Hemp fibre quality: what the industry needs?

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EIHA European Industrial Hemp Association

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Guiding Questions ?

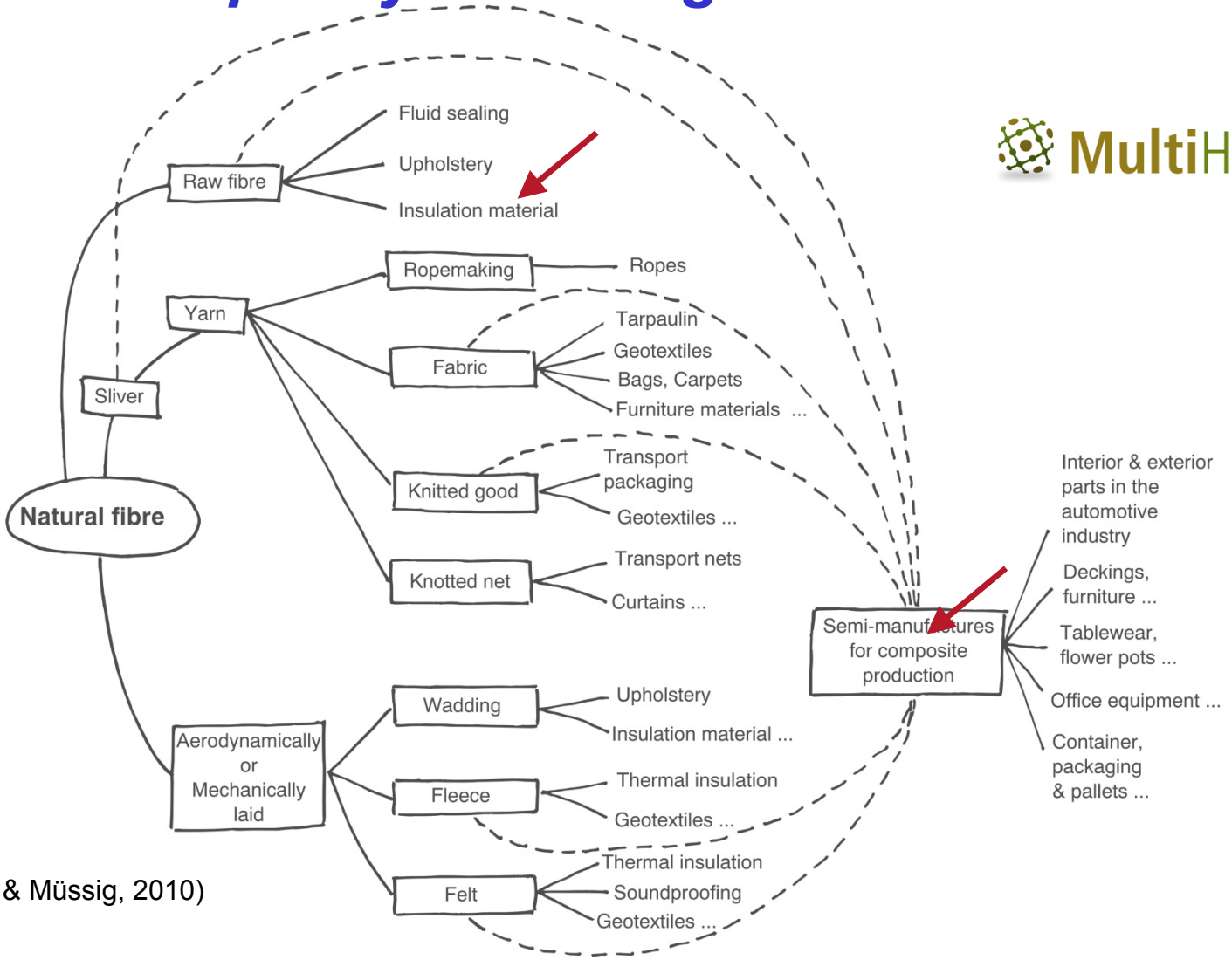
- What are the main differences regarding hemp characteristic for different uses of natural fibres in industrial applications?

- Are we able to identify the most important quality characteristics for the use of hemp in industrial applications? Is it possible to define generally accepted and applicable measurement methods?

- Is the proposed integrated quality management concept practical and feasible? Can the concept help to improve hemp breeding activities and product optimization?

Hemp fibre quality: challenge & vision

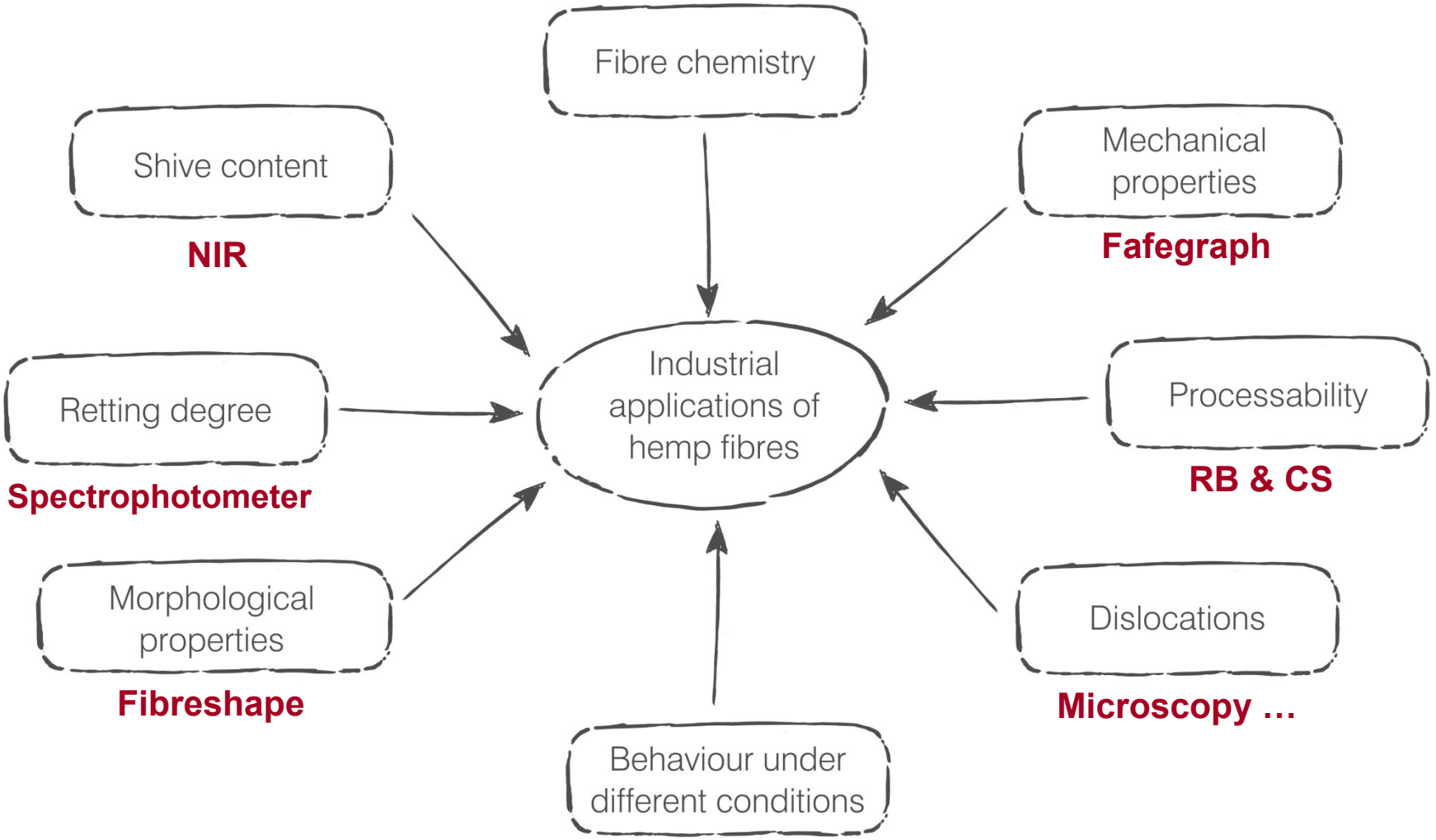
MultiHemp



(Graupner & Müssig, 2010)

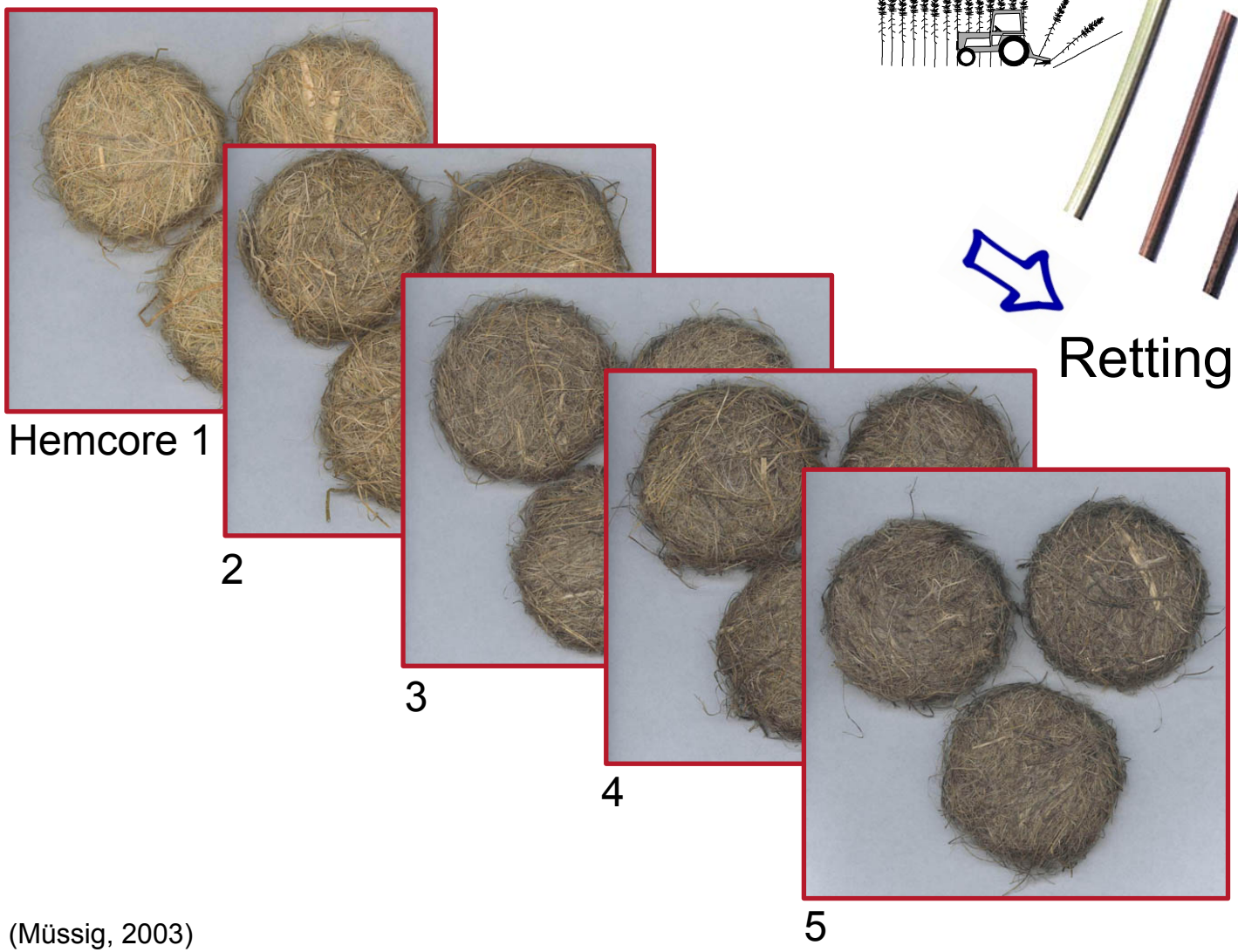
Different uses of natural fibres in industrial application.

Hemp fibre quality: challenge & vision



A selection of quality characteristics for the use of hemp in industrial application.

Retting



(Müssig, 2003)

Retting degree – Colour

Colour measurements method

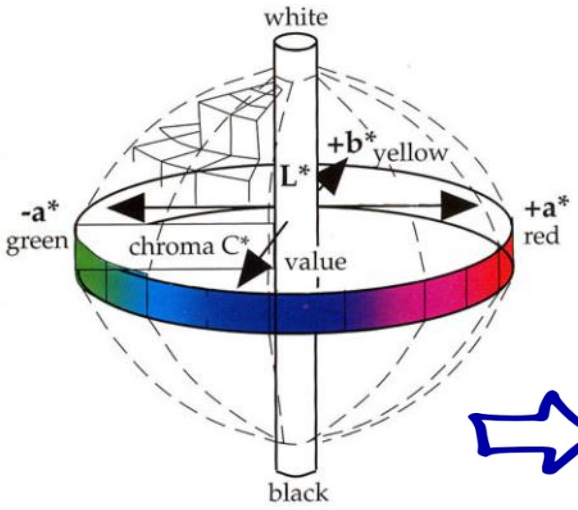
Spectrophotometer CM-2600d, CIELAB, 10° standard observer, illuminant D65, SCE (diffuse reflection without orientation), 3 samples each 4 g (climate 20°C, 65 % humidity of air), 3 measurements (0°, 120° & 240°) on each side.

(Müssig, 2003)

Comparisons between specimens

England	***Germany***	***Difference***
- Hemcore 1	- AGRO - R1	
L* = 63.31	L* = 66.54	ΔL* = - 2.93
a* = 3.51	a* = 3.66	Δa* = - 0.15
b* = 21.85	b* = 21.29	Δb* = + 0.56

(Müssig, 2003)

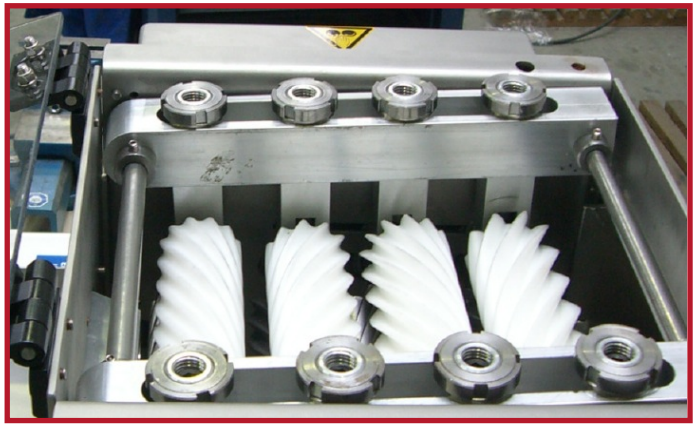


Solid L* a* b* Colour Solid (HunterLab, 2000)

- ΔL* = Hemcore 1 sample a little darker
- Δa* = Hemcore 1 sample a little greener
+ Δb* = Hemcore 1 sample a little yellower

⇨ **Communicating colour by number !**

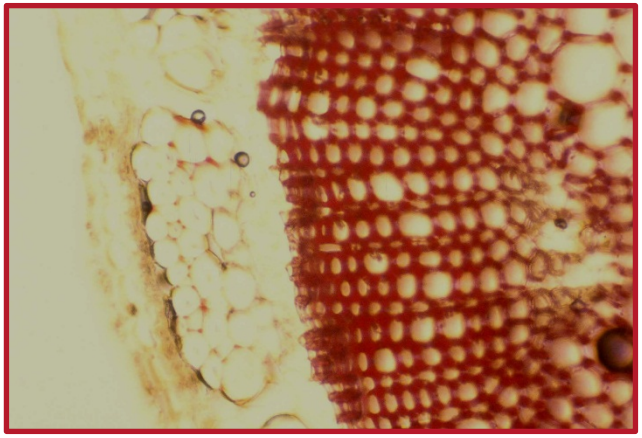
Assessment of Processability



WORTHMANN AUTOMATION

Assessment of the processability of hemp stem within the MultiHemp project.

Rapid Assessment of Quality of Bast Fibre

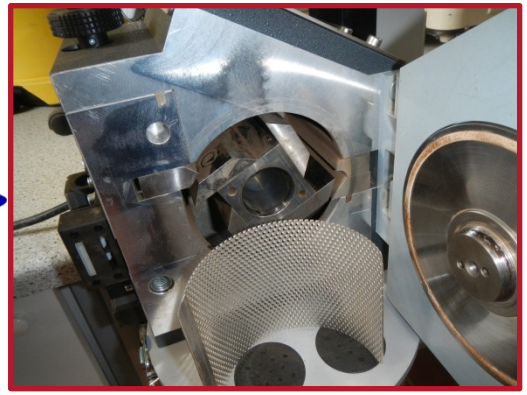


(Akin, 2013)

Near infrared spectroscopy; chemometric models. Standard test method for the measurement of shives in retted flax ASTM D-7076-05 (Akin, 2010).

Shive content – NIR

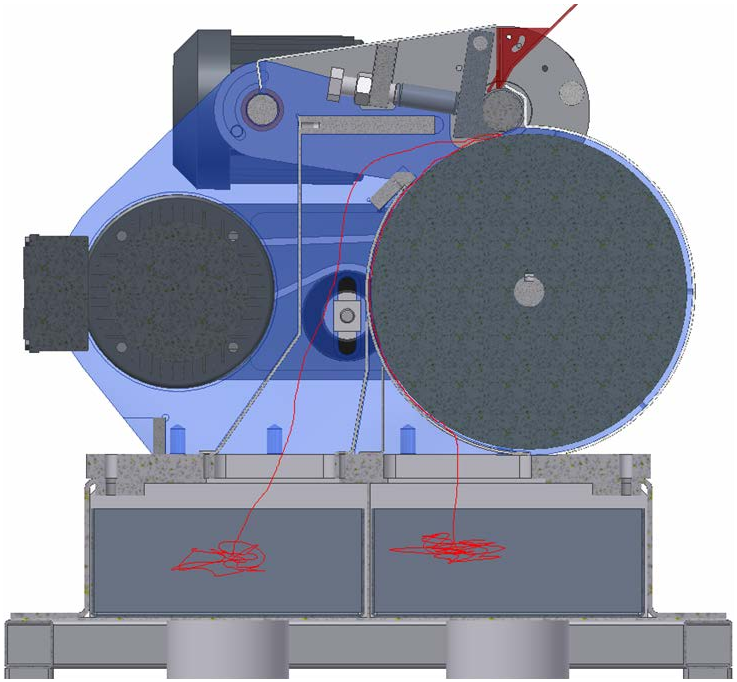
Rapid Assessment of Shive Content in Hemp

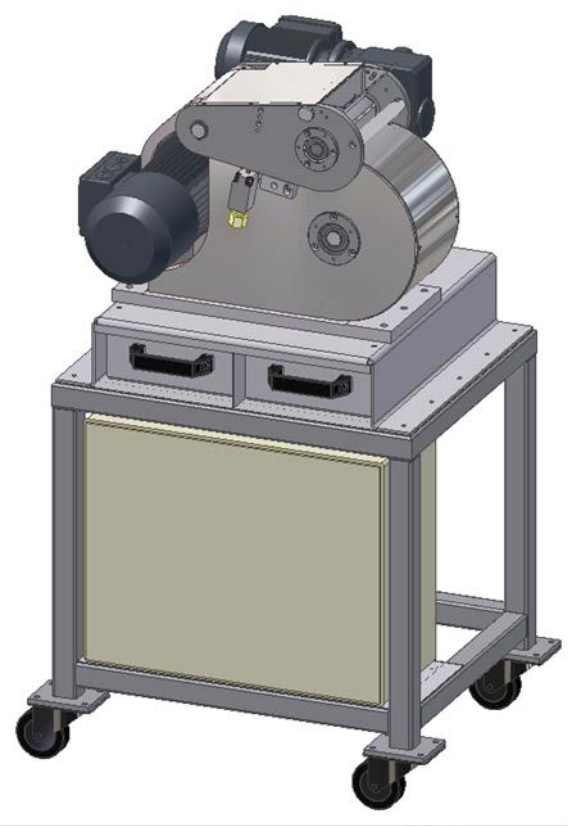


- Variety: USO 31
- Location: ATB, Potsdam, DE
- Sowing: 2010-05-17
- Harvest: 2010-09-17
- Retting: 3 weeks
- Bast & Shive separation
- Grinding & mixing

Sample preparation of retted und unretted hemp within MultiHemp.

Assessment of Processability

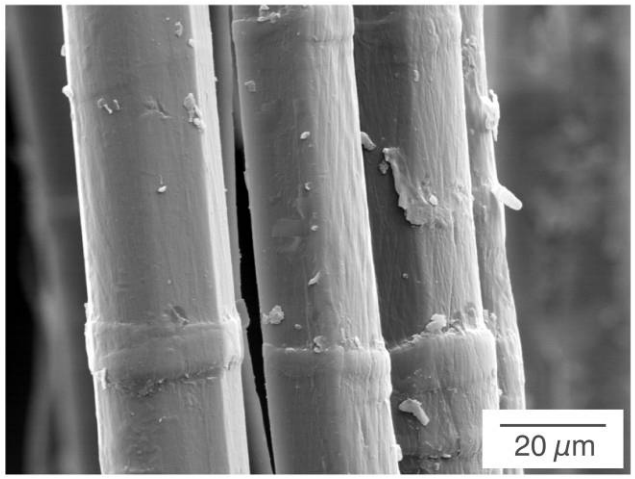




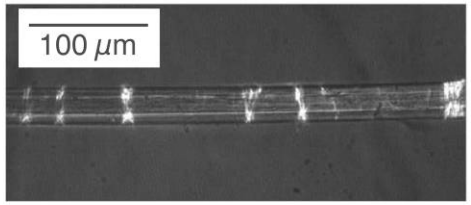
WORTHMANN AUTOMATION

Assessment of the processability of hemp fibre bundles within the MultiHemp project.

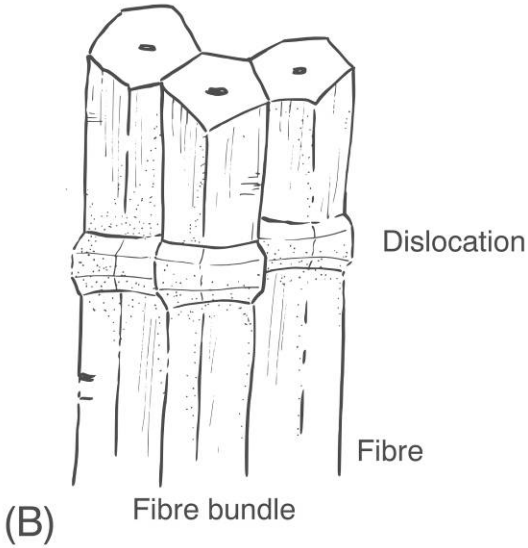
Factors Affecting the Fibre Properties



(A)



(C)

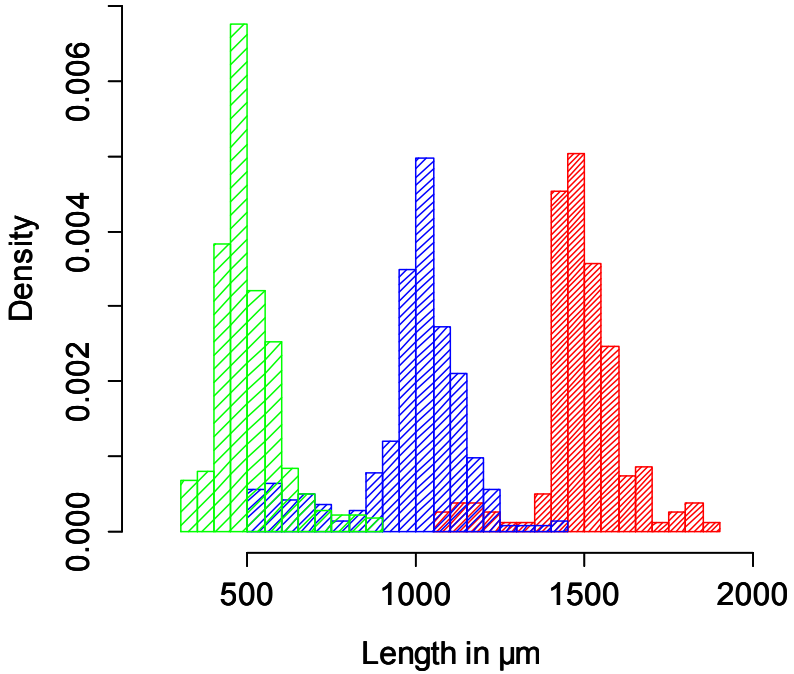


(B)

(A) Scanning electron micrograph of dislocations in a flax fibre bundle. (B) Schematic representation of dislocations in a flax fibre bundle. (C) Dislocations in flax, shown as bright zones crossing the fibre when viewed under polarised light in an optical microscope.

(Müssig & Hughes, 2012)

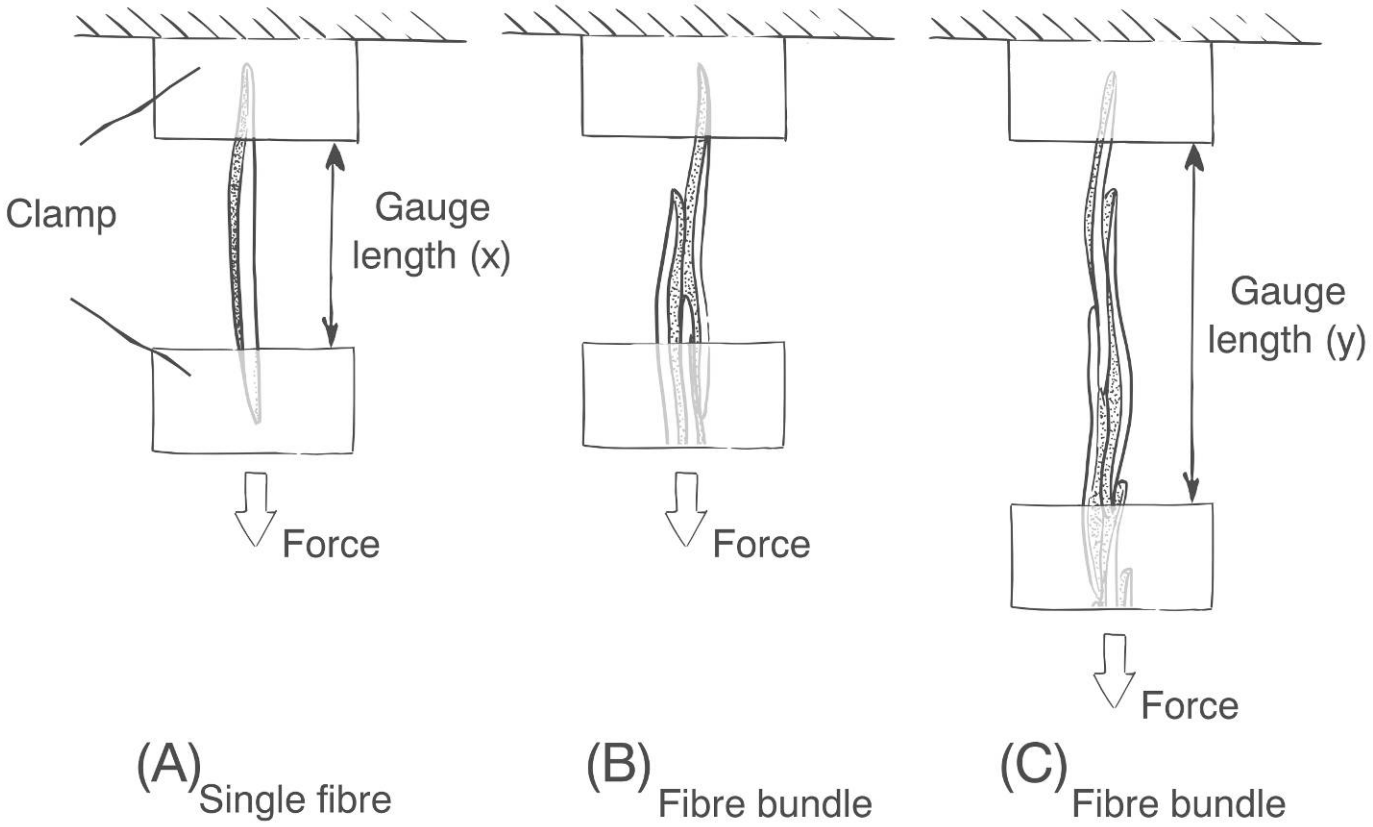
Morphological Characterisation



- FibreShape, IST AG, CH
- Determination of width & length distributions of fibres
- Measurement of fibre orientations
- High resulution scanners up to 4000 dpi
- Slide & flat bed scanner

Image analysis system Fibreshape for the length and width measurement of fibres & fibre bundles.

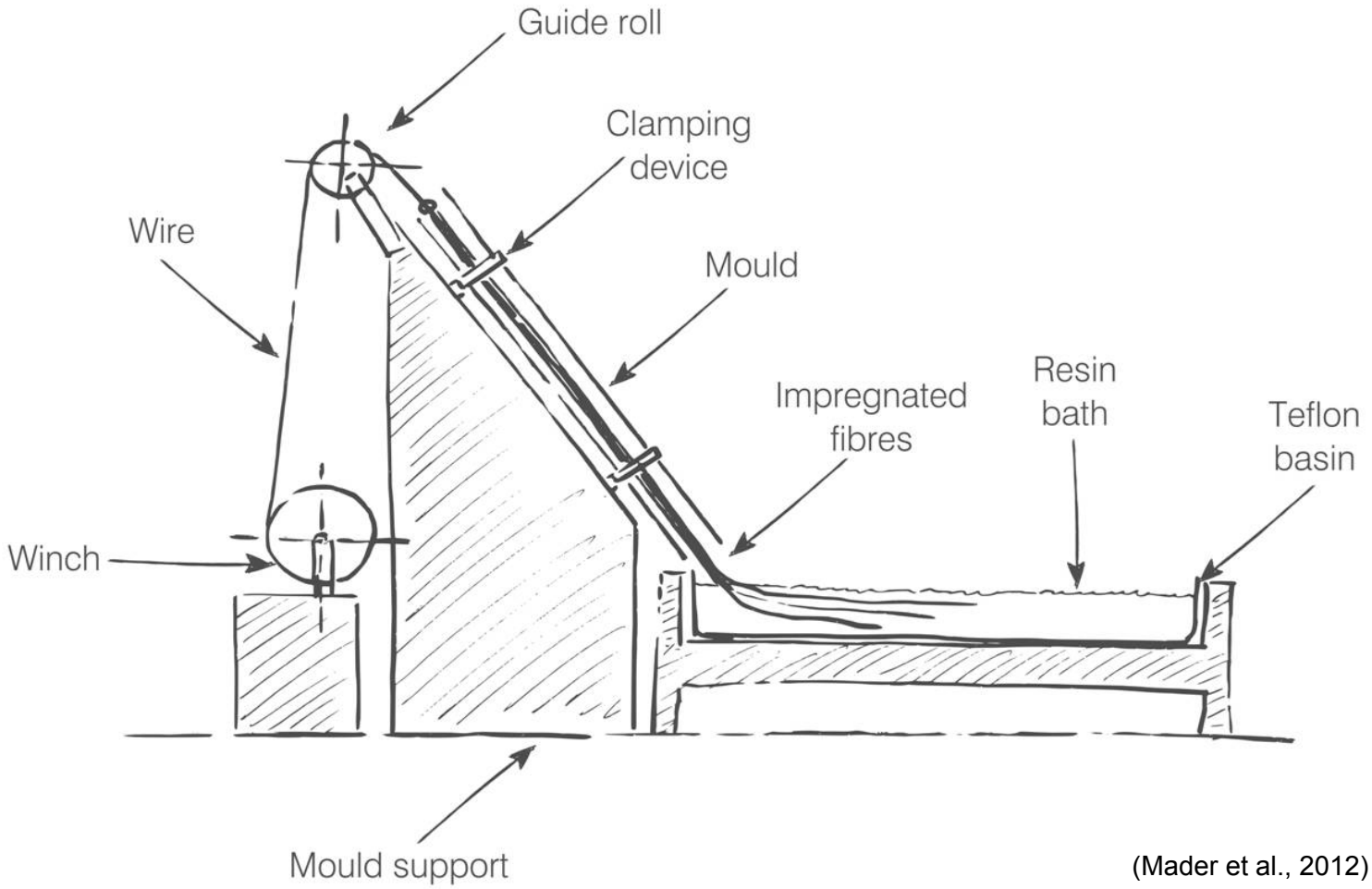
Mechanical Properties



Various testing methods to test the tensile properties of plant fibres and fibre bundles. (A) Single fibre fixed in clamps at a gauge length (x). (B) A fibre bundle prepared for tensile testing with the same gauge length (x) as the single fibre. (C) Fibre bundle with a greater gauge length (y).

(Müssig & Hughes, 2012)

Mechanical Properties



(Mader et al., 2012)

Pilot-scale pultrusion testing.

Conclusion

- It is useful to distinguish between a general and a product specific hemp fibre quality management.
- Are we able to identify the most important quality characteristics for the use of hemp in industrial applications? ☺😐
- Is it possible to define generally accepted and applicable measurement methods? ?
- Is the proposed integrated quality management concept practical and feasible? ☺?
- Can the concept help to improve hemp breeding activities and product optimization? ☺

Many thanks for your attention!

Prof. Dr.-Ing.

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MultiHemp

SEVENTH FRAMEWORK PROGRAMME

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