Biomass Production Chain and Growth Simulation Model for Kenaf

Work Package 5: Utilisation of kenaf for industrial products and energy.

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Introduction

- What is ATO
- What is the role of ATO in this project
- Presentation of BTG and thermal conversion methods by Mr. Douwe van den Berg

ATO

- Agro Technological Research Institute
  - (For and with Industry, 70% Industry)
  - Food & Food Processing
  - Agro & Industrial Production Chains
  - Renewable Resources
    - Polymers, Composites & Additives
    - Bio-conversion
    - Fibre & Paper Technology

Facilities

- Head building:
  - offices
  - laboratoria
  - technology halls
  - library and meeting rooms
- 3 Technological facilities
- 5 Qualitrons

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Fibre & Paper Technology

- Paper Technology
  - influence of fibre raw material and treatment on paper quality
- Biomass for energy
- Agricultural fibres for bio-composites
- Industrial fibre crops for building materials

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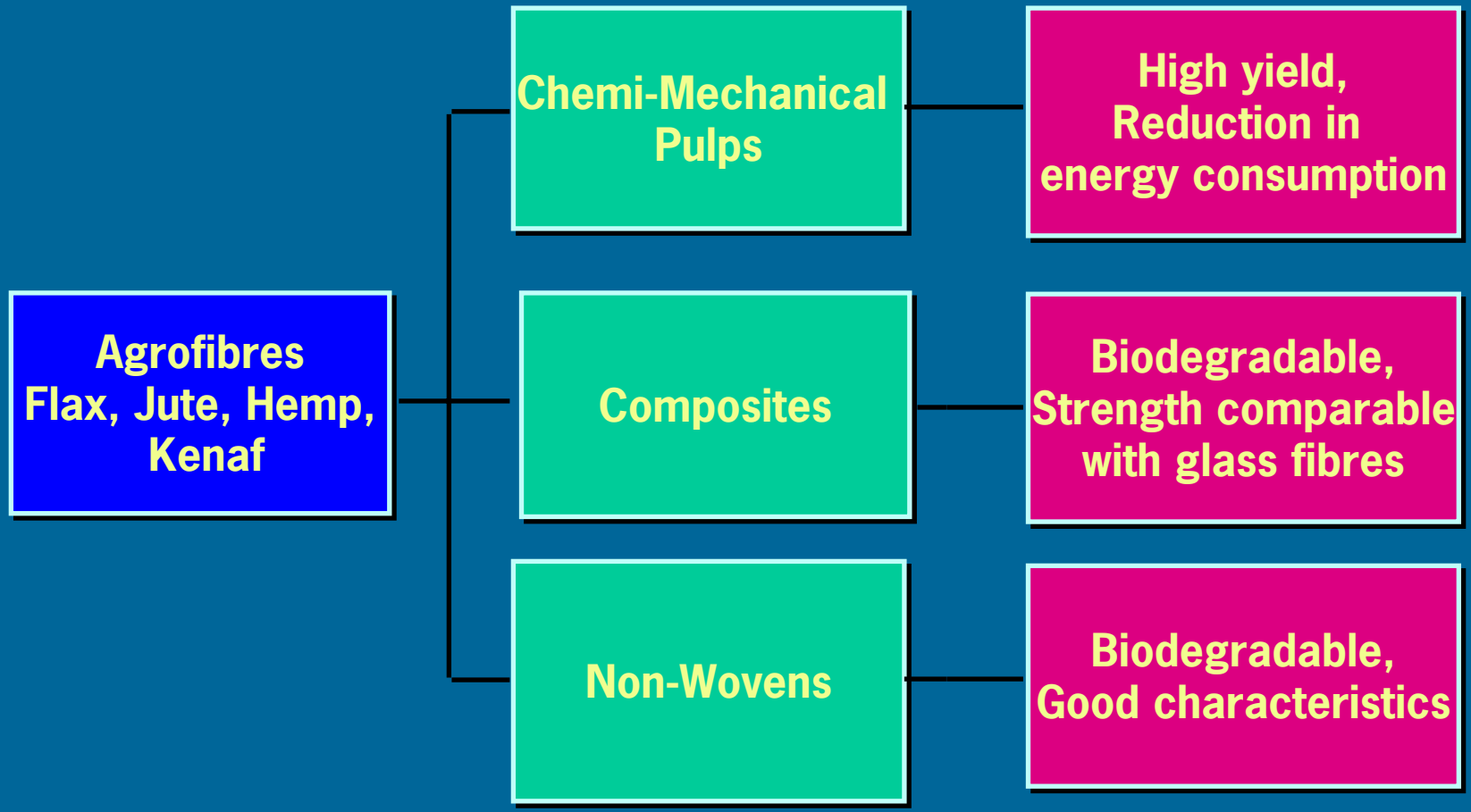
Related projects

- Some of the related projects within ATO
  - Paper from hemp and green jute
  - Optimal fibre quality from hemp
  - Coir based building material
  - bio-ethanol from lignocellulose
  - database biochemical composition lignocellulosic materials
  - validation of raw material from kenaf (Fair CT9616-1997)
  - Jute composites
  - Switchgrass for fibre products and bio-energy
  - Concept development multifunctional crop and land use

Why are Bast Fibres from Non-Wood Fibrecrops interesting Raw Materials?



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Fibre application and quality demands

	strength	length	fineness	fibrillation	absorbent	durable	bio-degradable	Low ash
textile	+++	+++	+++	-	+	+	+/-	++
composite	+++	+(+)	++	-	-	+	+/-	+
non-woven	+	++	++	+	++	+	++	++
paper	++	+	++	++	+/-	+	-	++
geo-textile	+	++	-	-	+	++	++	-
compost	-	-	-	-	-	-	++	-
bio-energy	-	-	-	-	-	-	-	+

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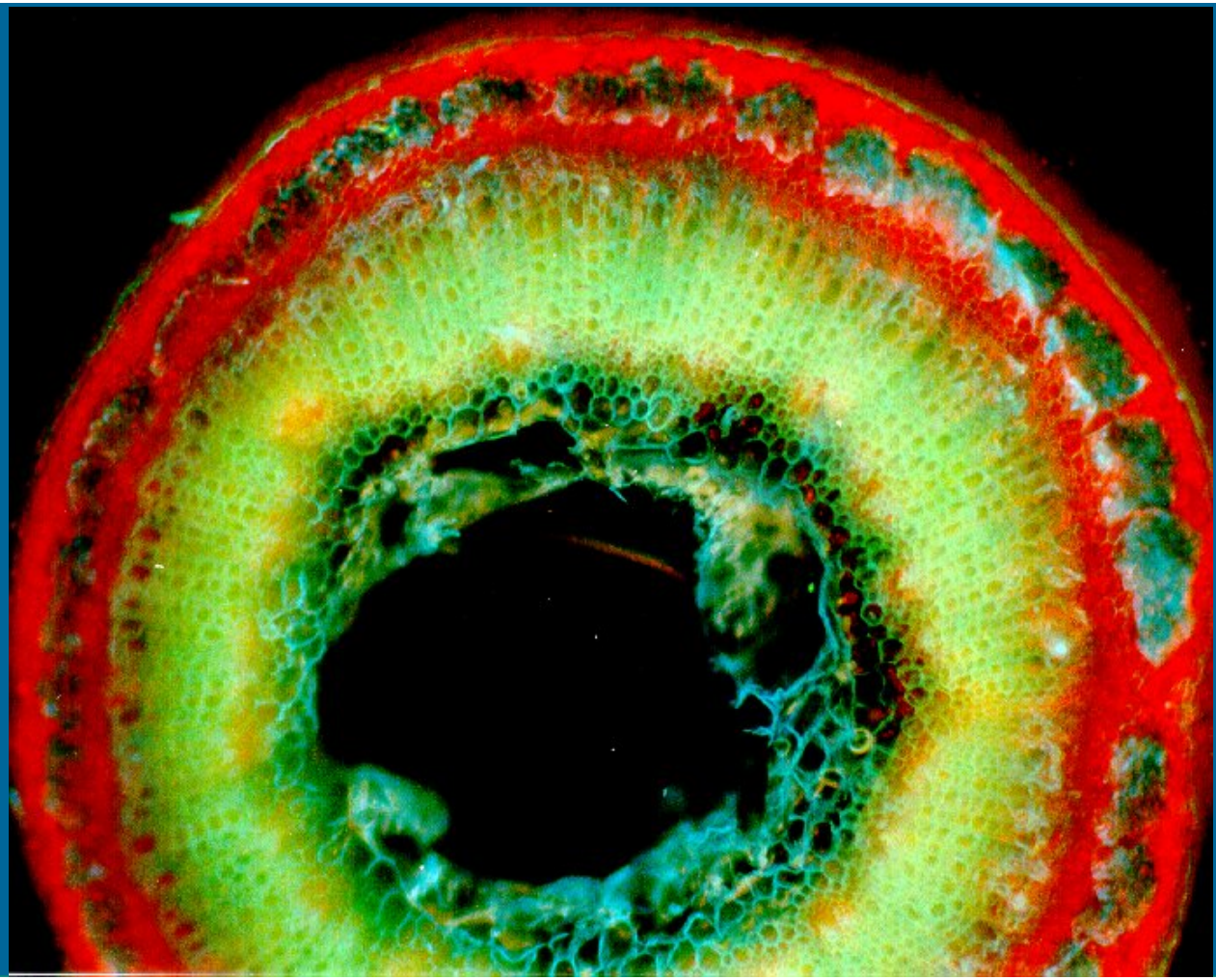
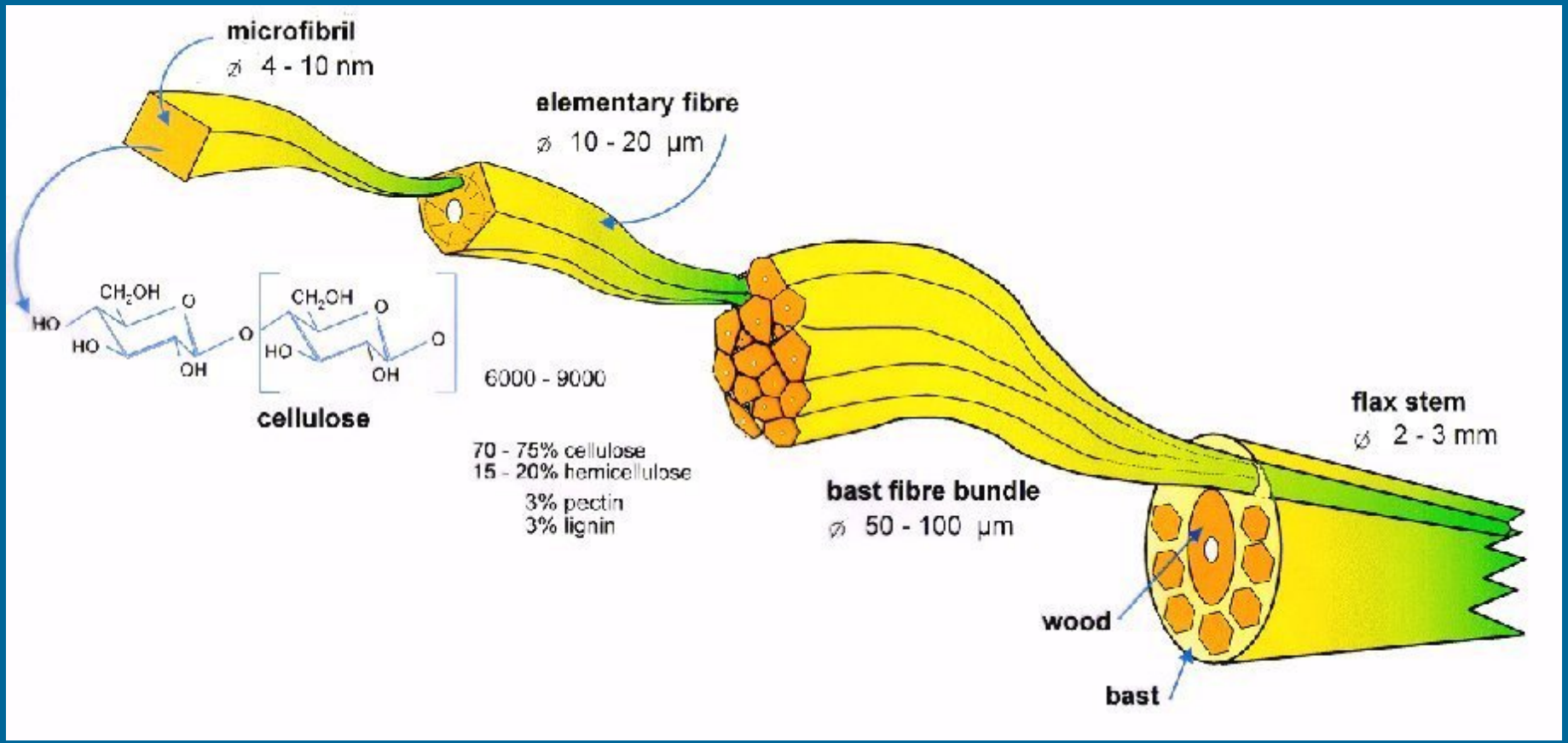
Flax Morphology



Flax Morphology



Fibre properties

	Jute Sliver	Hemp bastfibre	Kenaf bastfibre	
Morphology				
fibre bundle length	15-36	100-300		cm
fibre length	0.8-7	5-55	2-6	mm
fibre width	5-25	16-50	14-33	µm
cell wall width	2-5	5-10	3.7	µm
Strength				
Tensile	200-450	310-750	550-700	Mpa
Stiffness	20-55	30-60		GPa
Strain at rupture	2-3	2-4	2-3	%
Density	1400	1480		Kg/m^3
Chemial composition				
Ethanol /toluene extract	0.5	1.5	1.1	w%
Ethanol extract	0.3	0.3	0.1	w%
Hot water extract	1.3	5.1	2.9	w%
Cellulose	59.4	70.1	56.0	w%
Hemicellulose	10.7	8.7	13.3	w%
Pectin	2.6	3.1	3.1	w%
Lignin	14.6	3.8	11.9	w%

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Fibre properties

- Fibre properties and chemical composition varies with:
  - growing conditions
    - soil, climate, fertilisation etc.
  - cultivar
  - maturity
  - plant part
  - post harvest handling

- All these variations can influence the quality for fibre and energy applications

Role of ATO in this project

- Participant and leader work package of WP5

Work package 5

- Task 5.1.1 Fractionating of kenaf stems (ATO)
- Task 5.1.2 Market and techno-economic feasibility studies for industrial application. Application tests on two or three selected areas (ATO)
- Task 5.2 Thermal conversion experiments with combustion, pyrolysis and gasifier equipment (BTG and CRES)

- *Biomass has to be delivered by participants field trials*

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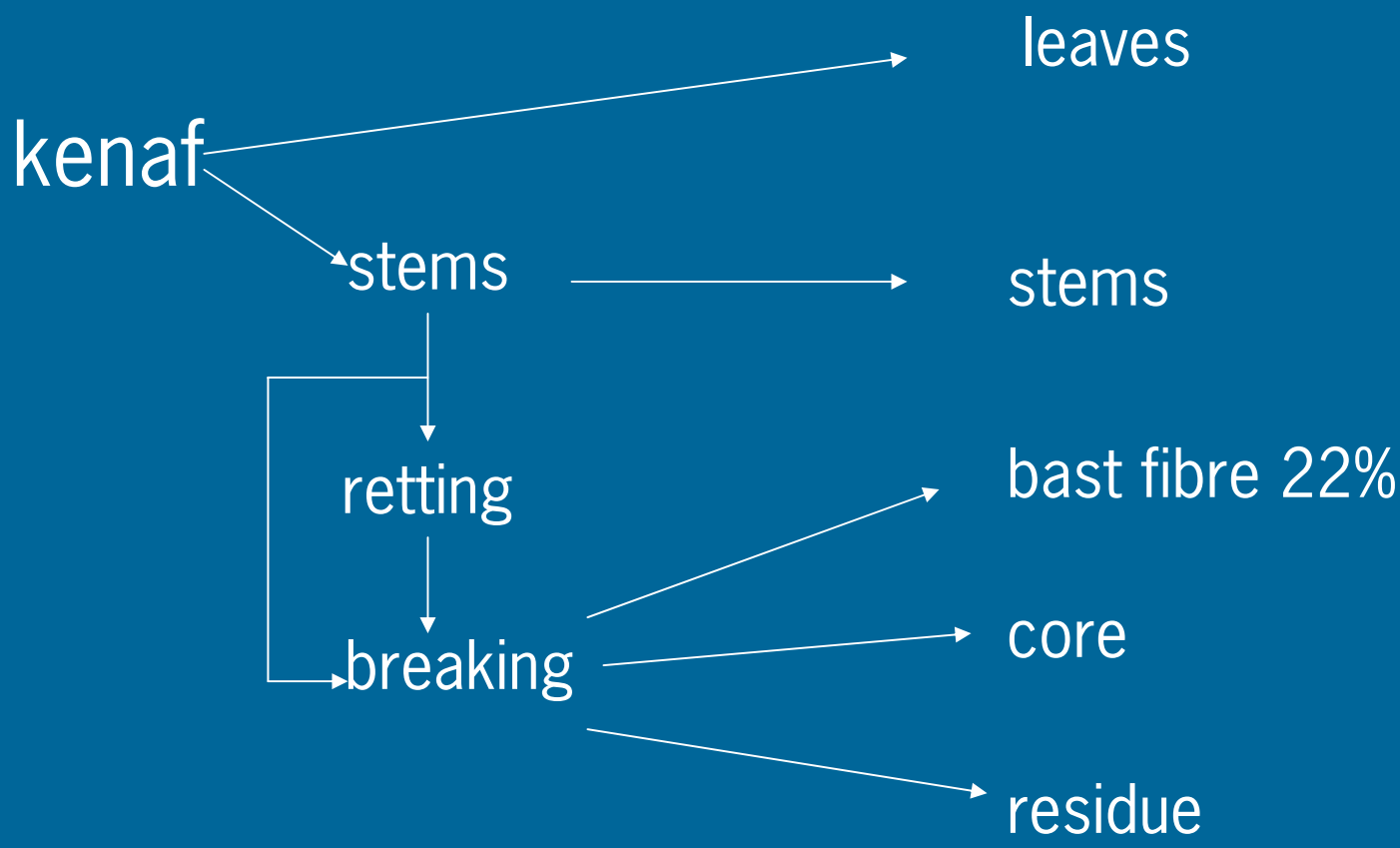
5.1.1: Kenaf fractionating

- Leaves in the field
- stems
  - bast fibres
  - core fibres
  - residue

- process dependent residue

5.1.1: Kenaf fractionating



5.1.2: Market and techno-economic feasibility studies for industrial application

- Market and literature review
  - Composites
  - Building materials
  - Nonwovens
  - Paper & board
  - Absorption particles

- Testing of two or three applications selected from the market and literature review
- *?? Consultation of Industrial Parties?*

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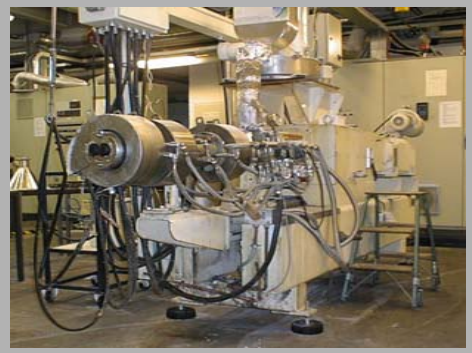
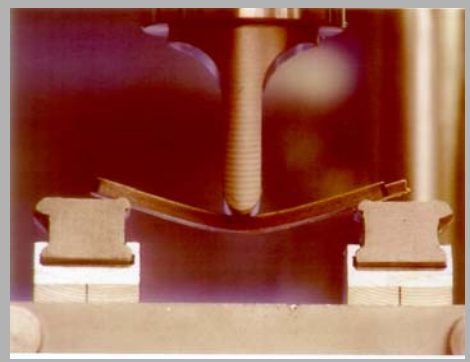
Extruder

- Extrusion
  - defibration
  - chemical treatment
  - composite granules



Extrusion of jute fibre compounds



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Refiner

- Refining for board and paper
  - defibration
  - chemical treatment
  - fibrillation for paper

Refining for paper or board

5.2: Thermal conversion experiments

- (co-) combustion
- pyrolysis
- gasification