

Development of polymer-hemp composites

PolyChanvre, a crossborder project between France and Belgium

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CERTECH, Seneffe, Belgium

**10th International Conference
of the European Industrial Hemp Association (EIHA)**

May 22nd – 23rd, Wesseling, Germany

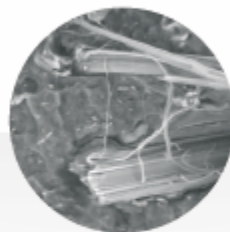
Cross-border
thesis



Characterization of
hemp as a material



Study of the
Polymer-hemp interface



Composites
formulation
and elaboration



Properties
evaluation



PARTNERS



ASSOCIATED OPERATORS



Interreg efface les frontières



Union européenne
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Wallonie



RÉGION
CHAMPAGNE
ARDENNE



Natural fibres thermoplastic composites

The interfacing of two worlds

Materials



■ Polymers

- Polypropylene, Polyethylene, PVC
- Bioplastics: PLA, PHA...

■ Natural fibres

- Lignocellulosic fibres (wood)
- Bast fibres: hemp, flax...

■ Additives

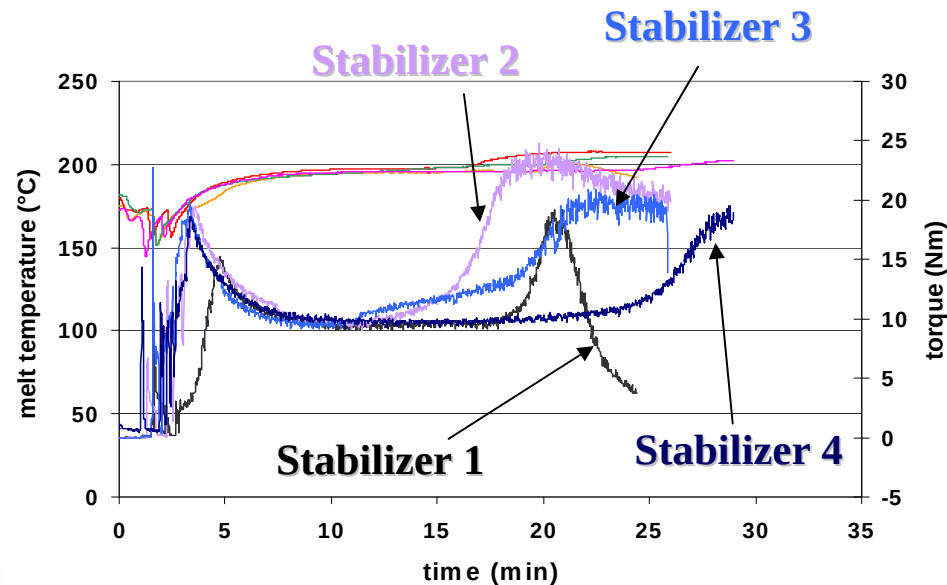
- Coupling agents, lubricants...



Key parameters

✓ Polymer matrix

- Processing temperature < 200°C
- Viscosity
- Formulation (stabilizers, lubricants...)



✓ Process

- Feeding
- Type of extrusion (t°, shear...)

✓ Interface

- Compatibilization
- Fibre or polymer chemistry

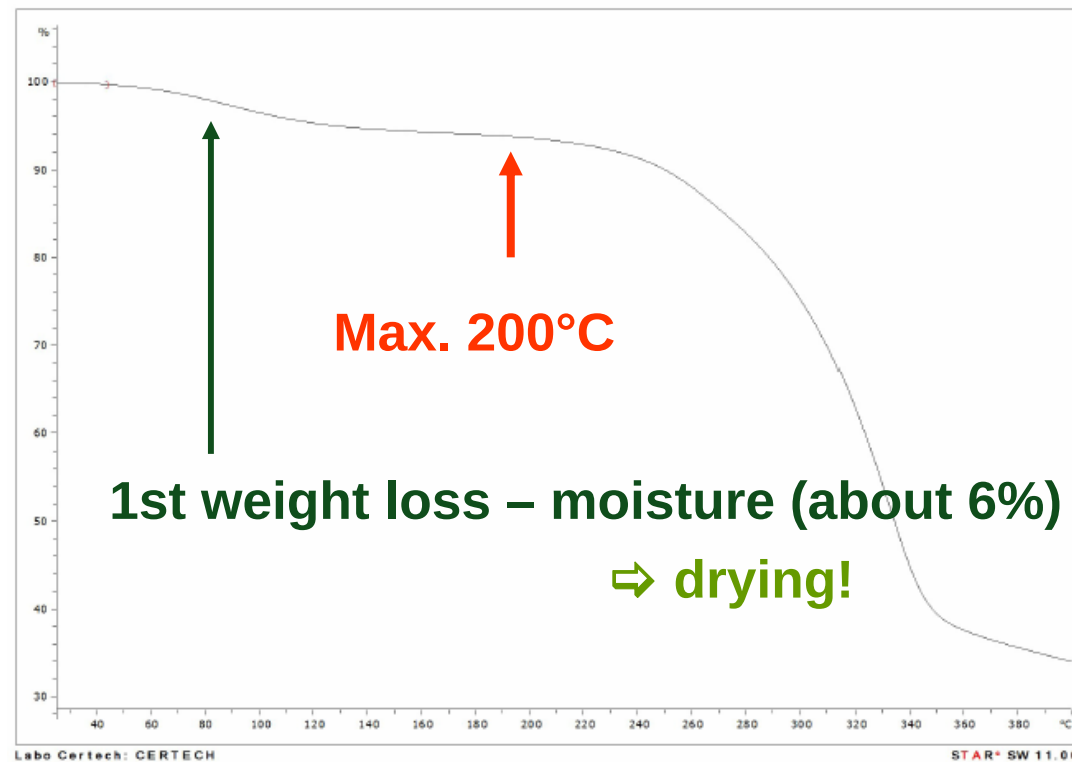


- Fibrous shives
(chopped straw,
no decortication)
- 1 – 5 mm
- Heterogeneity

⇒ Valorisation of
a by-product

Thermogravimetric analysis (TGA)

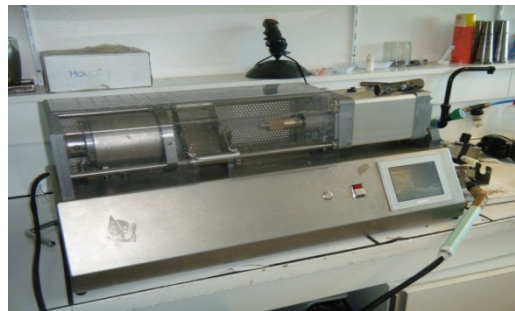
Hemp pellet



Hemp supplied by ChanvrEco

Separation of 3 fractions

- Raw fibrous shives
- Fibres isolated from the chopped straw
- Shives isolated from the chopped straw

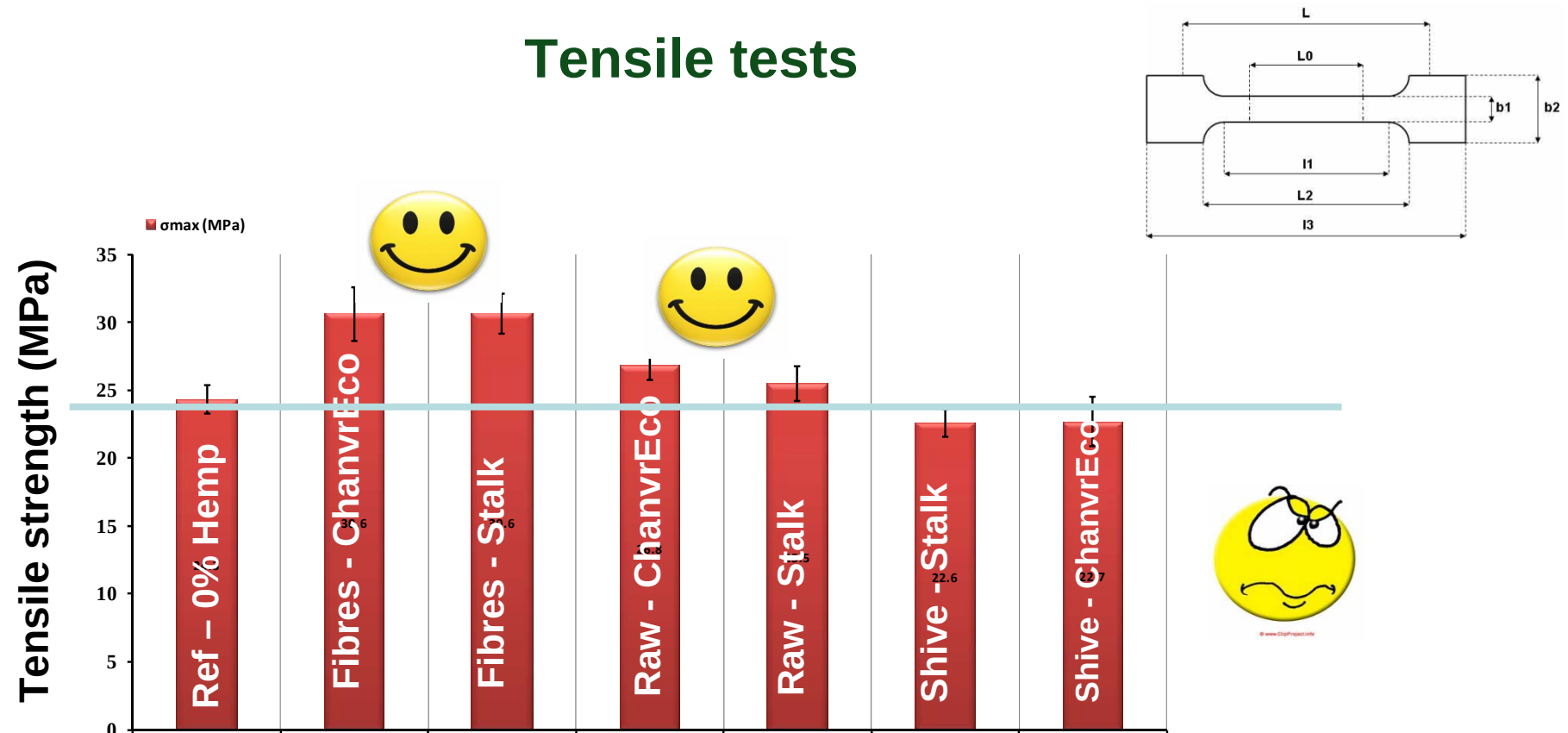


Extrusion / injection moulding

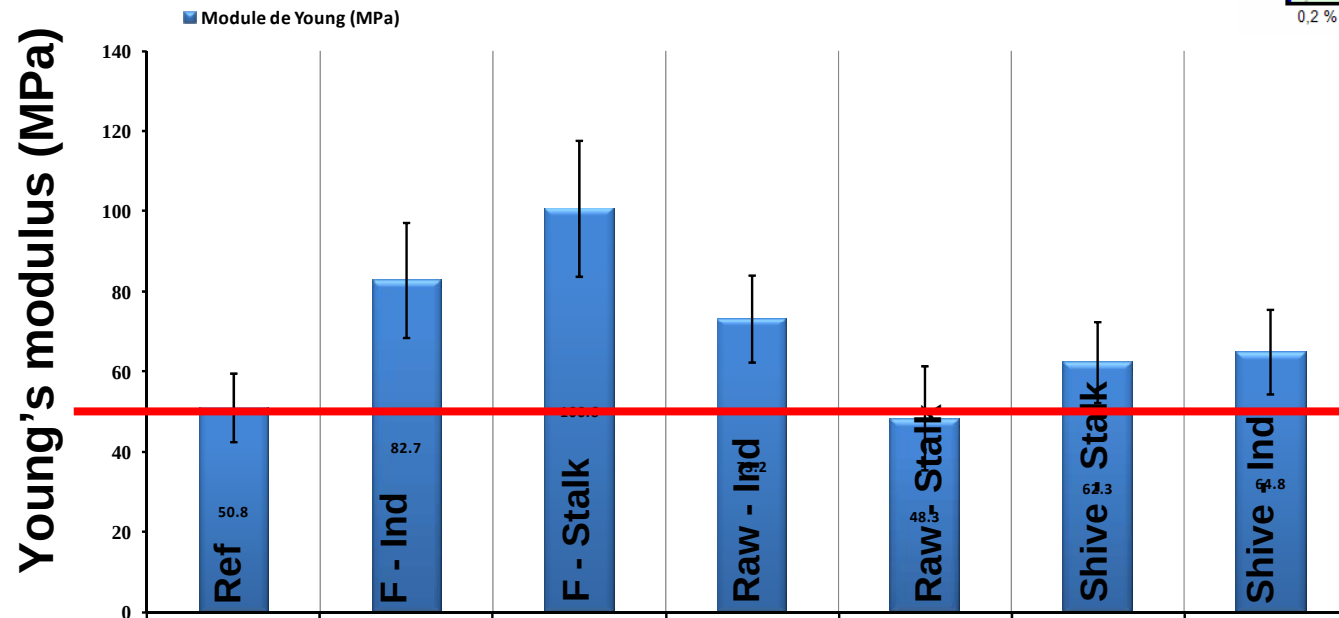
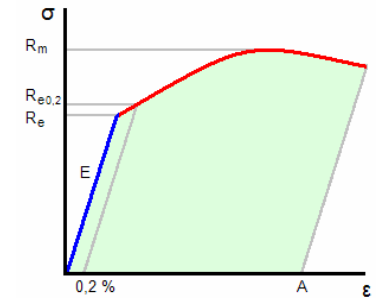
(small scale)

- ❖ 20 wt % in a polymer matrix
- ❖ Comparison with a reference (raw stalk)

Tensile tests

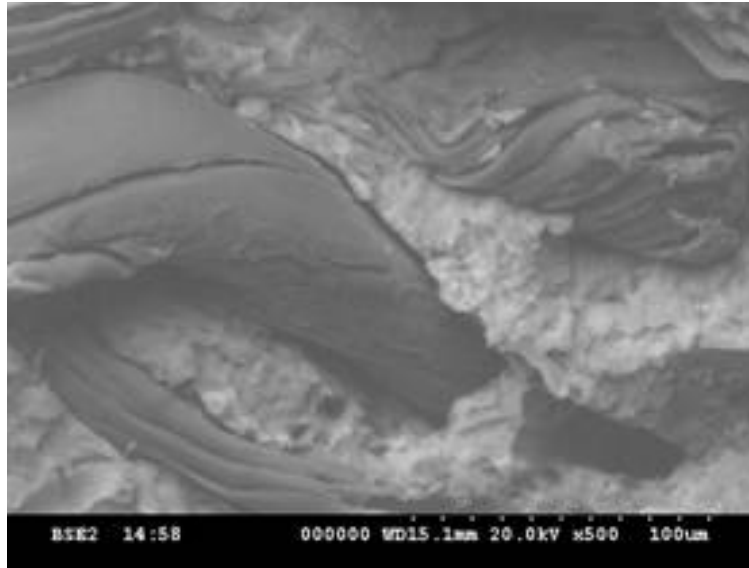


Tensile tests



Hemp chopped straw (fibrous shives), 1 – 5 mm

- ✓ **Reinforcing effect of the isolated fibres**
- ✓ **Fibres in the chopped straw contribute to reinforcing**
- ✓ **Shives in the chopped straw have a neutral or slightly positive effect on the composite properties**

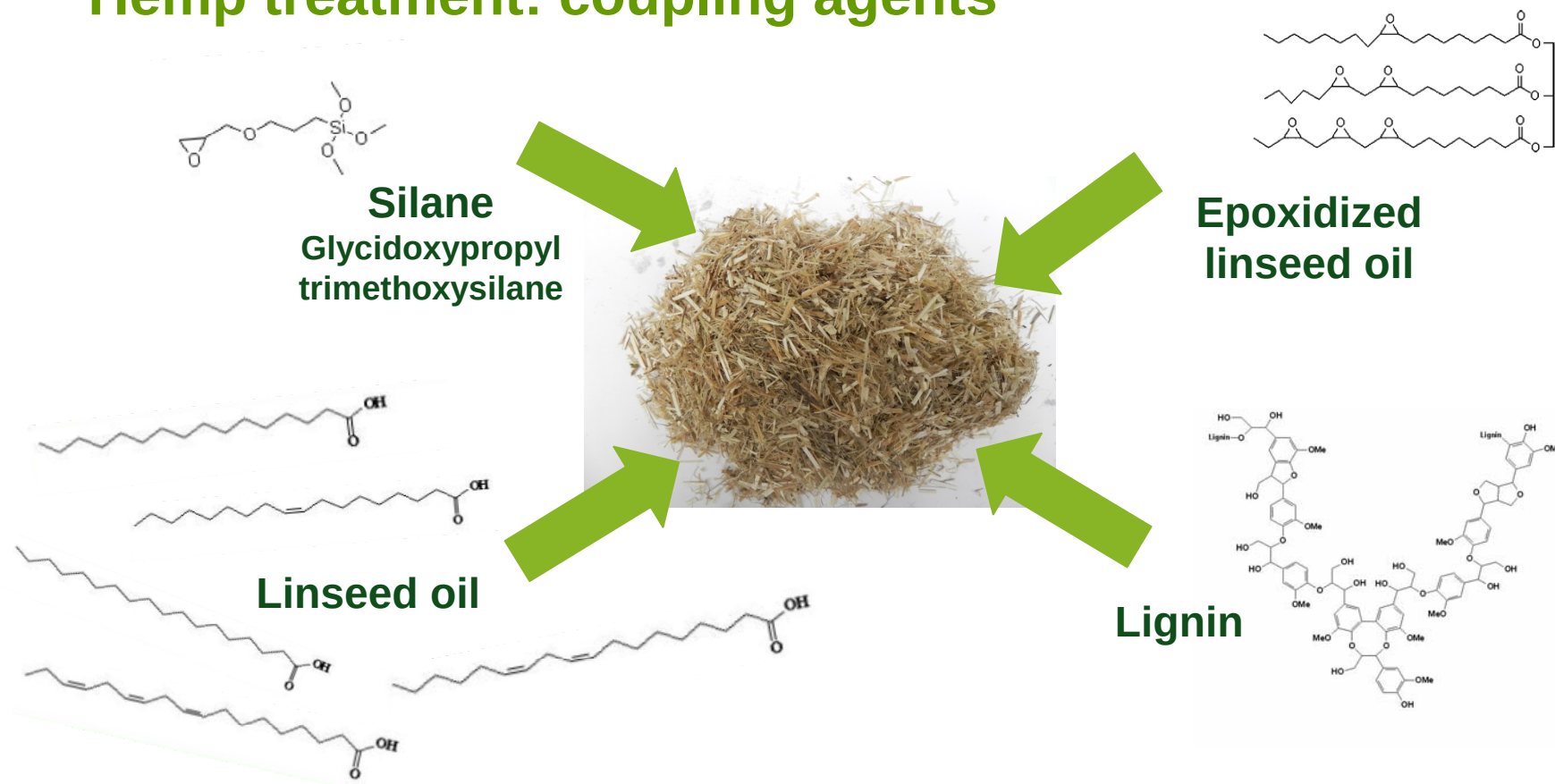


PVC – hemp 30% (SEM)

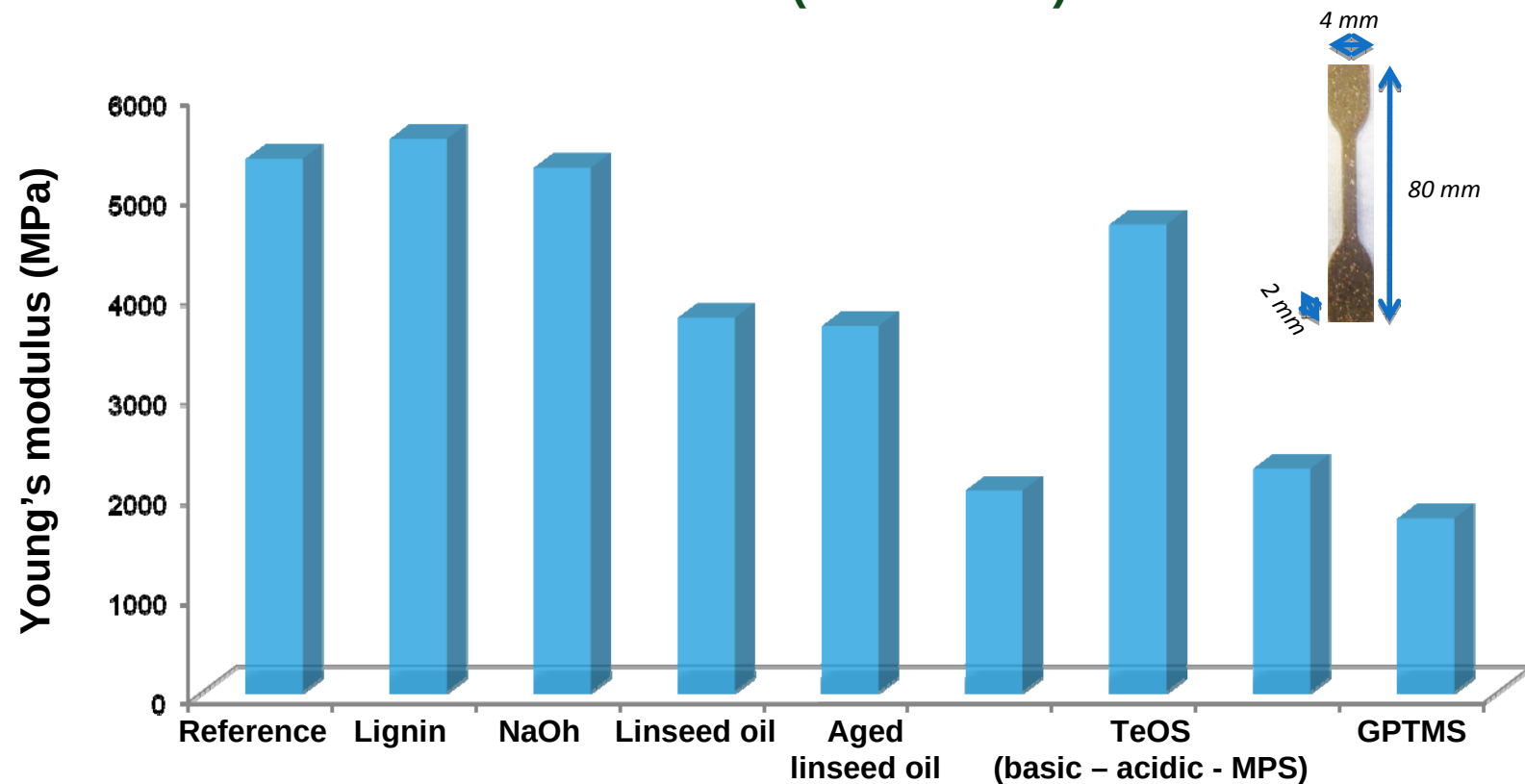
Interface

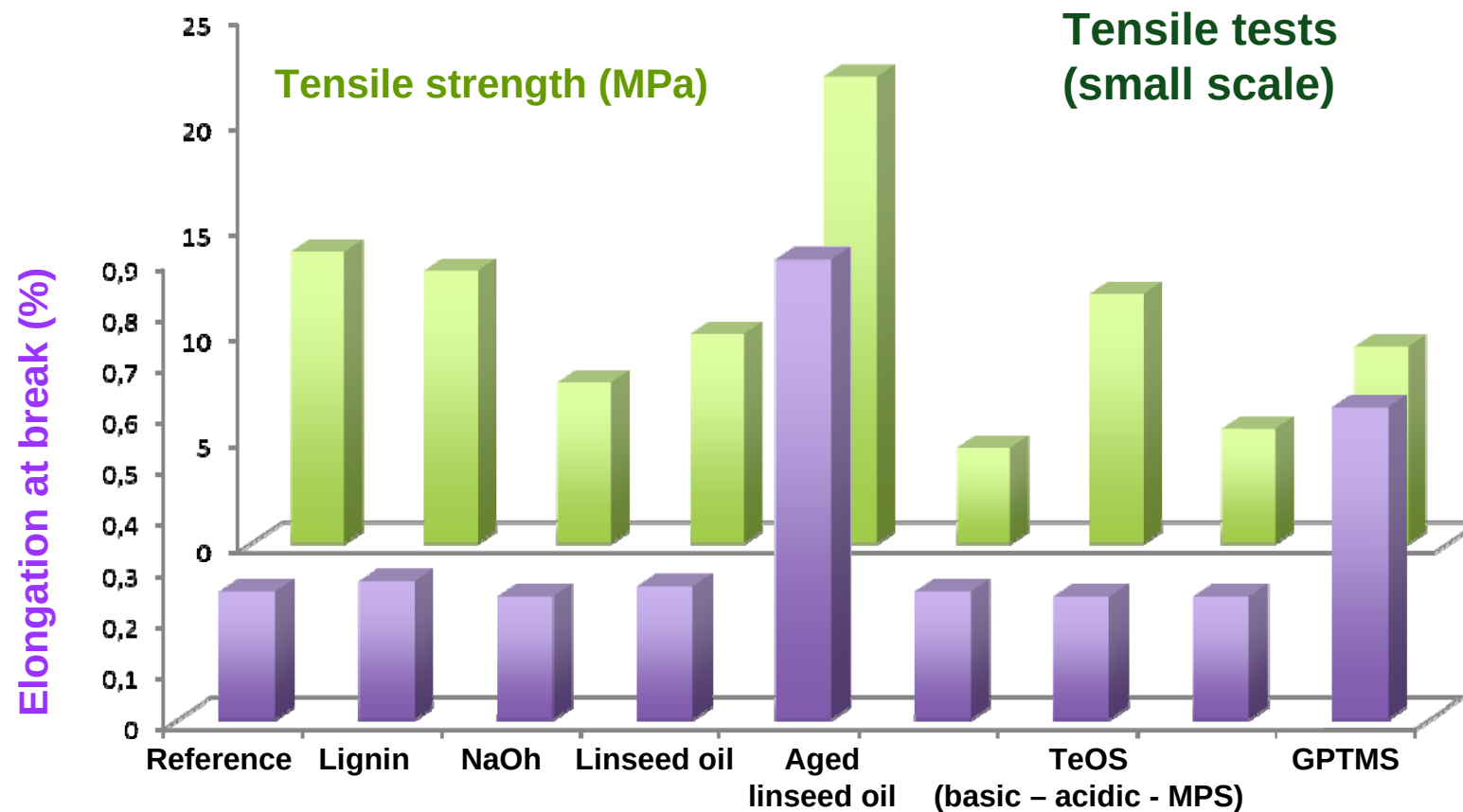
- Hemp treatment: coupling agents
- Polymer chemistry: compatibilization

Hemp treatment: coupling agents



Tensile tests (small scale)









Extrusion

Composite

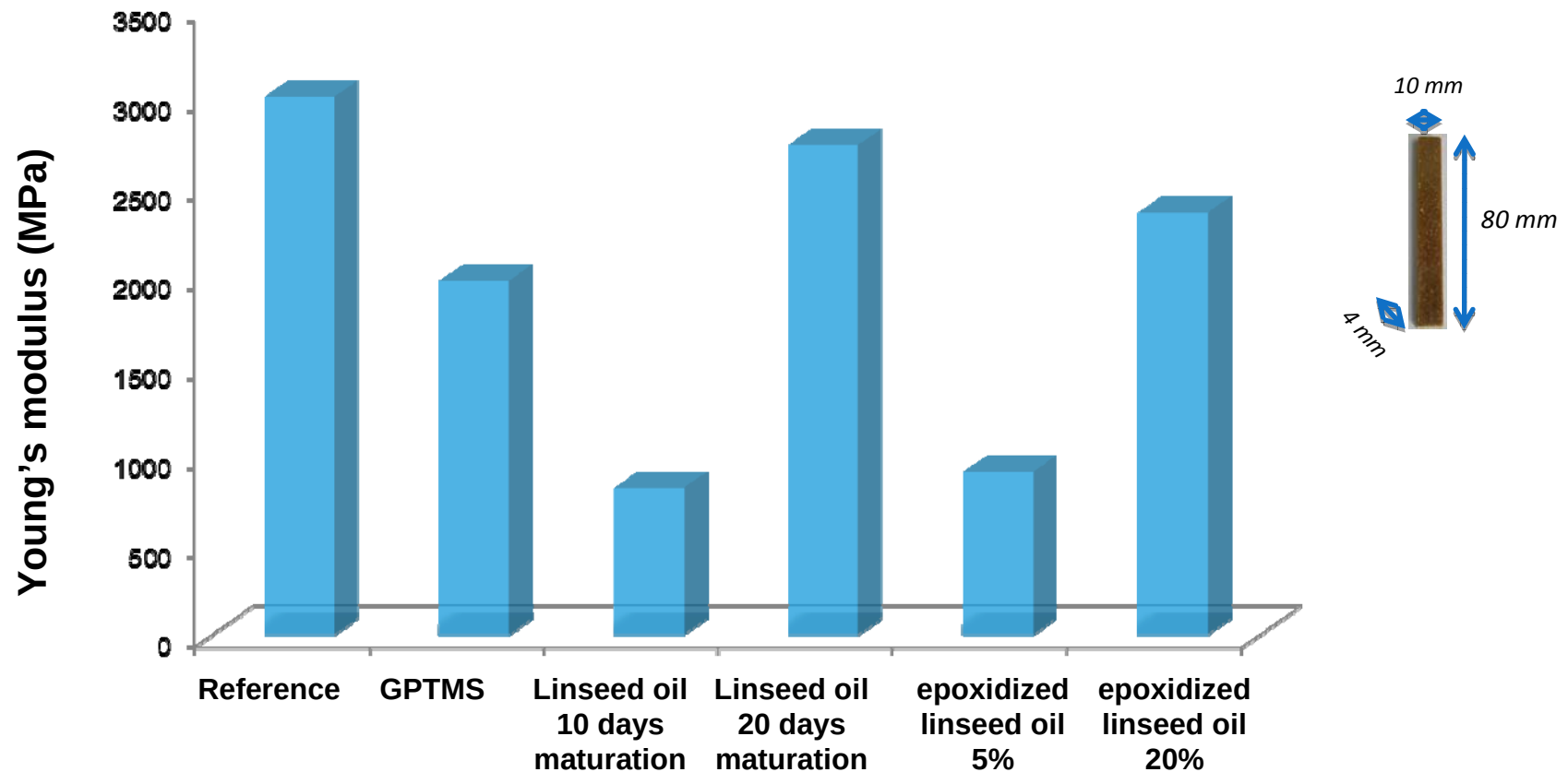


Hemp
Polymer

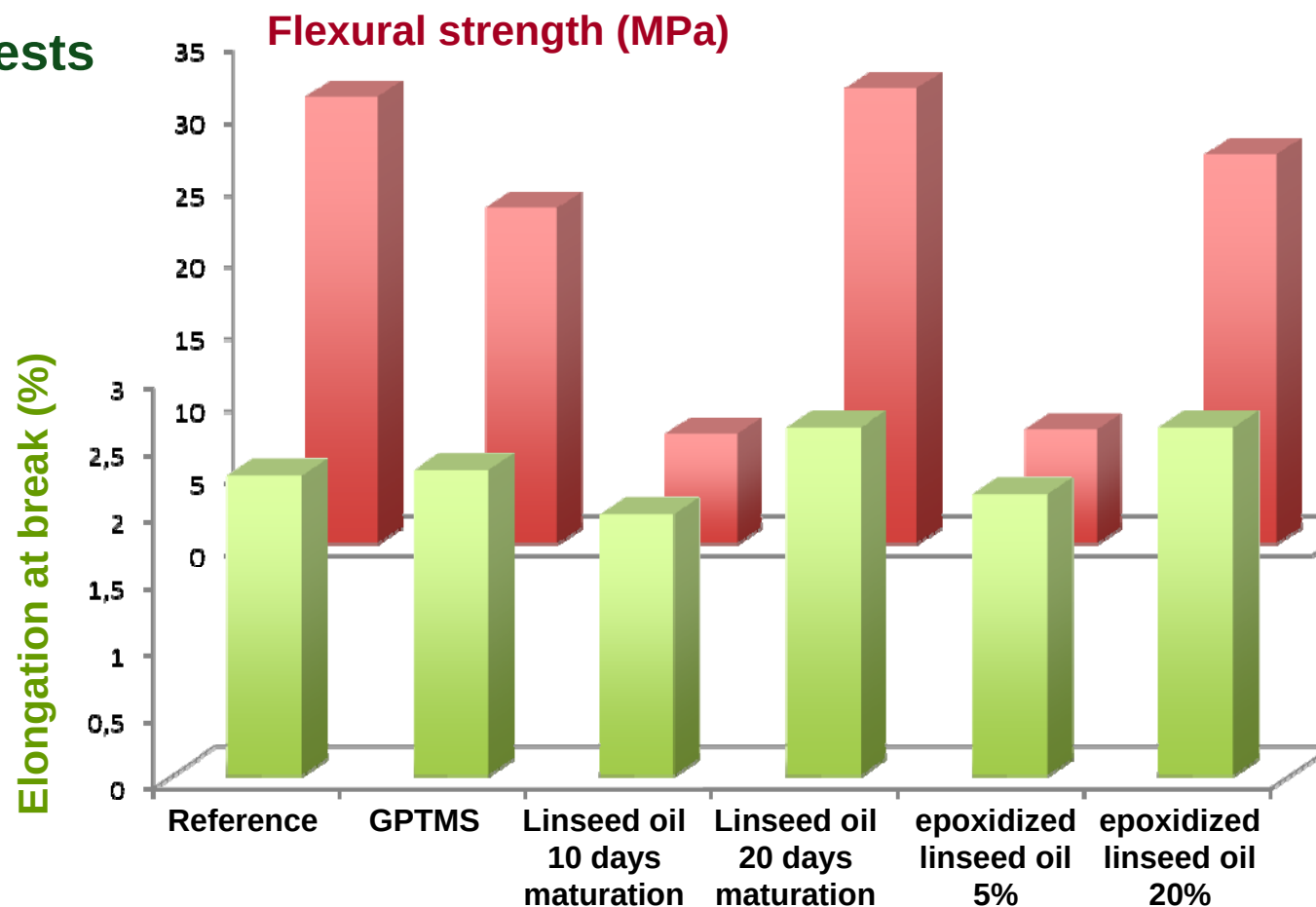
Pelletizing

Pellets

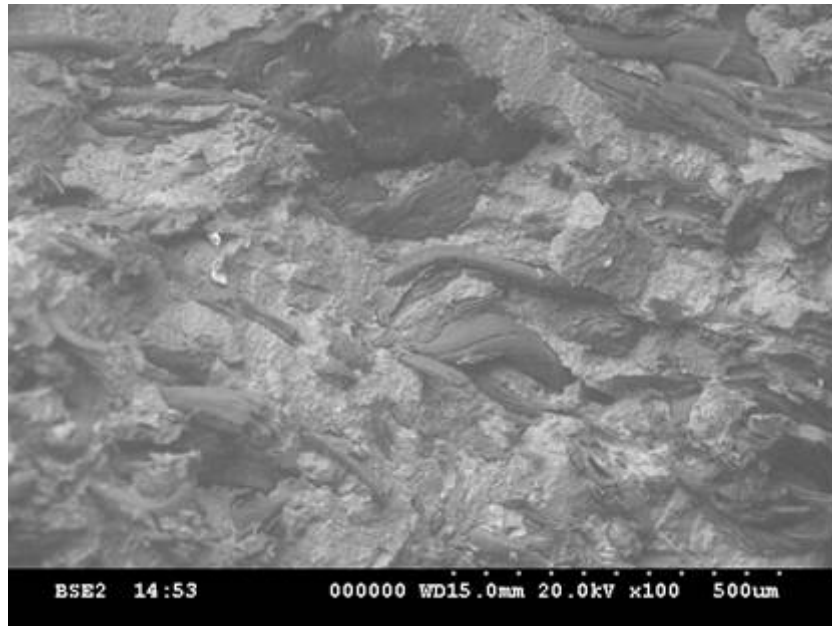
Bending tests



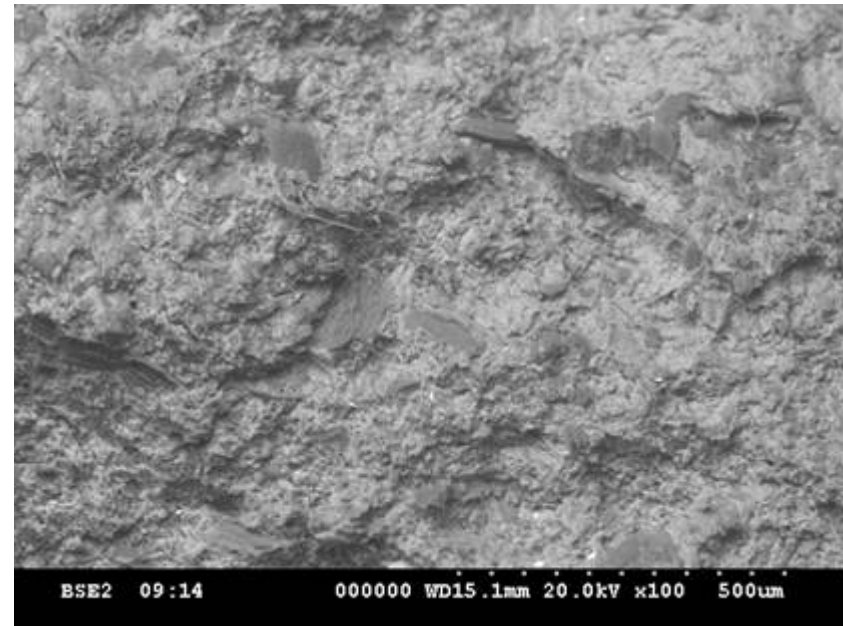
Bending tests



Scanning electron microscopy (SEM)



Without polymer comp.



With polymer comp.

Conclusion

- ✓ Polymer-hemp profile extrusion demonstrated using fibrous shives
- ✓ No significant improvement of mechanical properties adding coupling agents

Future

- ✓ Plasma treatment
- ✓ Fine characterization of the interface (XPS)
- ✓ Optimisation of compatibilization

PARTNERS



ASSOCIATED OPERATORS



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Thank you for your attention!

Journée Transfrontalière Chanvre



19 juin 2013 à Gembloux



www.polychanvre.eu

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