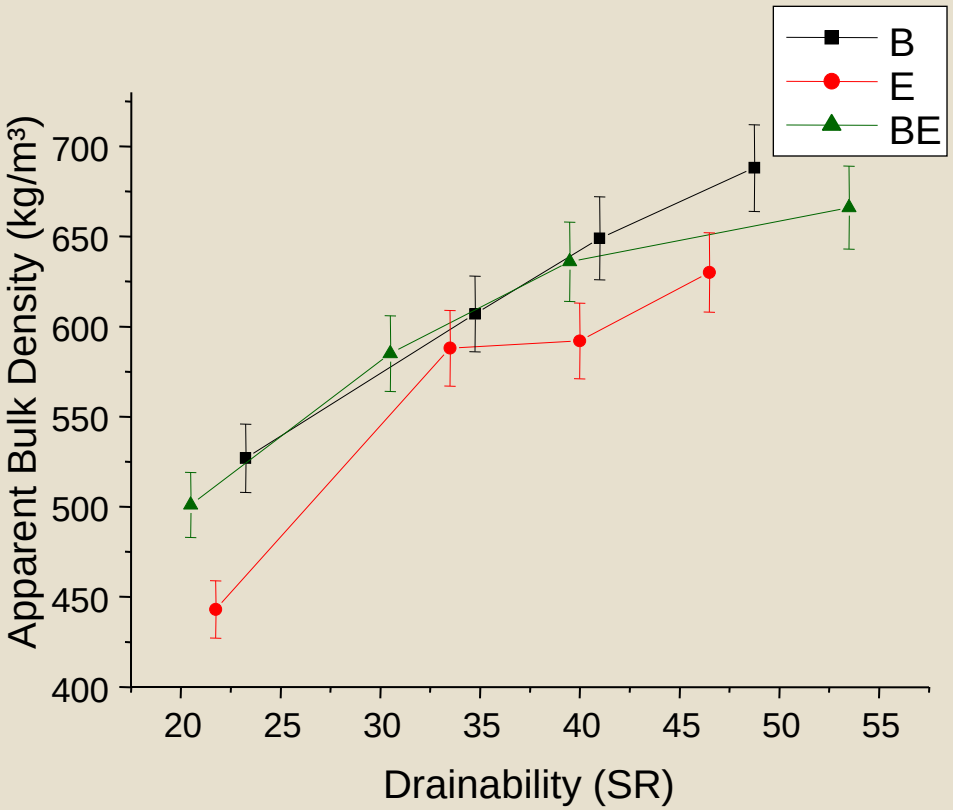
RESULTS
Air Permeance vs. Refining Degree



❖Air permeance reduction for all refining degrees

RESULTS

Apparent Bulk Density vs. Refining Degree



❖Apparent Bulk Density rise for all refining degrees

RESULTS
Separate Refining

To verify if it would be more appropriate for laboratory sheet properties

RESULTS
Separate Refining

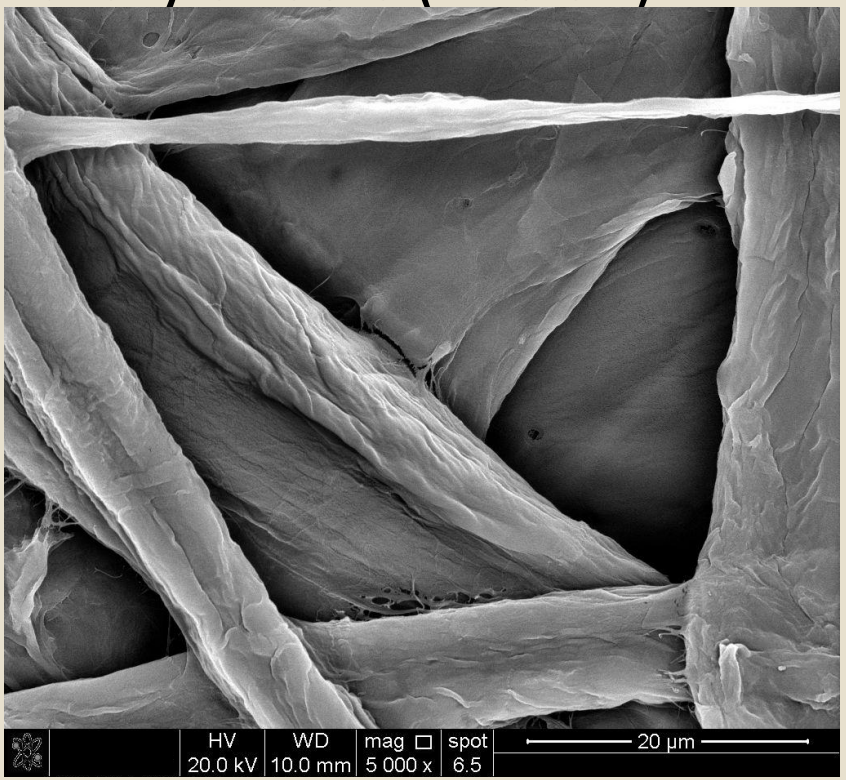
Property	Mixed Pulps (Pulp BE), interpolated to 37,8 SR	Separate Refining, 37,8 SR
Tensile Index (N·m/g)	55.2	51.0 ↓
Tear Index (mN·m²/g)	7.7	7.6 –
Burst Index (kPa·m²/g)	3.2	3.1 –
Folding Endurance	1.65	1.54 ↓
Air Permeance, *Gurley* (µm/(Pa·s))	7.5	10.9 ↑
Apparent Bulk Density (kg/m³)	617	609 ↓

❖Separate refining was not the best option for sheet properties.

RESULTS

SEM – Surfaces of Laboratory Sheets (~40 SR)

Pulp E



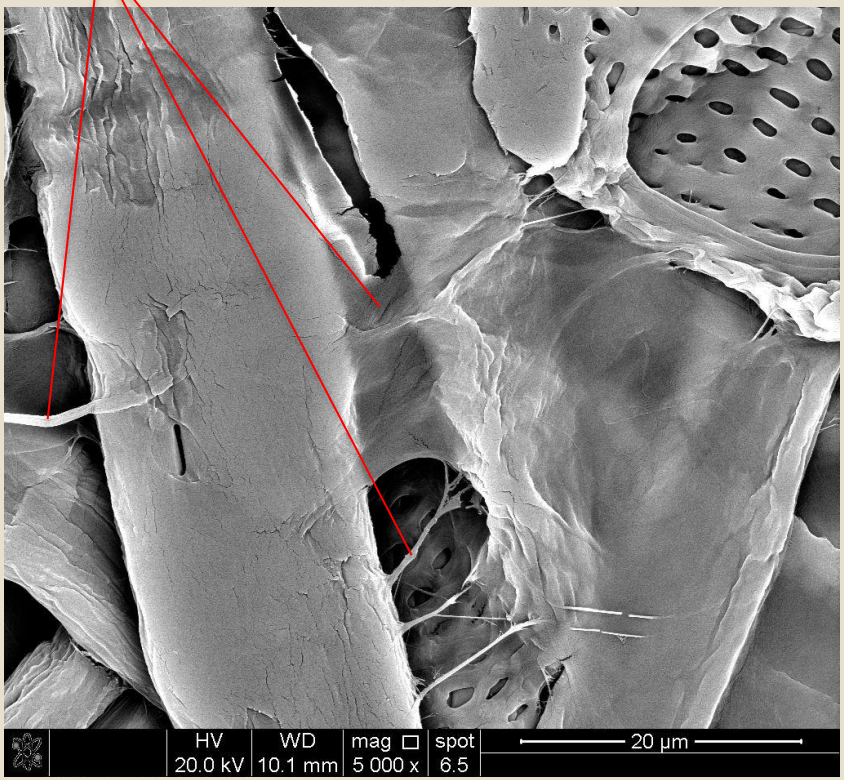
Pulp B

RESULTS

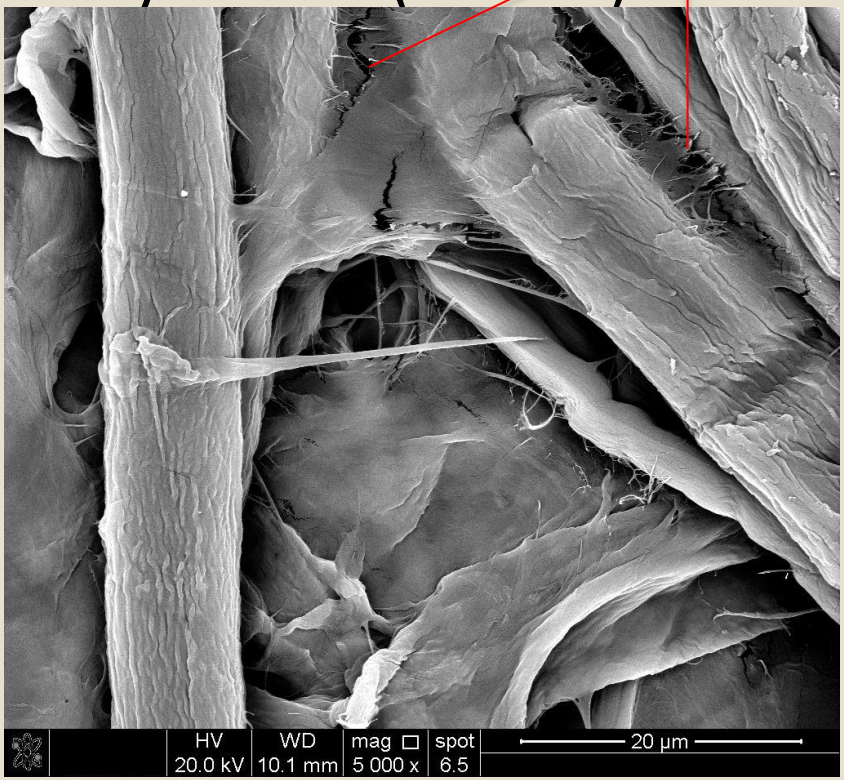
SEM – Surfaces of Laboratory Sheets (~40 SR)

Consolidated interfibre bonds

Brittle interfibre bonds



Mixed Pulps (Pulp BE)



Separated Refining

CONCLUSION

The addition of 50 % of sugarcane bagasse fibres into eucalyptus fibres led to:

- ❖ an increase of strength properties;
- ❖ a decrease of brightness reversion;
- ❖ a reduction of refining energy consumption.

Thank You!

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