AGROTECHNOLOGY & FOOD INNOVATIONS
WAGENINGEN UR

Results since last meeting

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

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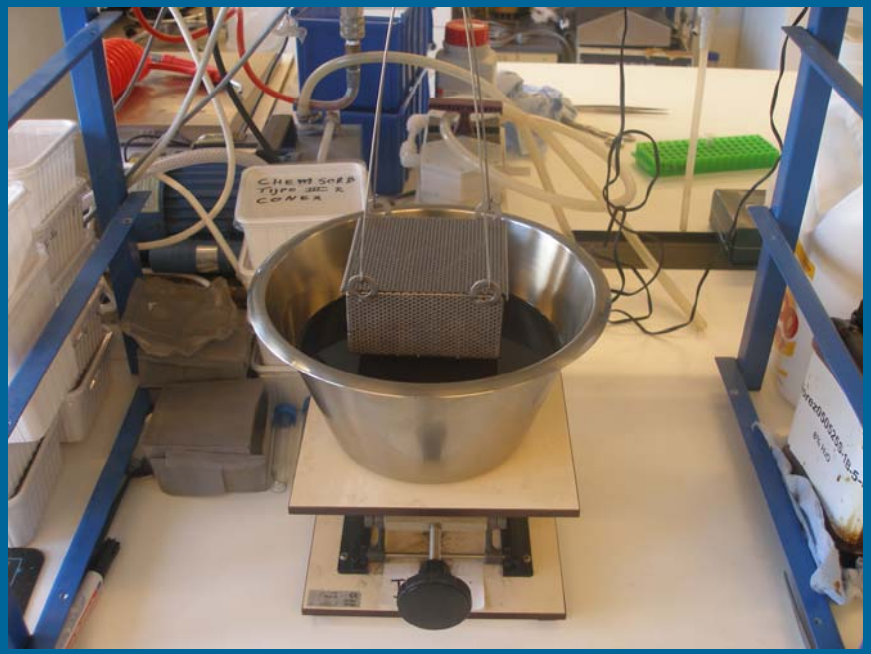
Madrid 27 September 2006

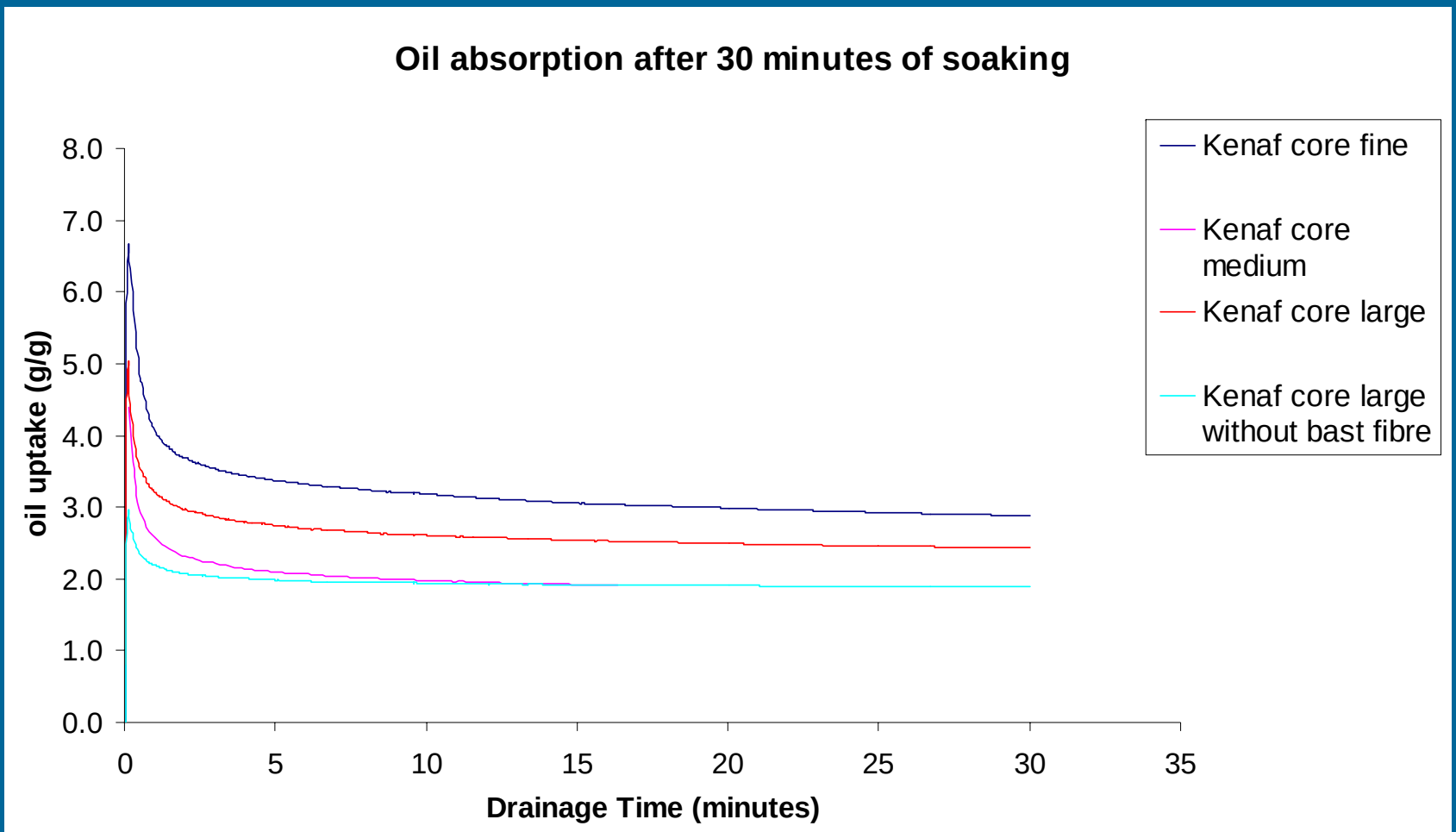
Content

- Additional oil absorption experiments.
- Testing of composites with microbial affected fibres.
- Extra tests of kenaf mats under high humidity

Oil absorption kenaf core and other materials



Oil absorption of kenaf core



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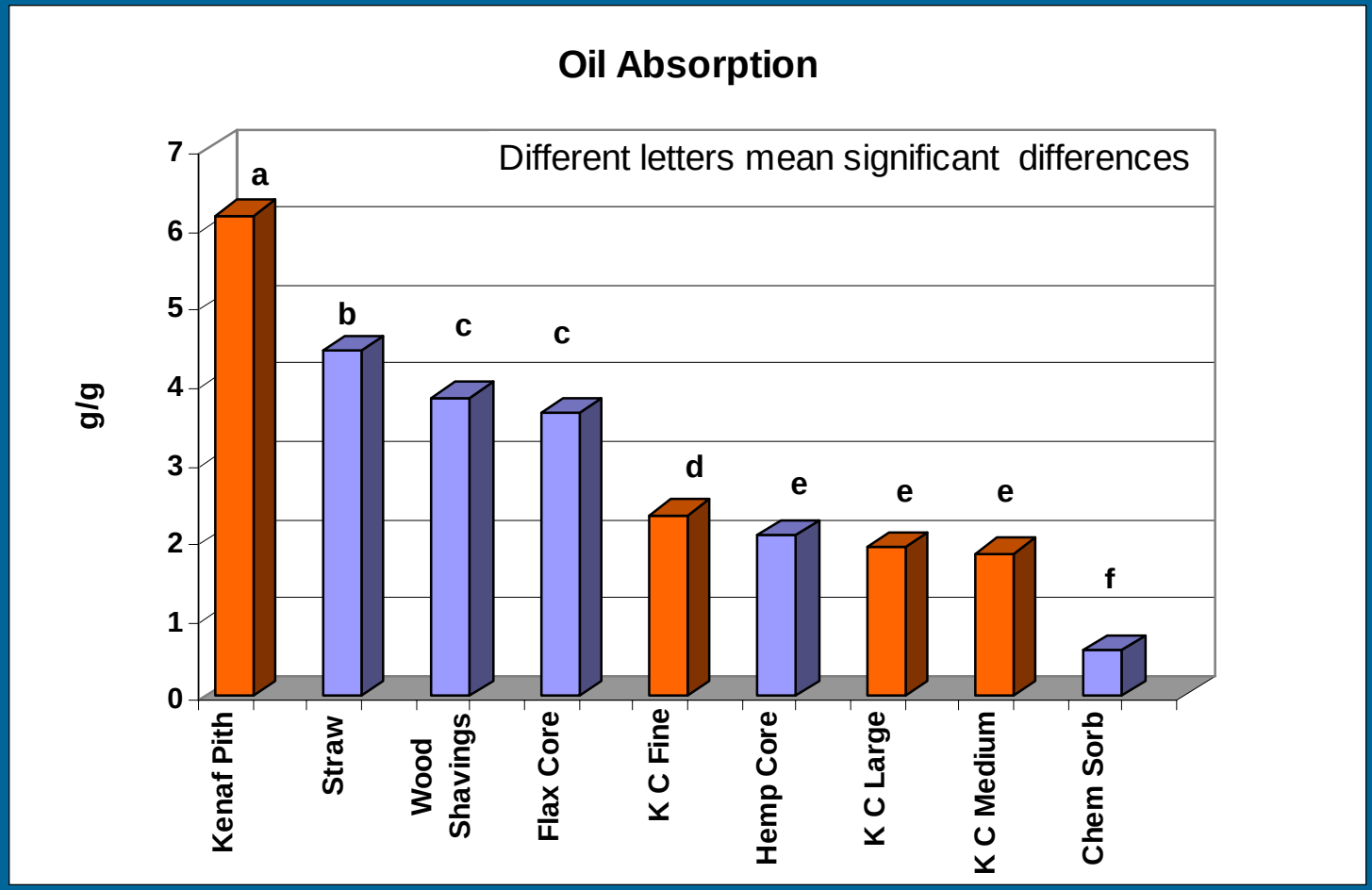

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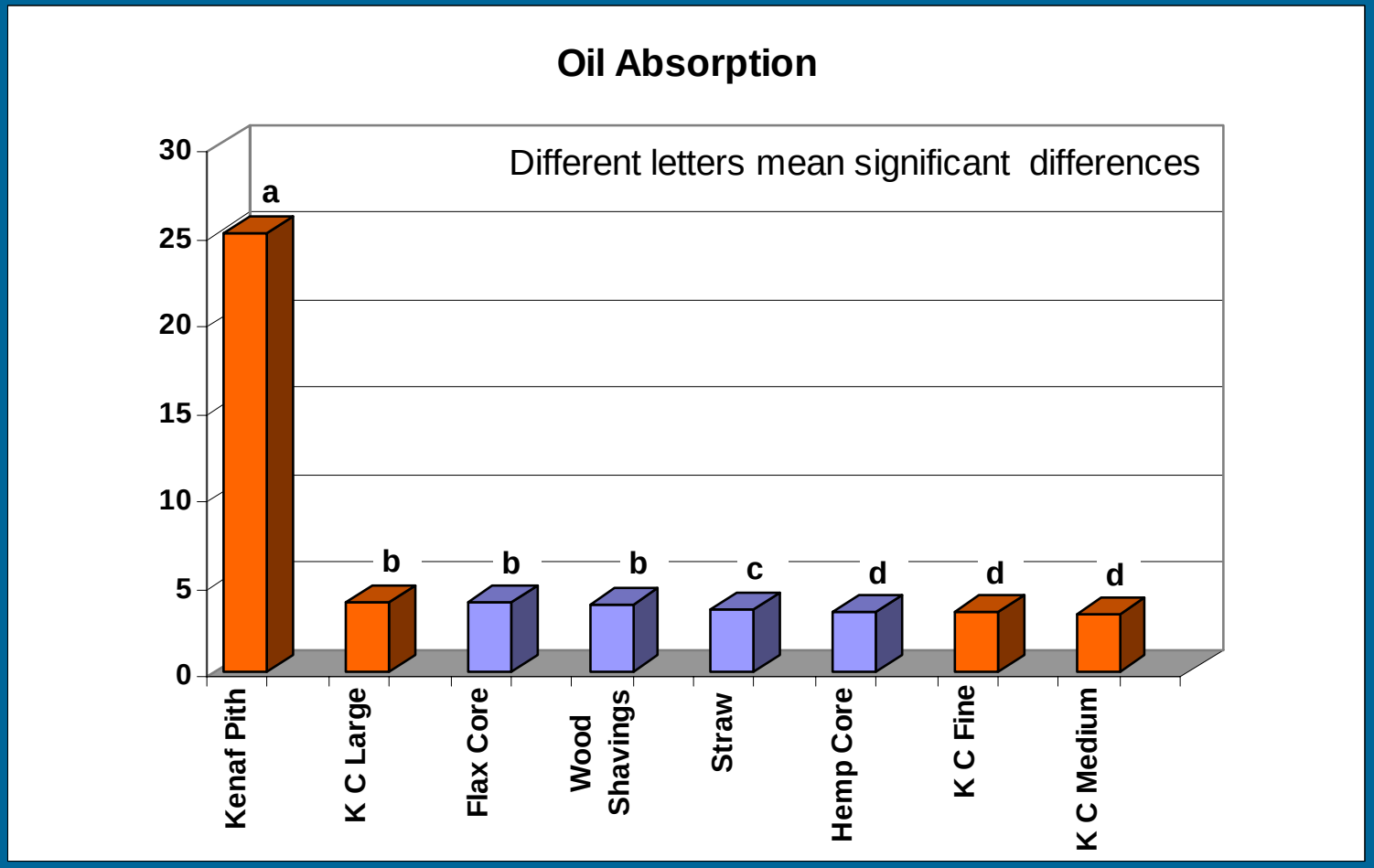
Oil absorption of milled kenaf core and milled other materials



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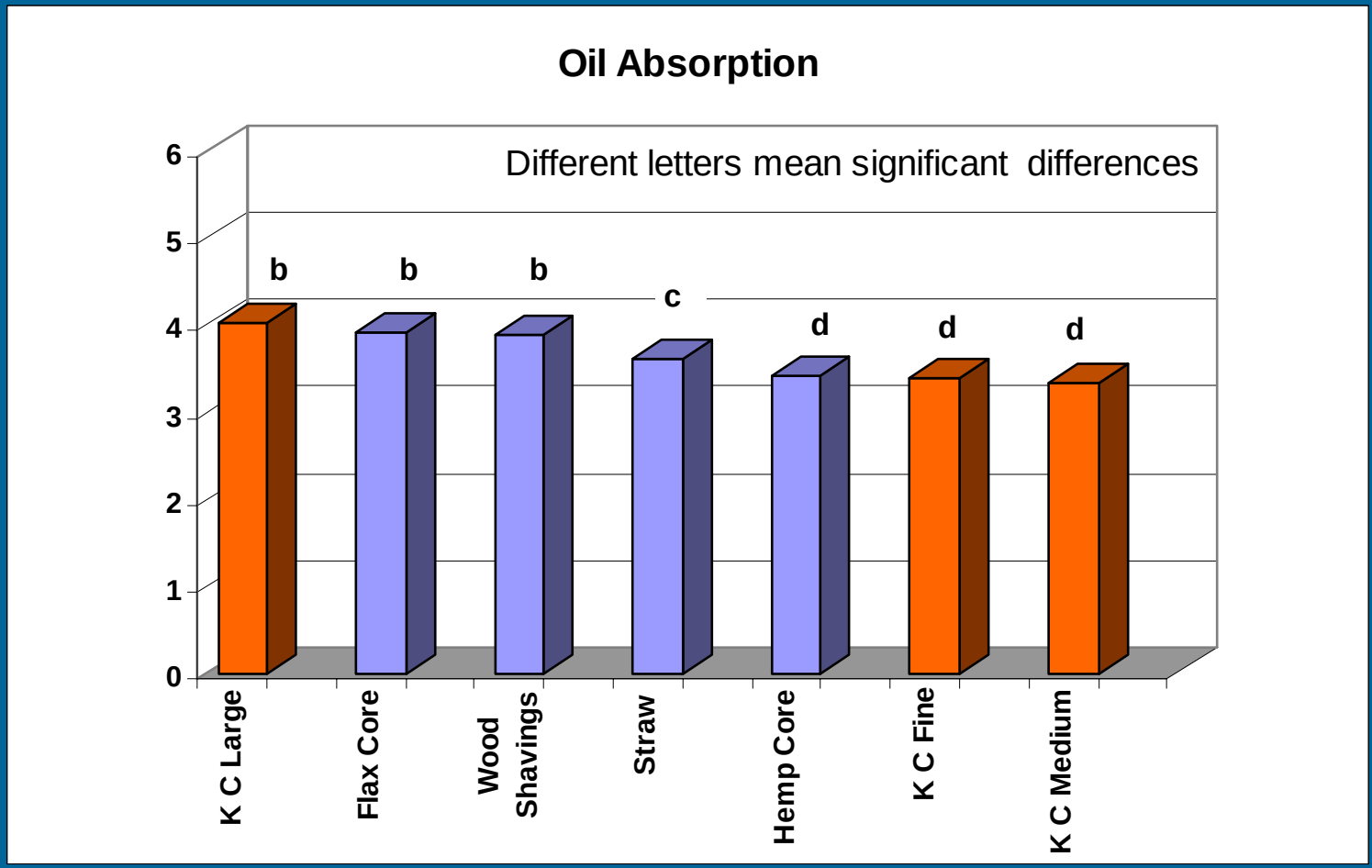

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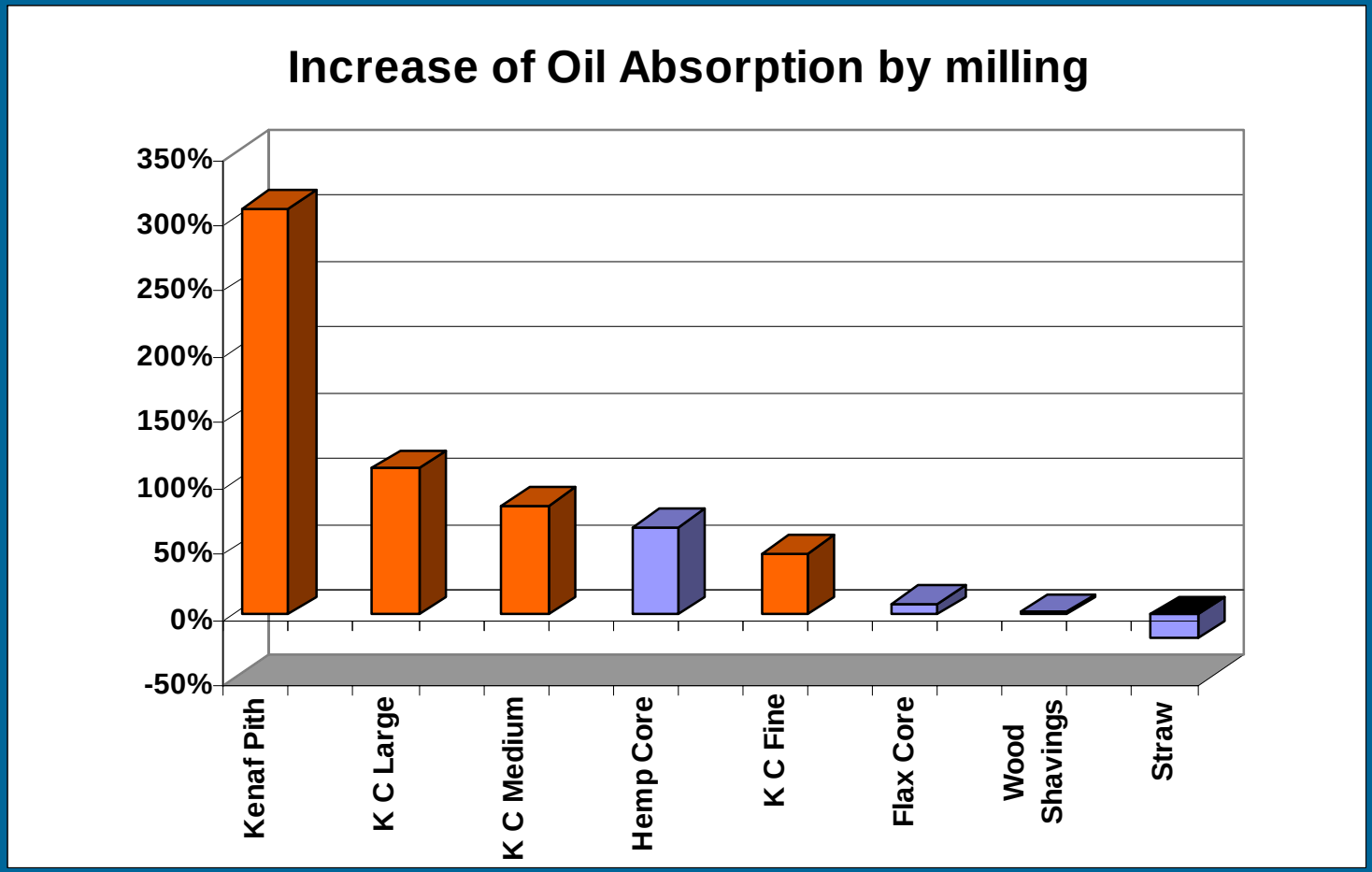
Oil absorption kenaf core and other materials



Conclusions – oil absorbtion

- Kenaf core as received shows low level of oil. The level is comparable to that found by Ghalambor
- Kenaf core is not a better oil absorber than the other tested organic materials
- Extra milling increases the oil absorption capacity

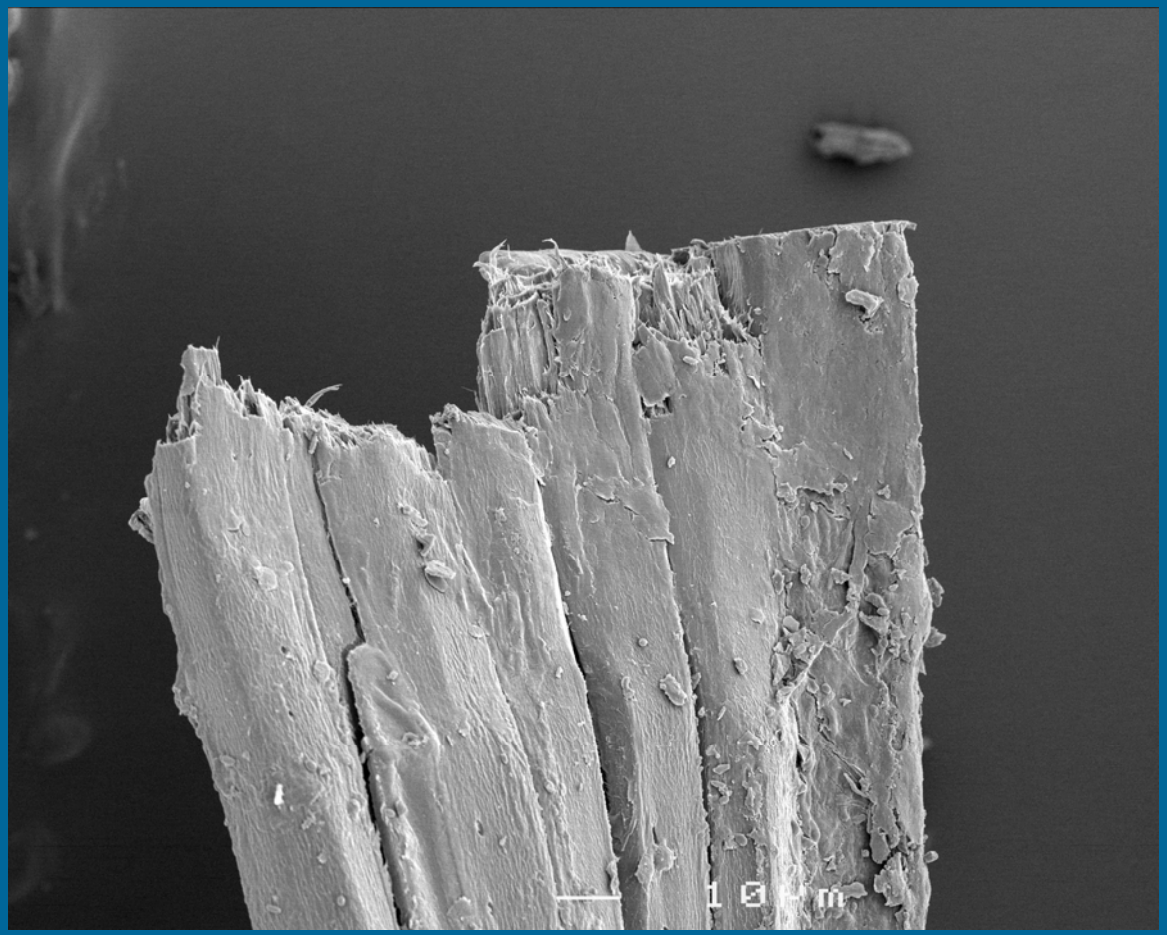
Conclusions – oil absorbtion

- Kenaf pith absorbs 200% more oil than kenaf core
- Milled kenaf core absorbs 500% more oil than milled kenaf core. This is comparable to the ratio found by Ghalambor

Strength fibres bundles

- Weak fibre bundles limit the application to insulation mats. Long fibres for woven applications are not possible.
- Strong fibres make applications like textiles and automotives possible.
- If strength of these fibres is too low they cannot be used for moulded composites.

Tensile fracture of a kenaf fibre bundle



Clamp distance
3.2 mm

Warm water retting

- 7 days
- 2 portions of 70 gram in water bath 33 to 35 ^{o}C
- Yield 72%

Tensile fracture of a kenaf fibres

Material	Tensile strength (MPa)	St.dev	n
Kenaf			
FAIR retted	556 – 682		
FAIR green decorticated	276 - 435		
CETA fibres	343 - 486		
Uni Catania fibres	425	41	3
Uni Nova fibres	374	69	3
Uni Nova fibres retted	462	88	5
Flax	500-880		
Hemp	400-750		
Jute	351-468		
Sisal	650		

Producing Kenaf-Polypropylene composite

fibres CETA

In the field during winter

Retted fibres UniNova Lisboa
harvested before winter

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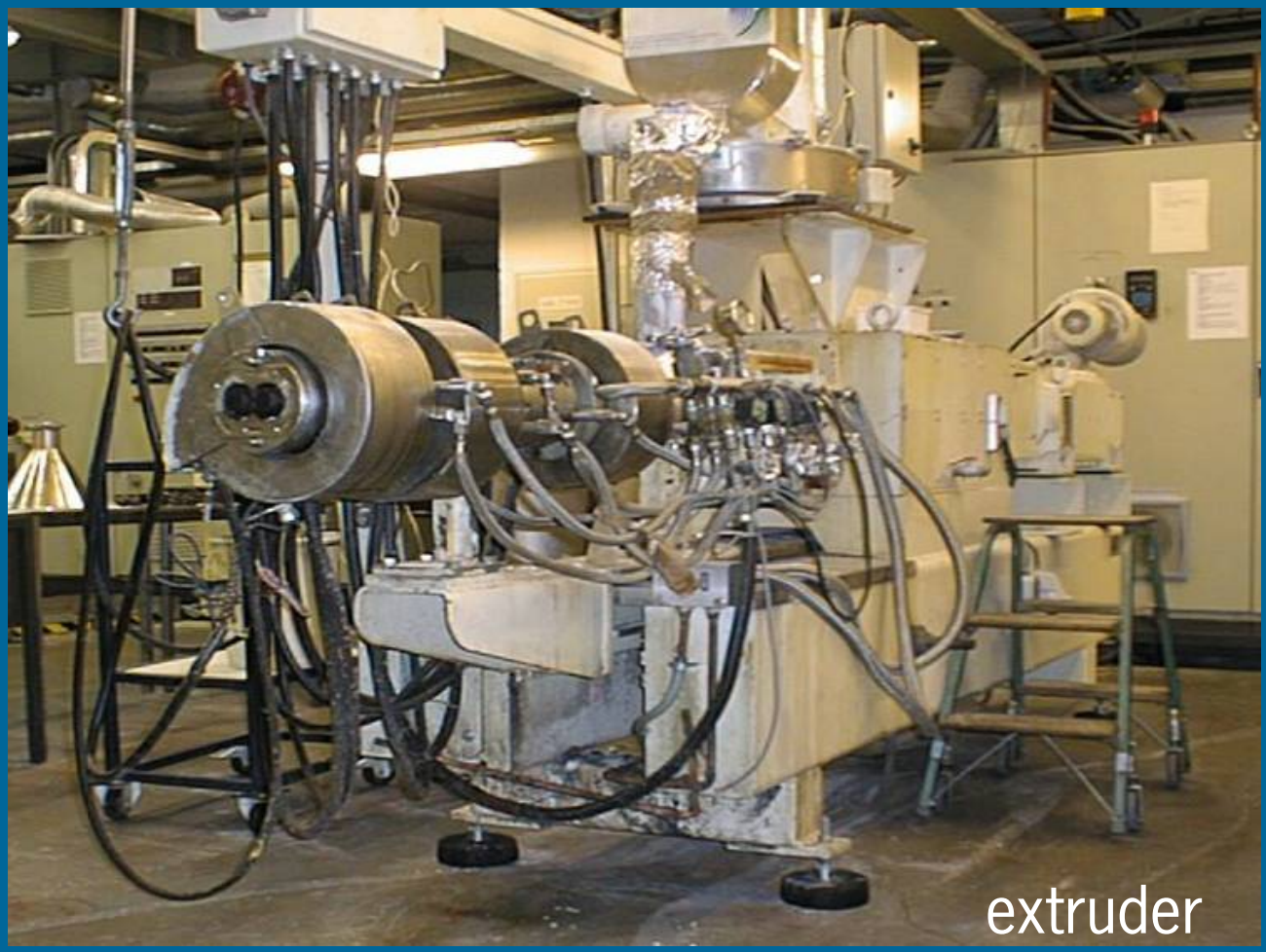
Producing Kenaf-Polypropylene composite

Producing Kenaf-Polypropylene composite

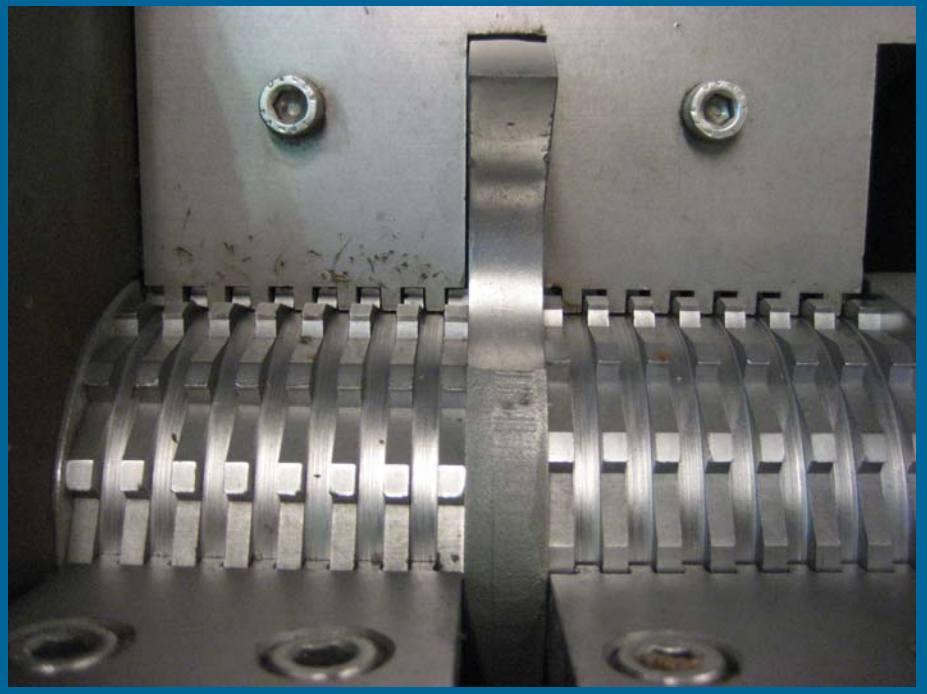


Producing Kenaf-Polypropylene composite

Kneading of the fibres with PP

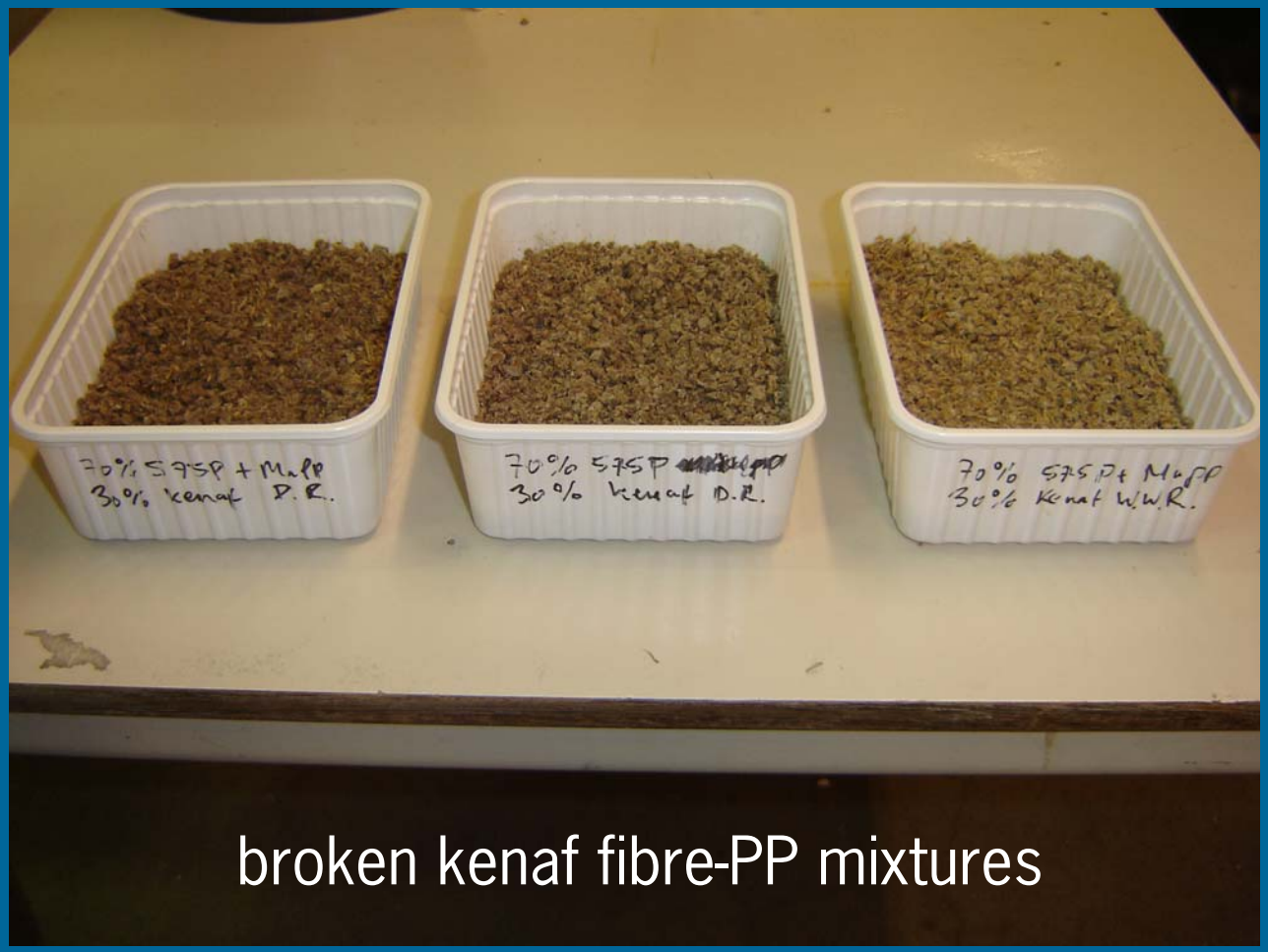
Producing Kenaf-Polypropylene composite

fibre-PP mixture



Breaker

Producing Kenaf-Polypropylene composite

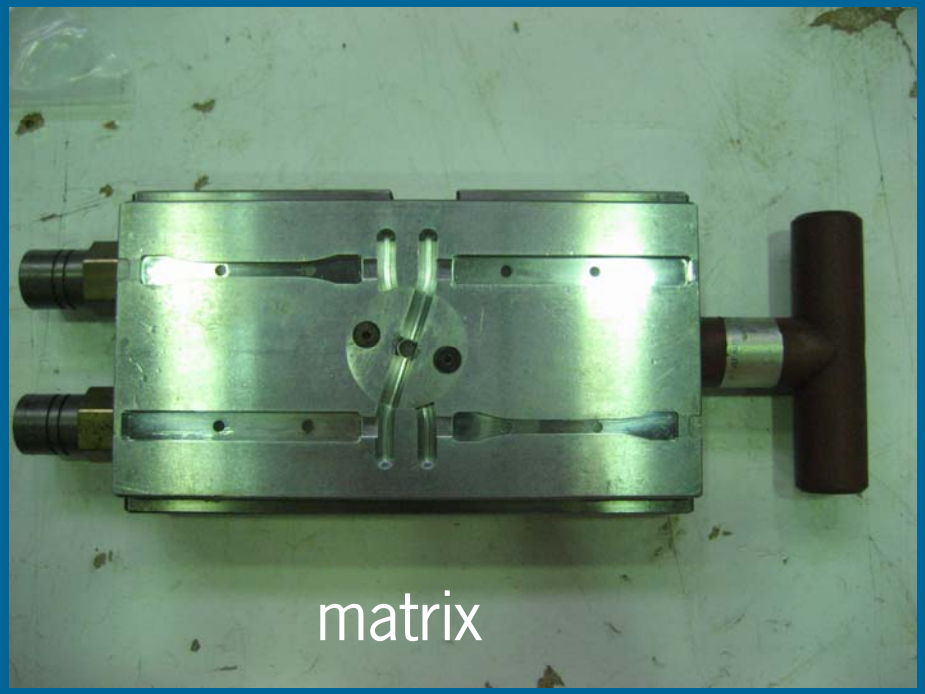


broken kenaf fibre-PP mixtures

Producing Kenaf-Polypropylene composite

Moulding machine

Producing Kenaf-Polypropylene composite

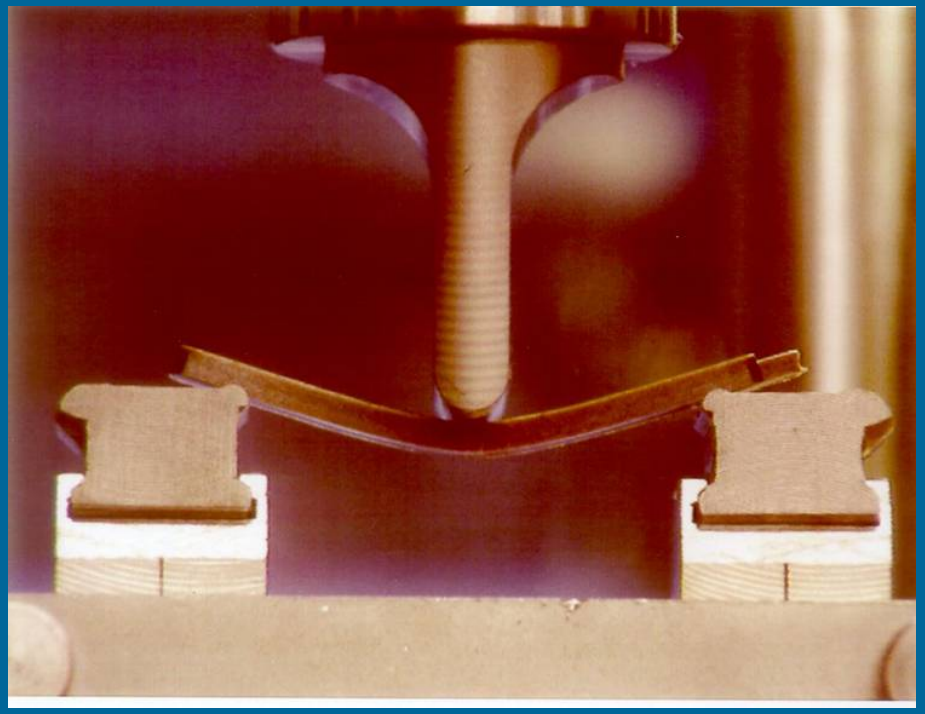


matrix

Moulded test pieces

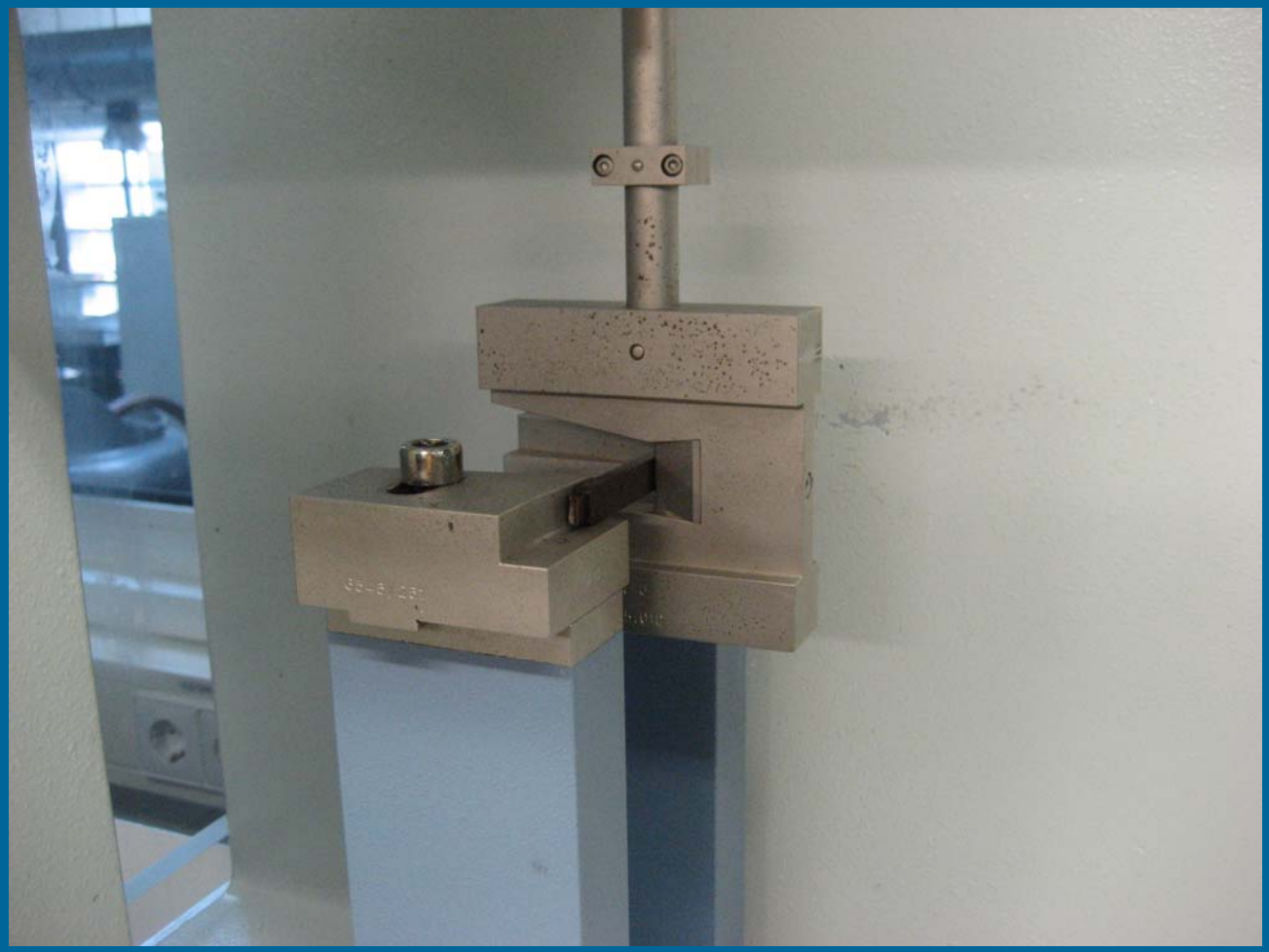
Testing Kenaf-Polypropylene composite

Test pieces



Bending test

Testing Kenaf-Polypropylene composite
Charpy test



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Testing Kenaf-Polypropylene composite
Charpy test

Strength properties of kenaf fibres/ PP compounds

Material	Flexural Modulus [GPa]	Flexural Strength [MPa]	Strain [%]	Charpy impact [kJ/m2]
CETA	3.3 (0.2)	53 (1)	3.6 (0.1)	12 (1)
CETA +MAPP	3.2 (0.1)	71 (1)	4.1 (0.1)	12 (2)
UniNova +MAPP*	3.1 (0.2)	70 (1)	4.2 (0.1)	13 (2)

*warm water retted

Strength properties of kenaf fibres/ PP compounds

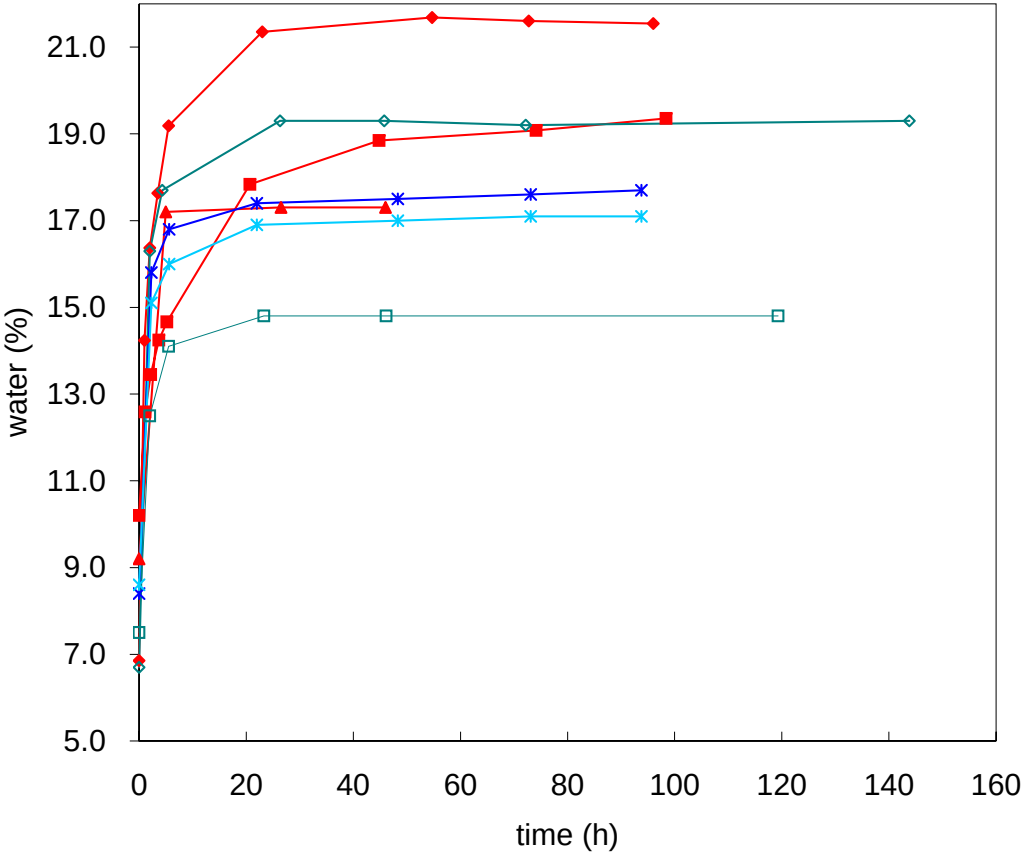
Material	Flexural Modulus [GPa]	Flexural Strength [MPa]	Strain [%]	Charpy impact [kJ/m2]
CETA*	3.3	53	3.6	12
CETA +MAPP	3.2	71	4.1	12
UniNova +MAPP	3.1	70	4.2	13
FAIR unretted	4.0	53	3.1	11
FAIR retted	4.1	55	3.2	12
Jute	3.2	69	4.8	18
Hemp	2.7 - 3	59 - 67	4.8 – 5.3	13 - 19

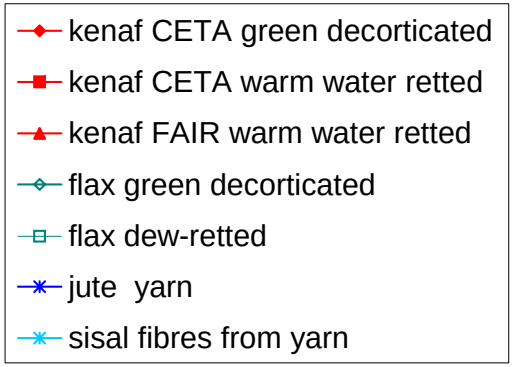
*fibres produced by CETA and extracted by KEFI

Conclusions Kenaf/PP compounding

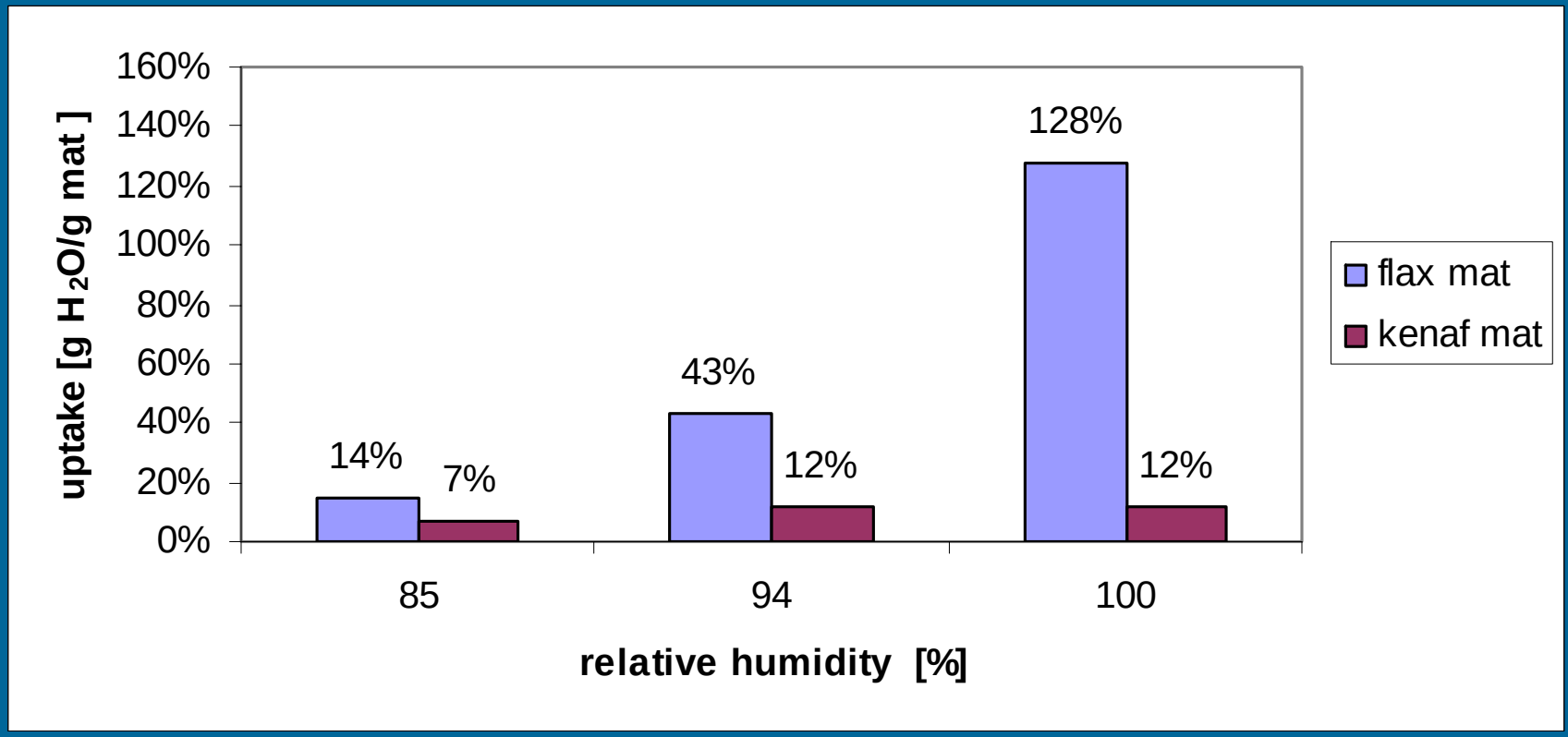
- CETA/KEFI fibres can be used for compounding, but composites are less strong than flax or hemp composites
- Retted kenaf fibres harvested in autumn did not give stronger composites than CETA/KEFI fibres
- Quality of the fibres in relation to harvest time and extraction method must be further investigated

Moisture absorption of natural fibres





Moisture uptake of insulation mats under semi- aerobic conditions



Kenaf mat with PE
no additives

Flax mat contains
flame retardants

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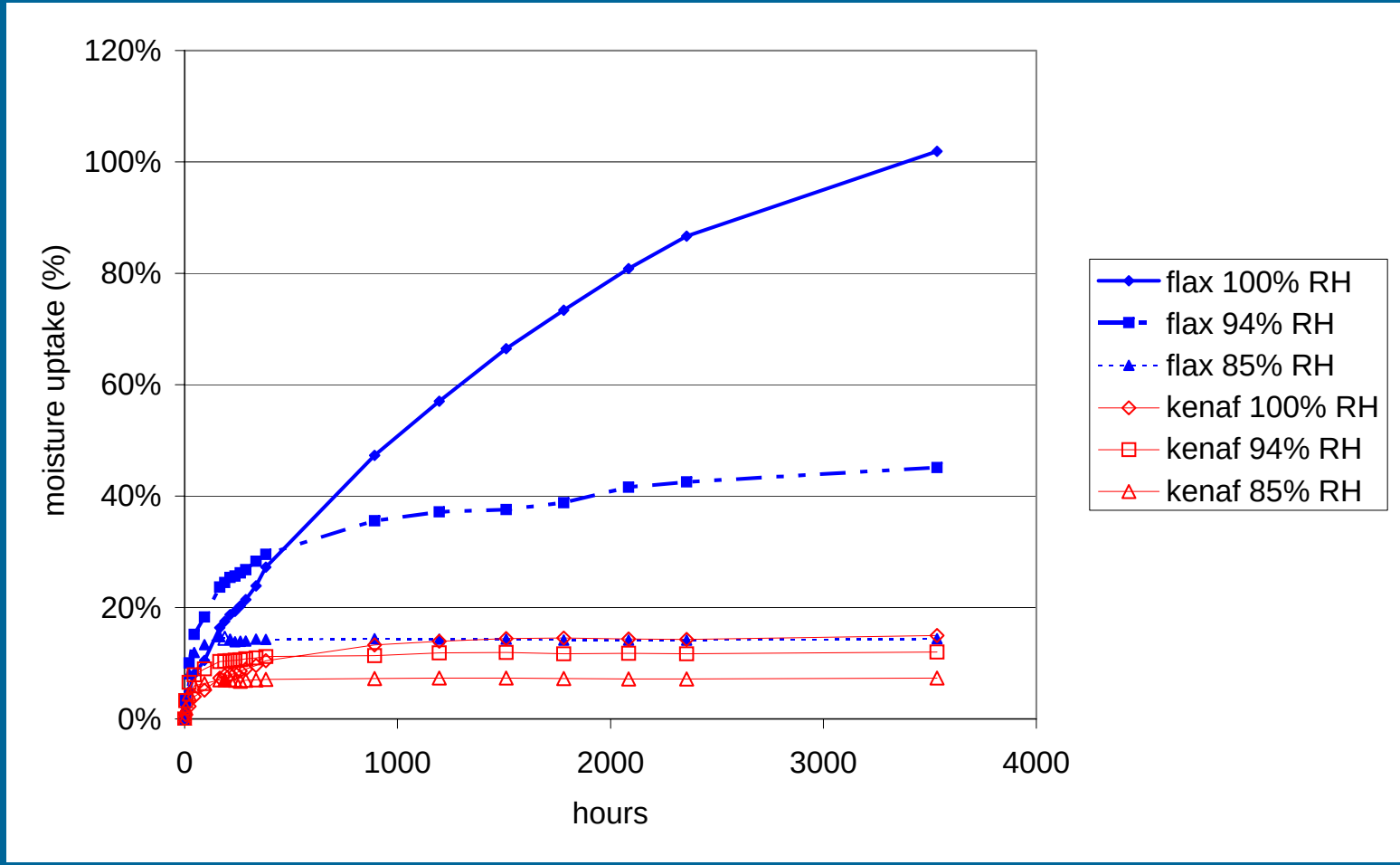
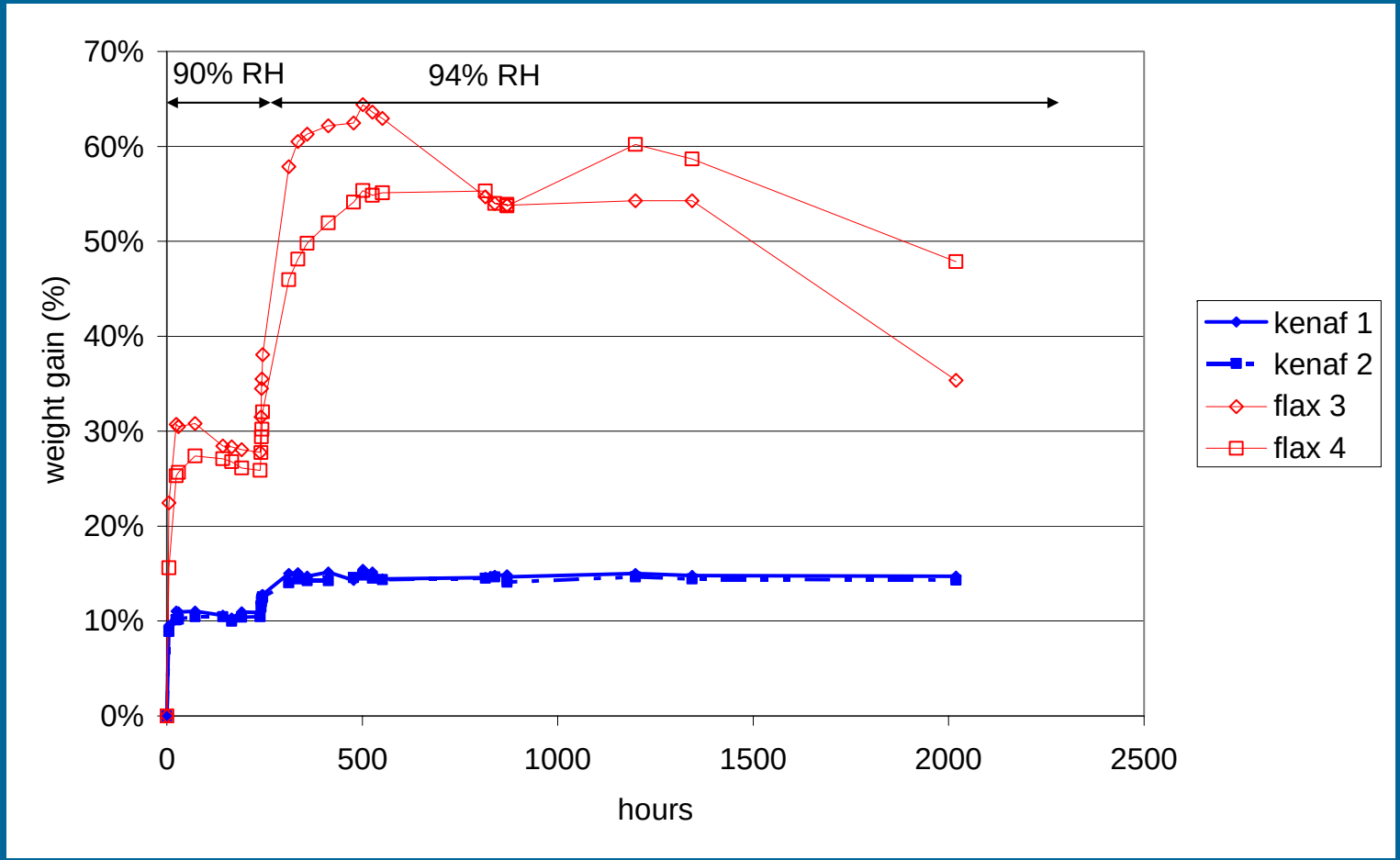
Moisture uptake of insulation mats under semi- aerobic conditions



Moisture absorption insulation mats under aerobic humid conditions



Moisture absorption insulation mats under aerobic humid conditions

Moisture absorption of fibre mats

- Kenaf mats show no visible microbial degradation at 94% RH and 23 ^{0}C.
- Flax mats with fire retardants show high water absorption in humid air.

New project?

- Production of higher quality fibres, based on controlled retting or other extraction steps
- De-gumming process Gruppo Fibranova like in HEMPSYS Project?
- Decortication in field?
- Selection of kenaf varieties with early end of life cycle?