Applications of Electron Processing in the Pulping Industry

Economics

Canadian TMP Pulp Mill — newsprint from black spruce

Specific Energy — 2200 kW.h/ton

Electrical Cost — US$ 0.03 per kW.h

Pulp Energy Cost — US $66/ton, $18.5M/yr.

— higher for southern pine

25% Reduction > US $4.5M Savings

European Energy Costs 2-3X Higher

Energy Savings 2-3X Higher

Effects of Electron Processing on TMP and CTMP Pulp Quality

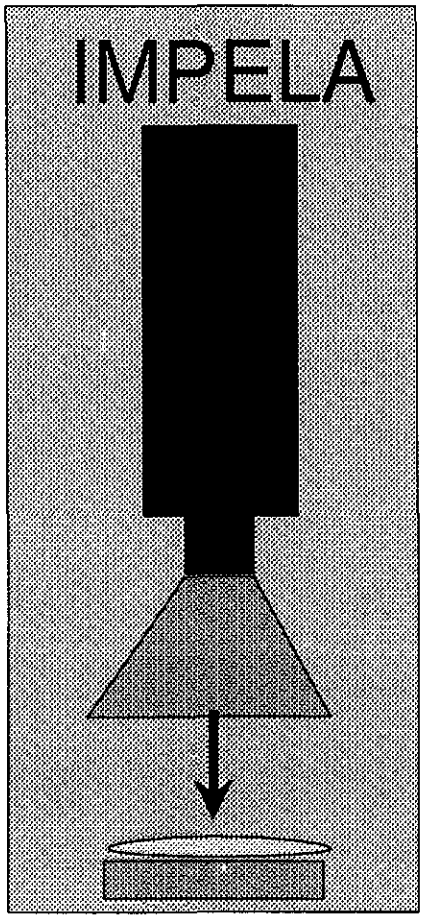
Summary

- 20% lower energy absorption
- Increased shives content
- Reduced long fibre content
- Shorter average fibre length
- Same density
- Lower tensile and burst indices (TMP pulps only)
- Lower tear index
- Same scattering coefficient
- Same pulp yield

MAXIMUM THROUGHPUT

30 kGy
50 kW

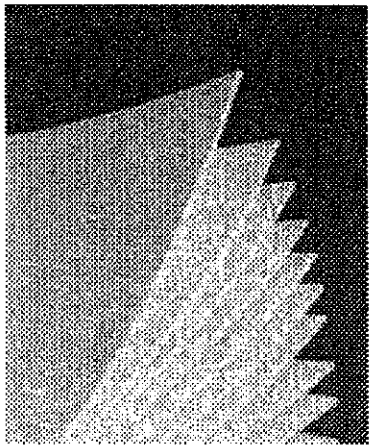
86 tonnes/day
31,000 t/a

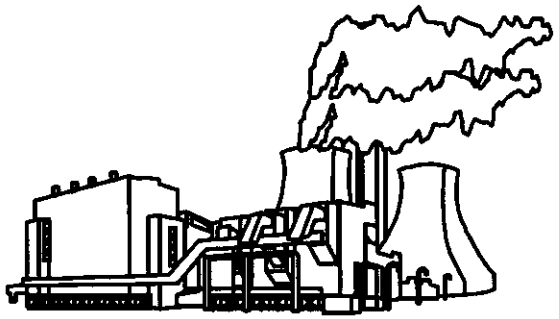


30 kGy
250 kW

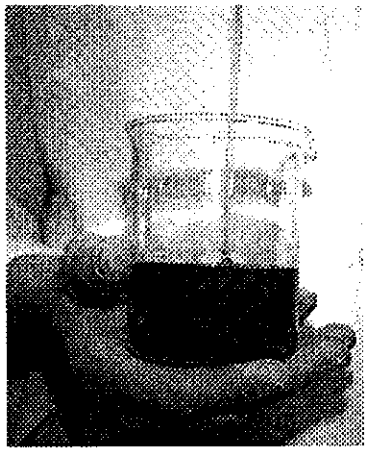
432 tonnes/day
155,000 t/a

Viscose Process





CS_2, NaOH

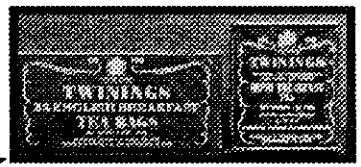


Cellulose
Wood Pulp

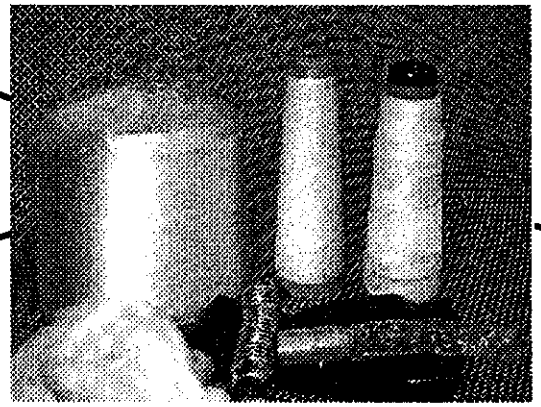
Viscose

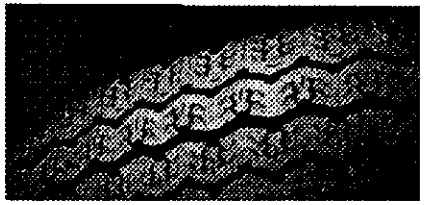
Viscose Products

Films

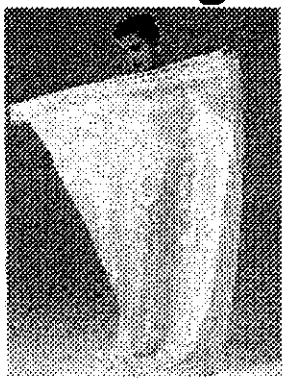


Tea bags

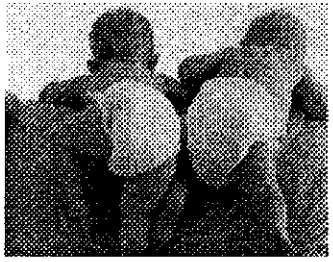




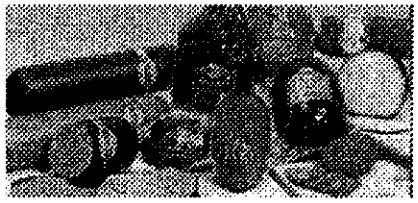
Tire Cord



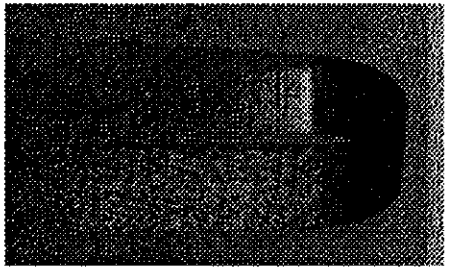
Textiles
Clothing



Sanitary Wear



SausageCasings

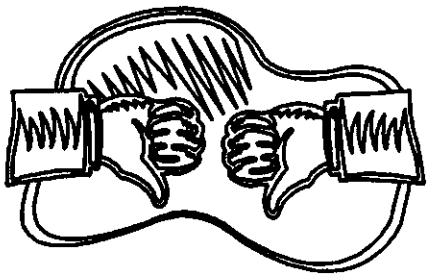


Belts, Hoses

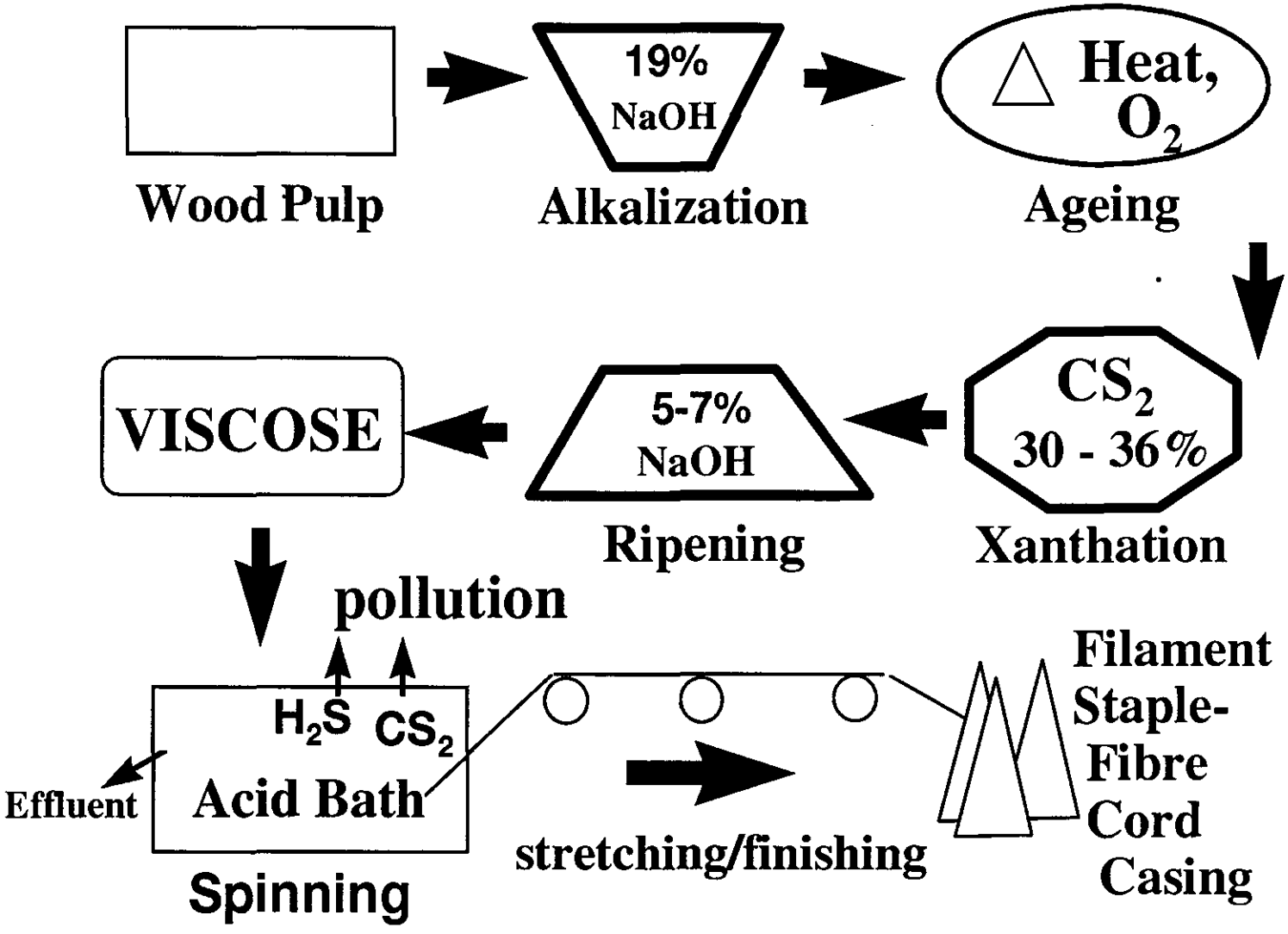
Viscose (Rayon) Industry

- Multibillion $ Global Industry
- Steady Growth

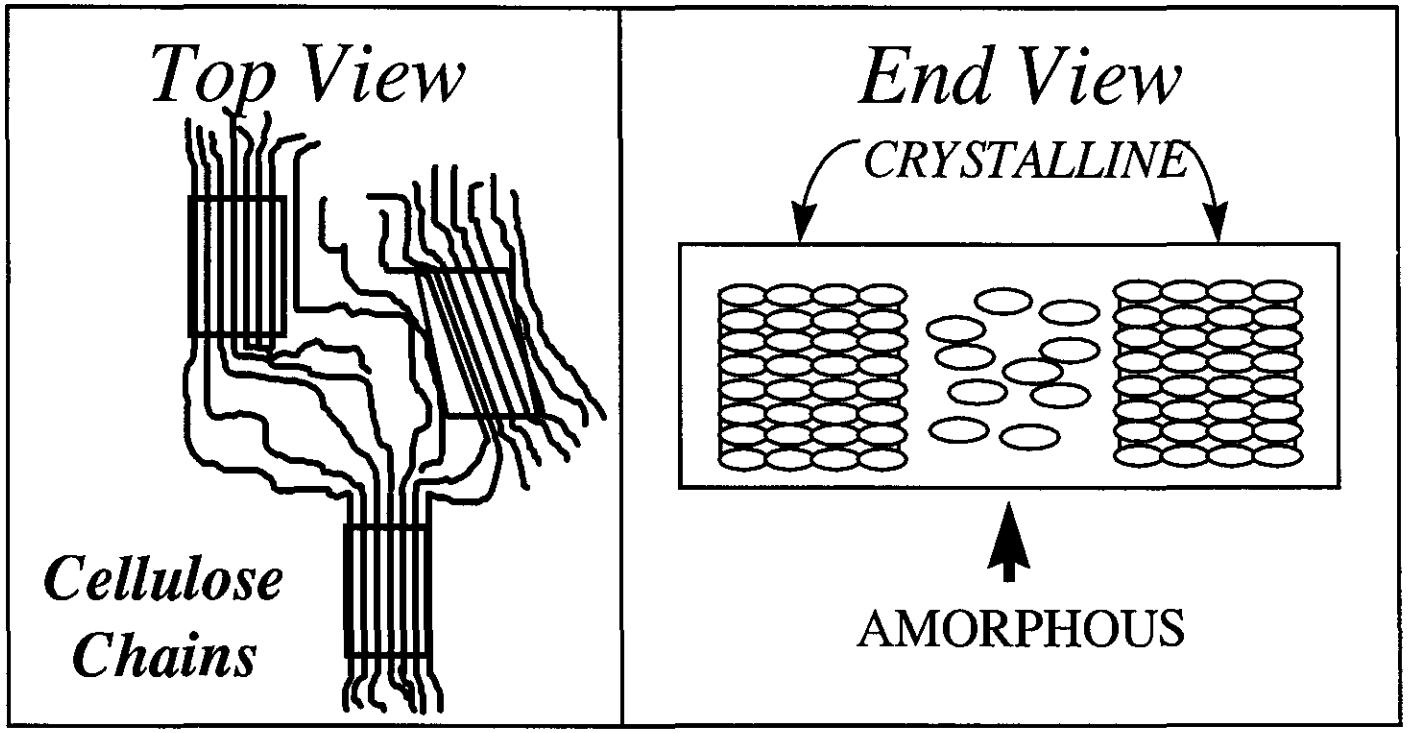
- Pollution Problems
- High Chemical Costs
- High Energy Costs
- Processing Problems



Conventional Viscose Process



Cellulose Structure

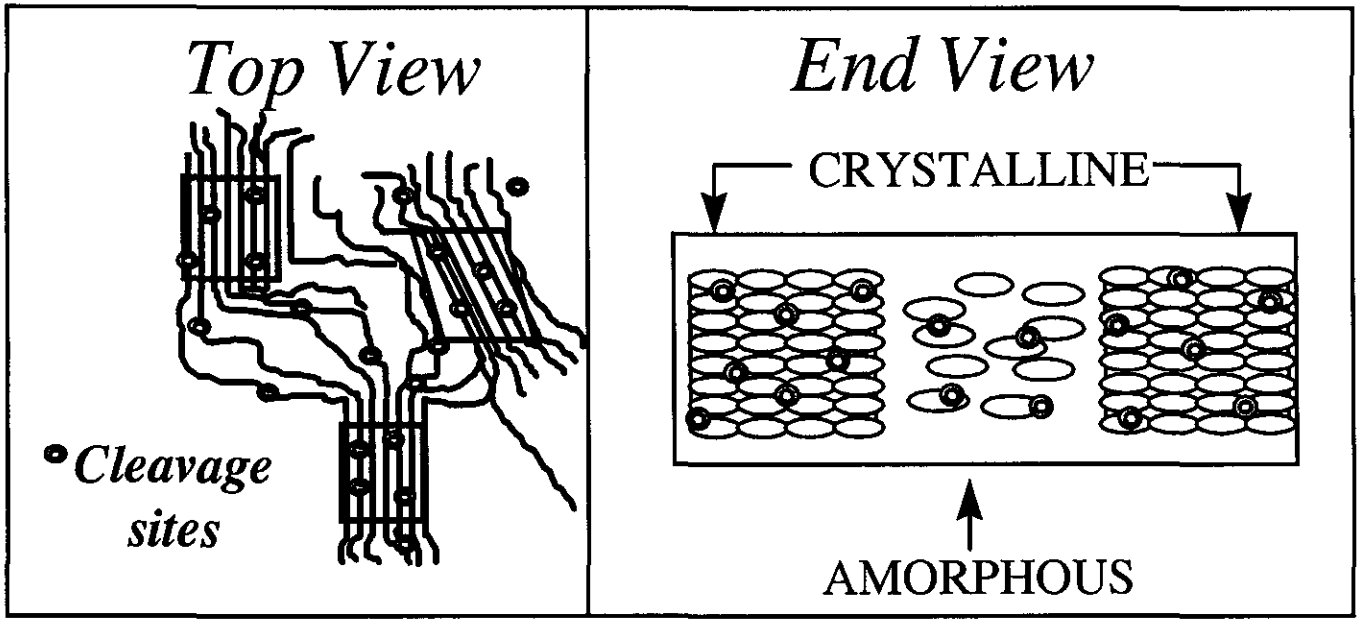


Crystalline Structure of Cellulose

- **Extensive Hydrogen Bonding Network**
- **Difficult to Penetrate by Reagents**
- **High Concentrations of Caustic and CS_2 Needed**

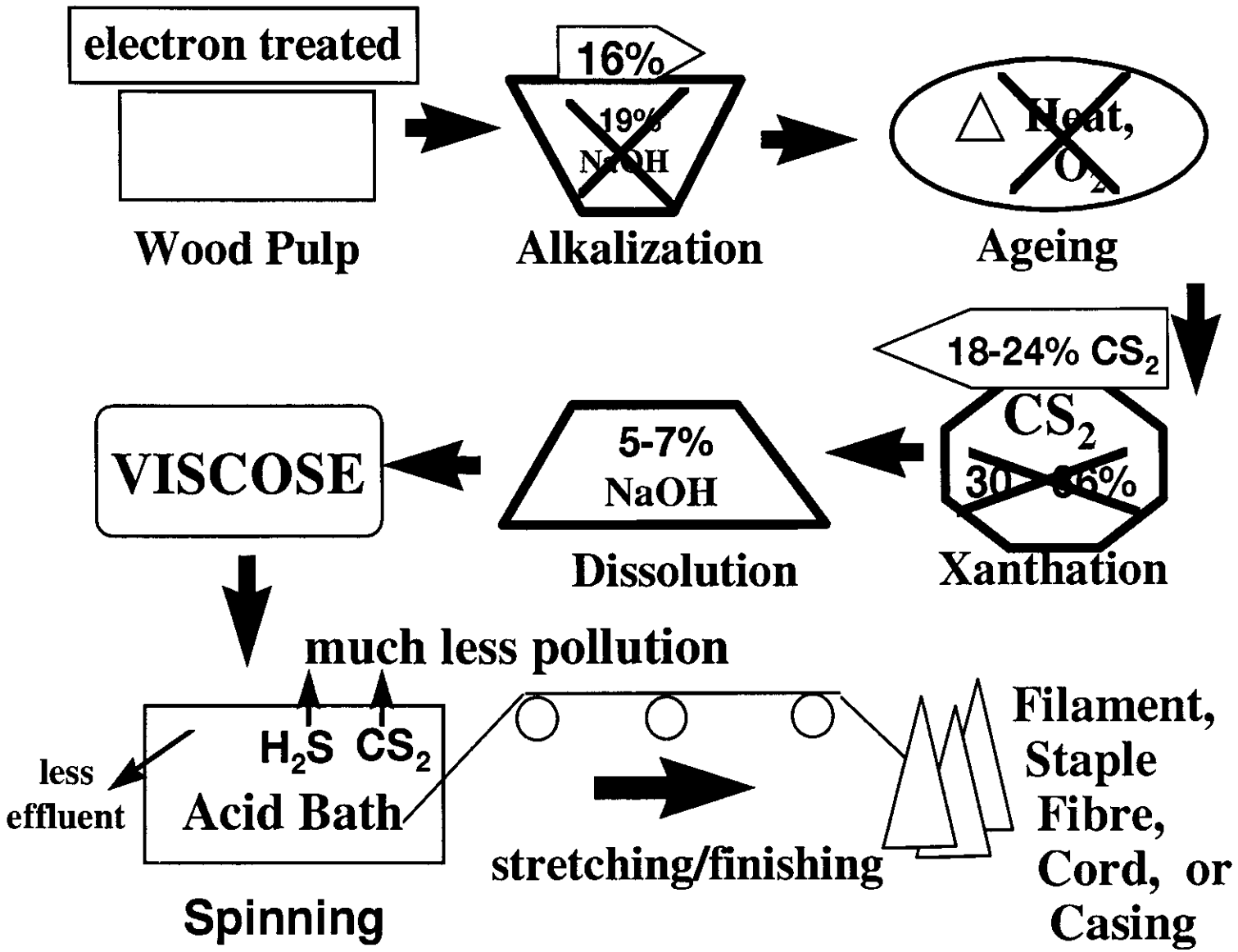
Electron Processing

Effects on Cellulose Supramolecular Structure



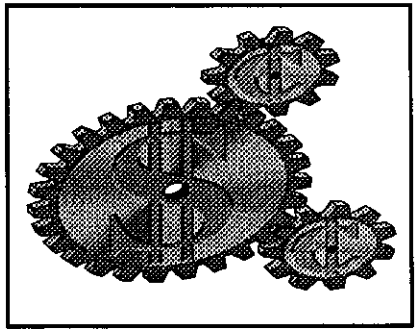
- **Electrons penetrate amorphous *and* crystalline regions**
- **Treatment produces chain cleavage -can replace aging step**
- **Treatment destabilizes crystal structure**
  - **enhances accessibility**
  - **allows use of less CS_2 and alkali**

Viscose Process Using Electron Treated Pulp



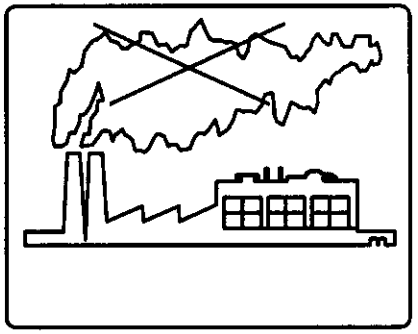
Benefits of Electron Processing in the Viscose Process

Reduced Chemical Demand



Carbon Disulfide, Alkali, Acid, Zinc
- **Several Million $ US in Savings**

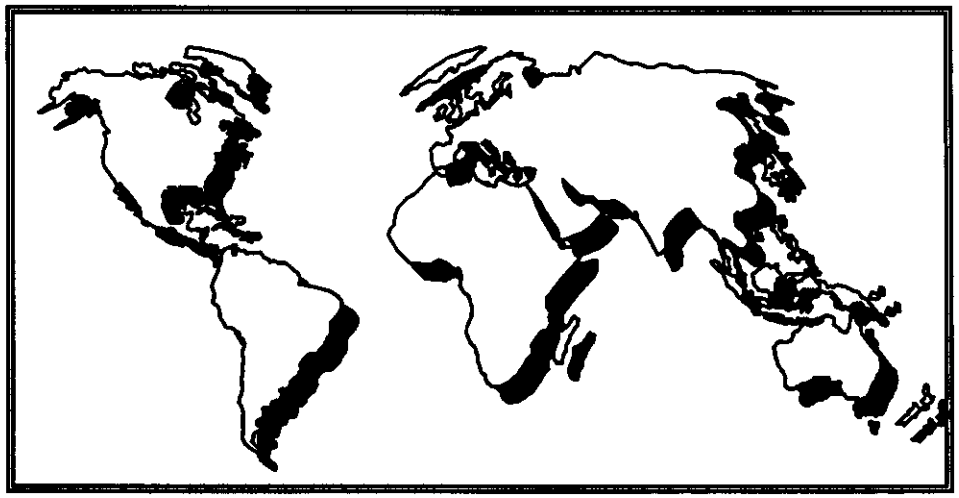
Environmental



Reduced Emissions / Efflents
- **CS_2, H_2S, Zinc**

Improved Process Control

Major Collaborators



Canada

UK

Norway

Sweden

Finland

USA

Austria

Mexico

Germany

Brazil

Switzerland

South Africa

India

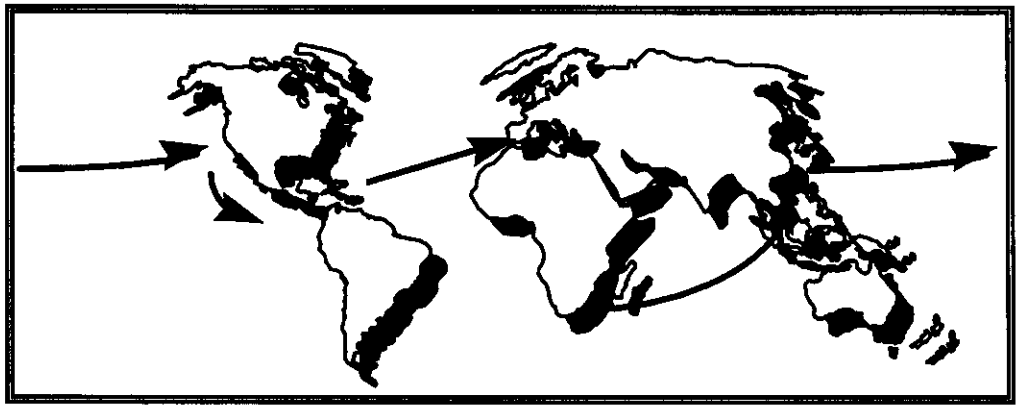
Japan

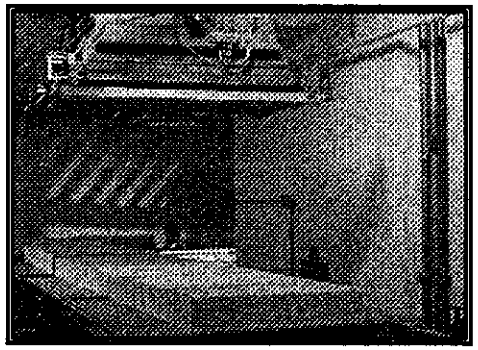
Taiwan

Over 25 Companies

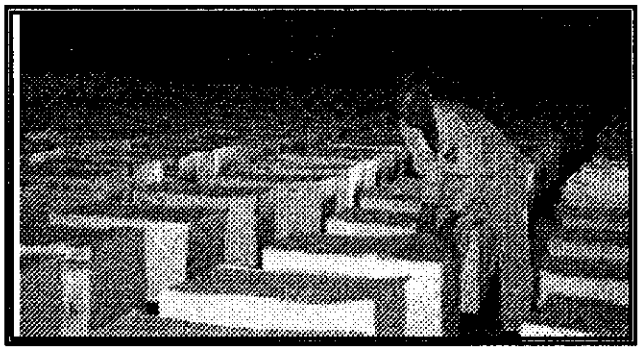
Plant-Scale Trials

1995: > 100 Tonnes, Complete Success





Electron Treatment of Pulp



1997: Marketing Trial

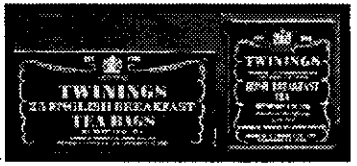
SUMMARY

The Biomass Group

- **Assisting over 25 Clients to Assess EPT in Viscose Process.**
- **ING A. Maurer S. A. Marketing Agreement**
- **Operating Parameters Optimized For 3 4 More Shortly**
- **2 Plant-Scale Trials Conducted 1997-99: 4 more**
- **Spinning Parameters - Zinc Optimization**

Viscose Products

Films



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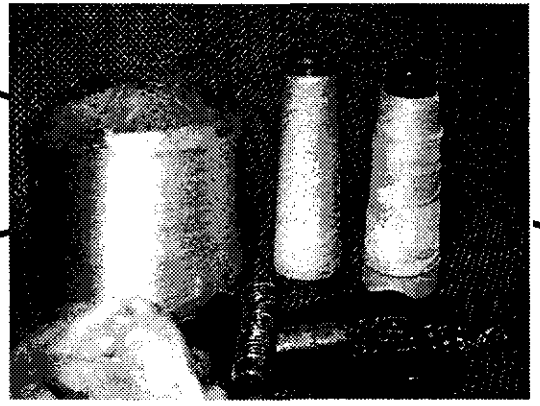

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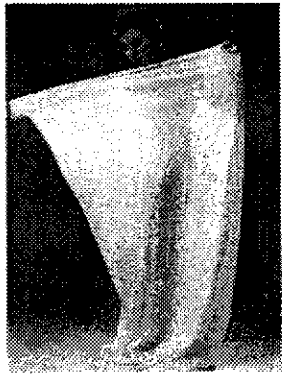

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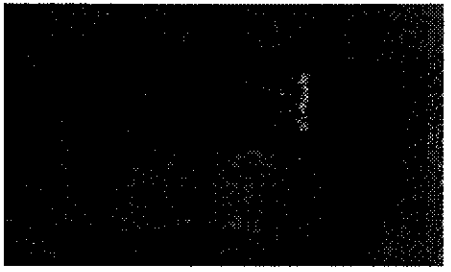

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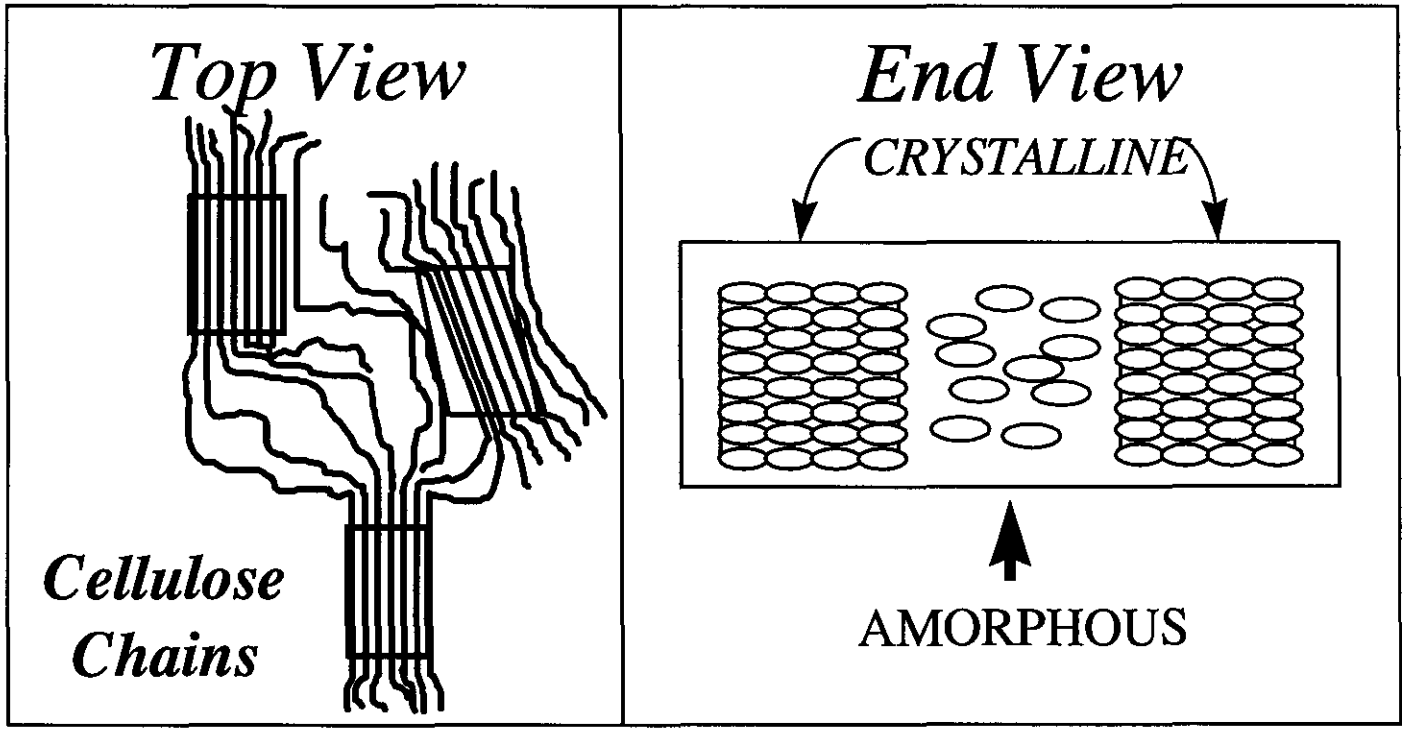
Cellulose Structure



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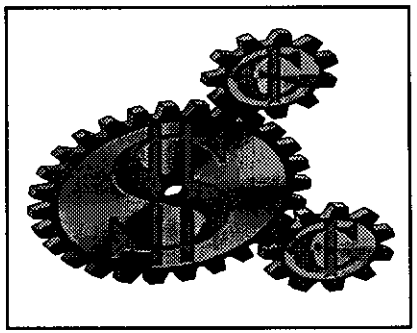

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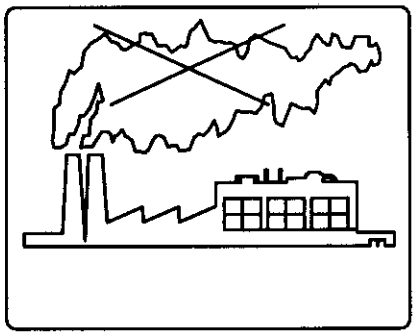

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