INSTITUT
Mines-Télécom

Enjeux de l'utilisation de la biomasse végétale et du développement des bio-raffineries

Patrick Navard

Plan de l'exposé

- Biomasse végétale.
- Concept de bioraffinerie
- Quelques exemples
- Conclusion

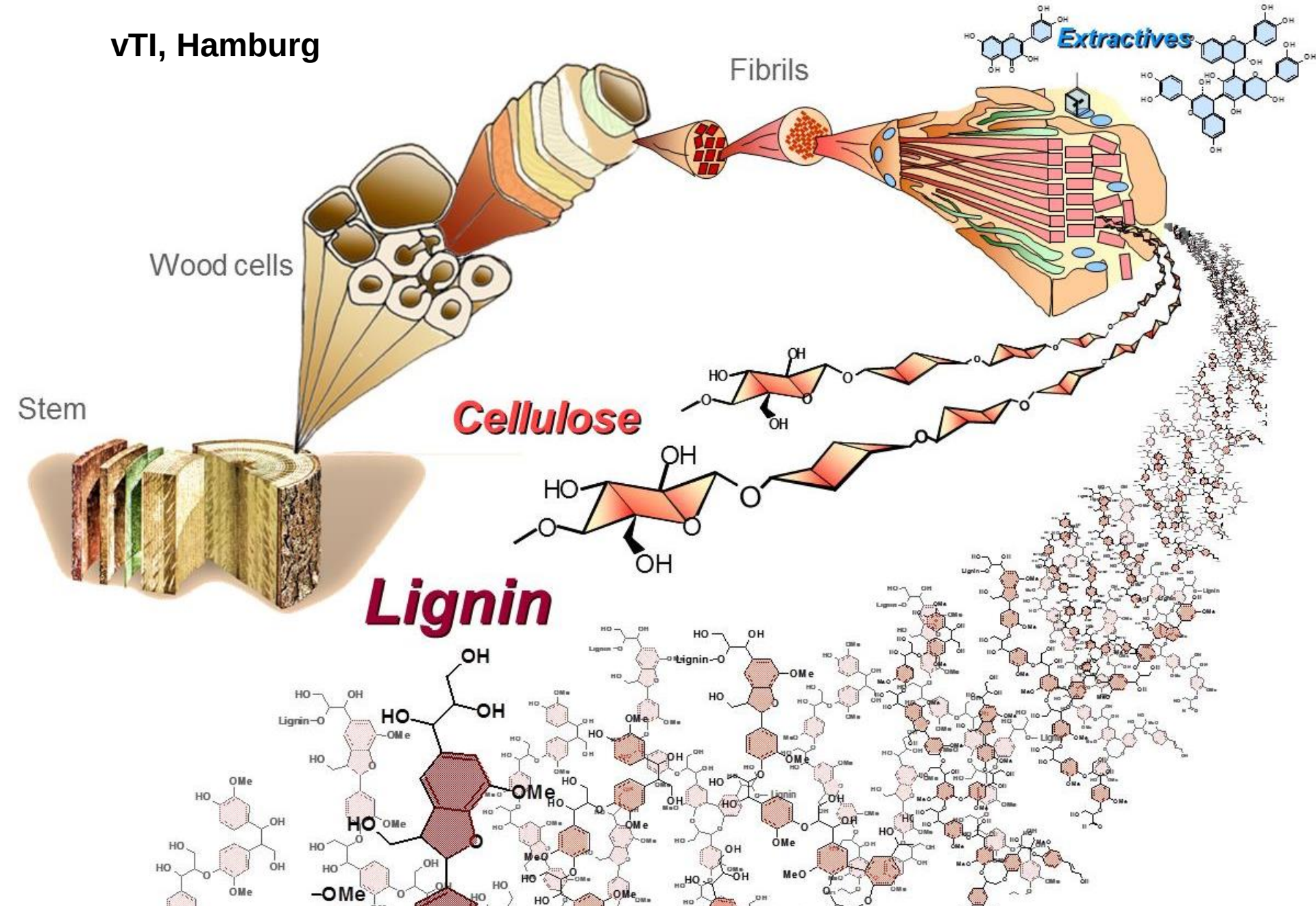
Biomasse végétale

Biomass is produced by Nature

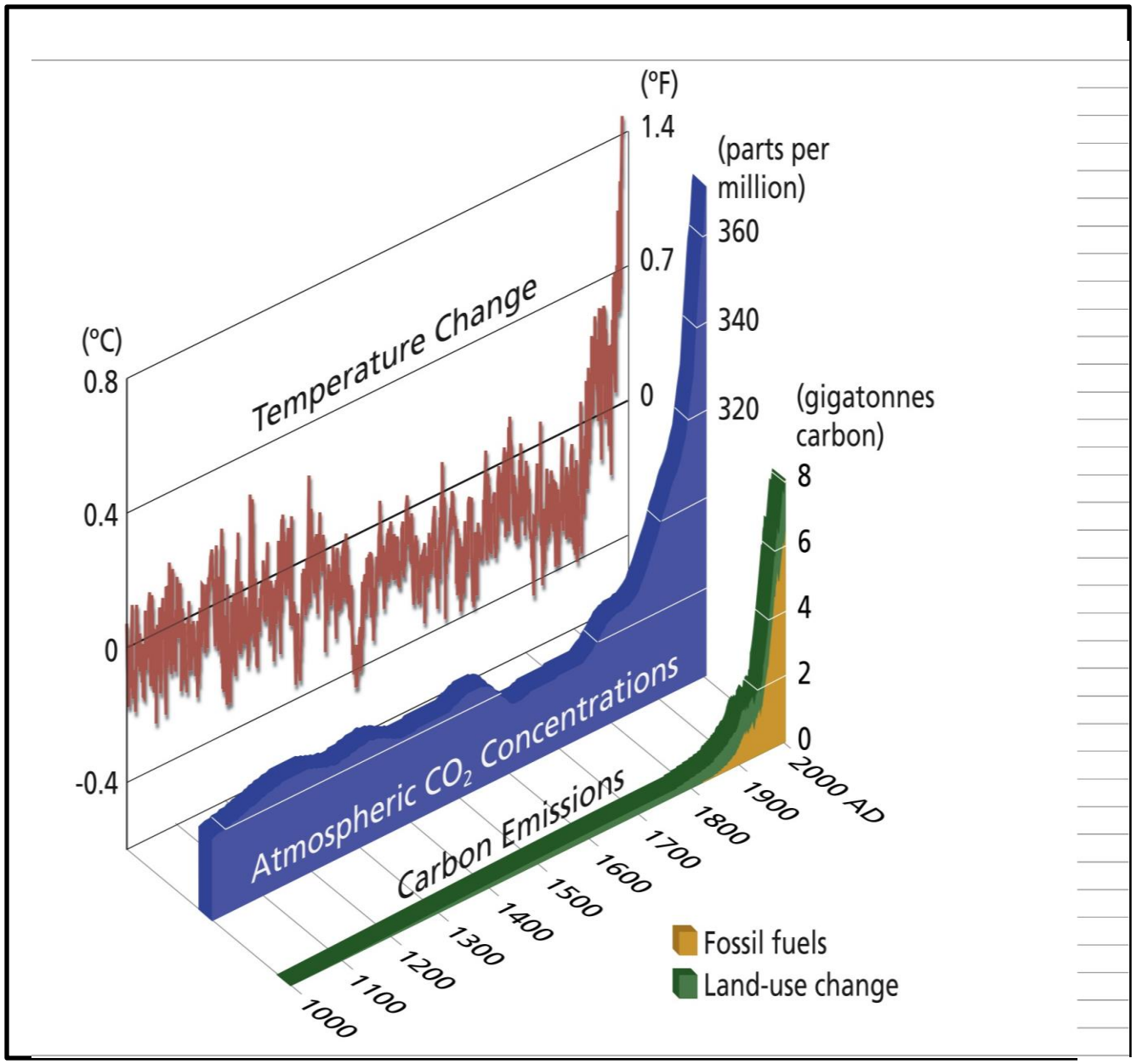
Biomass is produced by different types of micro organisms, plants and animals for a large variety of uses.

The details of biomass biosynthesis are generally not well known, except for some important cases like cellulose or starch.

vTI, Hamburg

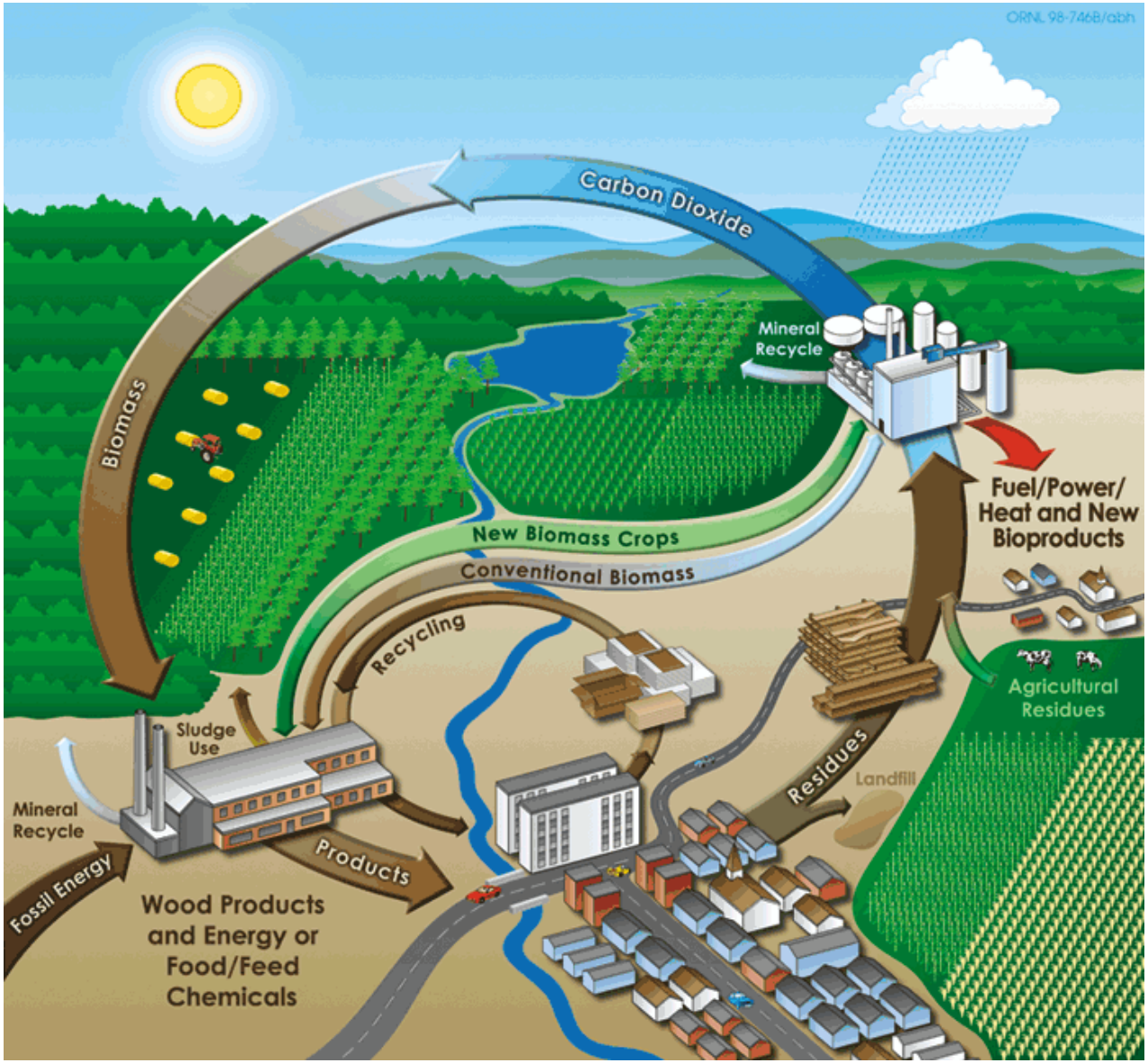


Concept de bioraffinerie

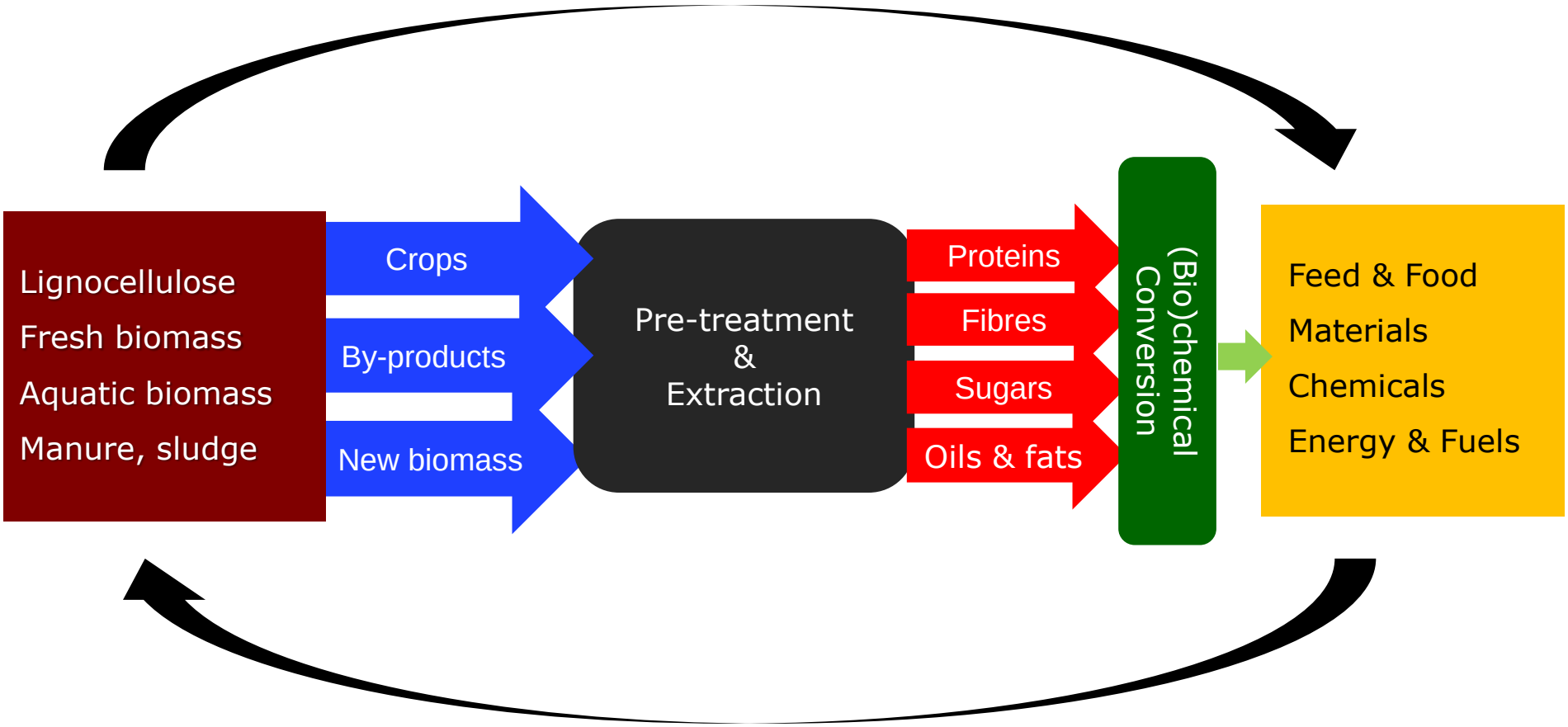

(°F)
1.4
0.7
0
(°C)
0.8
0.4
0
-0.4
Temperature Change
(parts per million)
360
340
320
Atmospheric CO_2 Concentrations
(gigatonnes carbon)
8
6
4
2
0
Carbon Emissions
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000 AD
Fossil fuels
Land-use change

Bioraffinerie

- A biorefinery is a facility that integrates biomass conversion processes and equipment to produce fuels, power, heat, and value-added chemicals from biomass.
- The biorefinery concept is analogous to today's petroleum refinery which produce multiple fuels and products from petroleum.
- Sustainable processing of biomass into a spectrum of bio-based products (food, feed, chemicals, materials) and bioenergy (biofuels, power and/or heat).



http://www.nature.com/nbt/journal/v22/n6/images/nbt0604-671-F1.gif



Chaîne de valeur du champ à l'usine
Disponibilité de la ressource, qualité, environnement, logistique, fin de vie

Contraintes industrielles // nature

- Les procédé industriels et encore plus les produits doivent être bien définis et reproductibles .
- La nature produit des structures et des molécules très variables et peu reproductibles.

Pulp fibres from wood
bar: 10µm

Contraintes industrielles // nature

- C’est cette flexibilité qui permet aux produits naturels d’évoluer et de s’adapter.
- Comment concevoir des procédés et matériaux ayant un tel niveau de variations?

Transition vers une économie bio-sourcée

Quelques exemples

1- Relations between genotype and properties of polymer composites

2- Use of dust

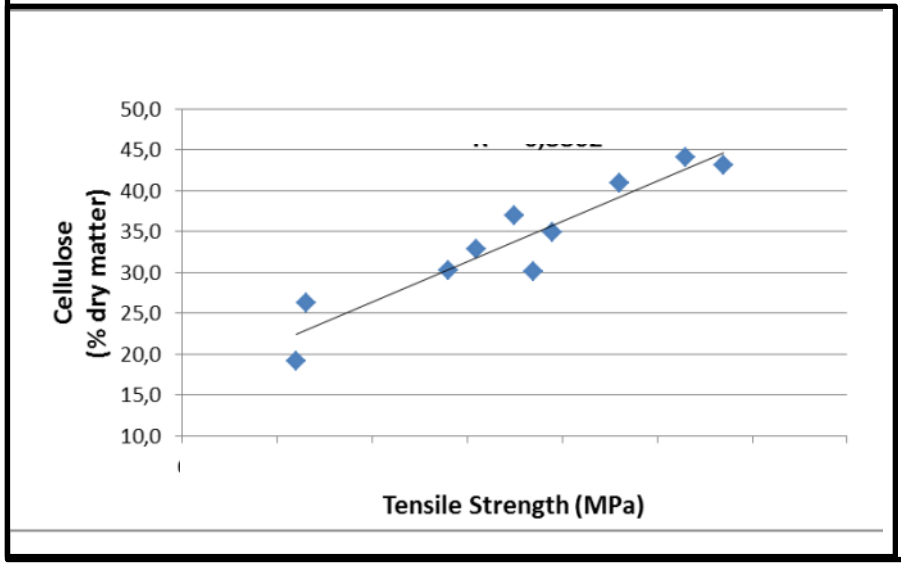
3- Use of by-products of algae-based production of food thickeners

1- Relations between genotype and properties of polymer composites

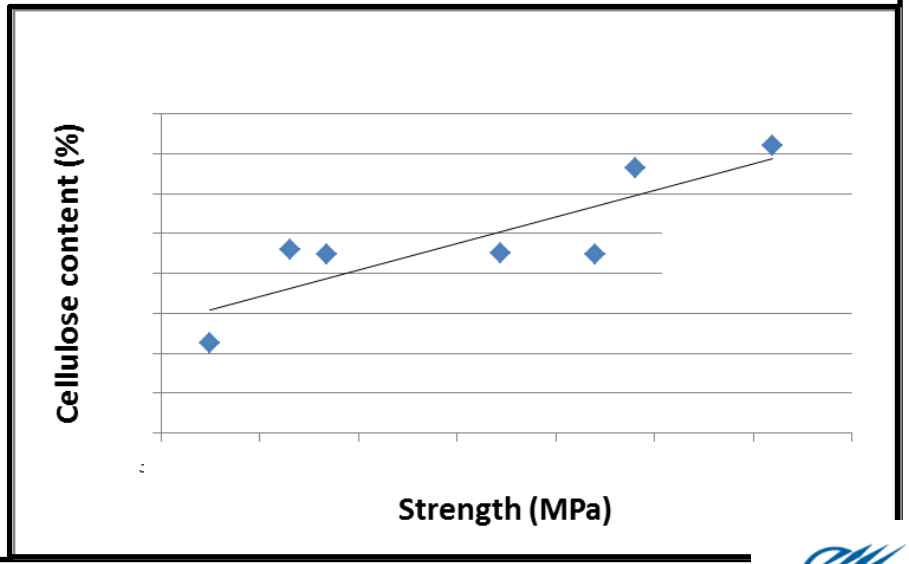
Goals: to relate plant genotype to properties of plant-based polymer composites

Correlations cellulose amount – mechanical properties of PP or PE composites

sorgho

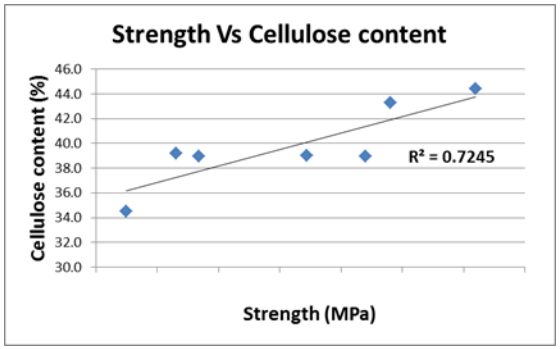


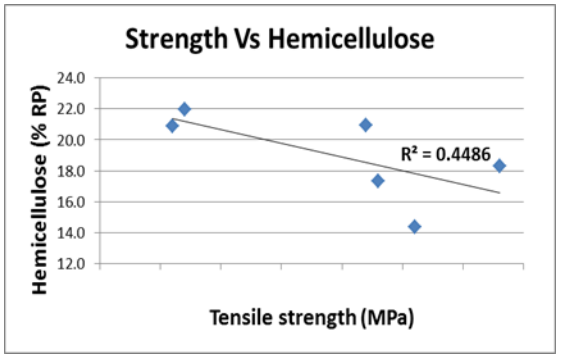
miscanthus

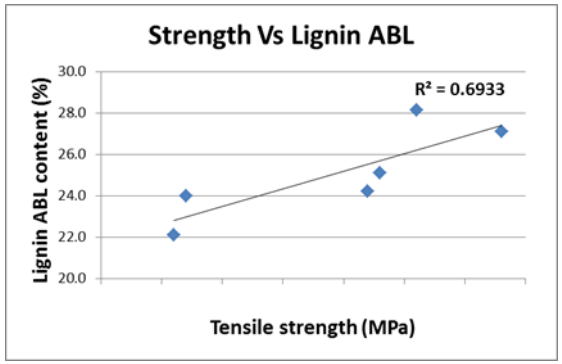


1- Relations between genotype and properties of polymer composites

Goals: to relate plant genotype to properties of plant-based polymer composites

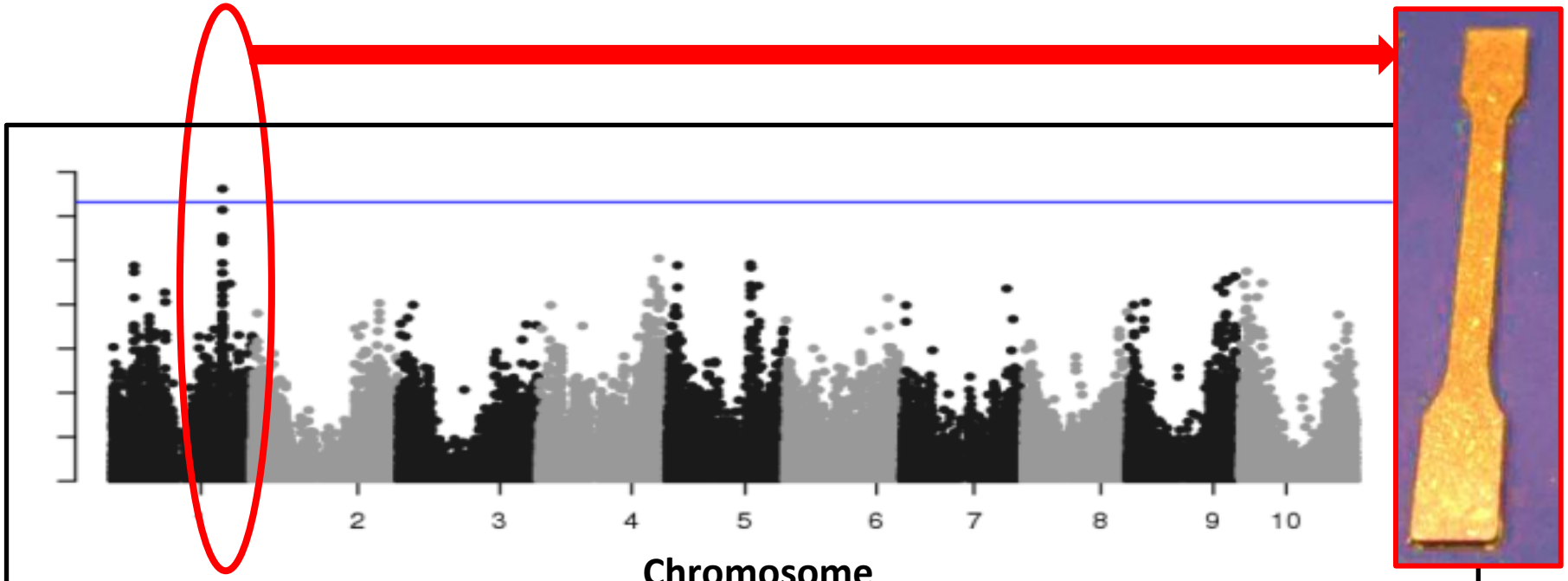






1- Relations between genotype and properties of polymer composites

Goals: to relate plant genotype to properties of plant-based polymer composites



Exampleof a phenotype: amount of cellulose in cell wall of sorgho

2- Use of dust

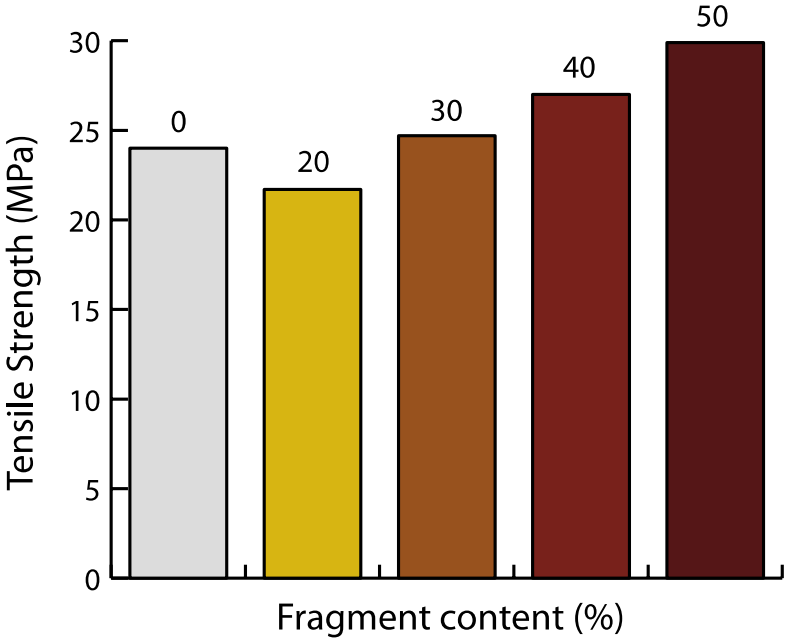
Utilisation des poussières de tamisage après récolte comme charge dans les polymères.

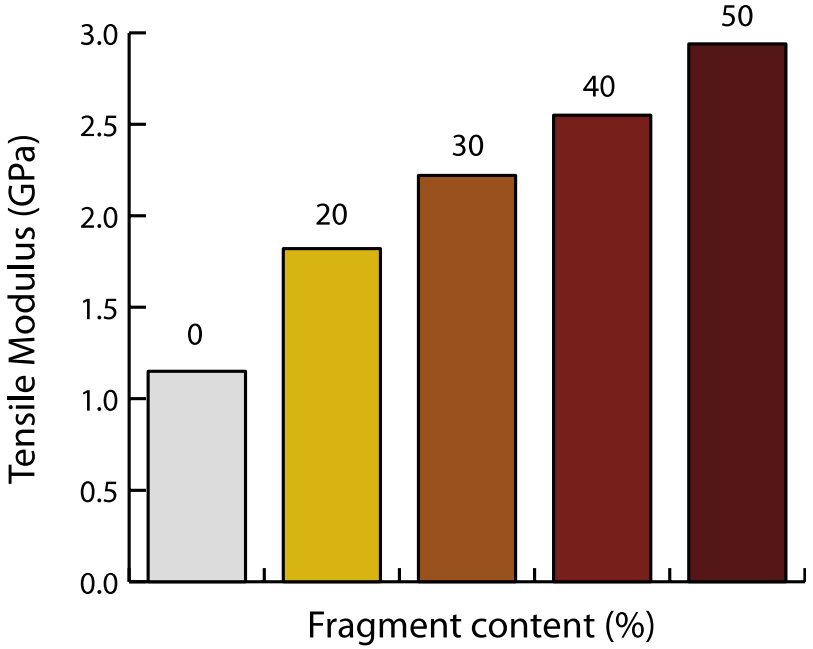
Poussières de miscanthus après récolte
70% ont une taille inférieure à 100µm
30%ont une taille moyenne de 800µm et un L/D moyen de 3

Chargement de 20, 30, 40, 50 % en masse dans du polypropylène.

2- Use of dust

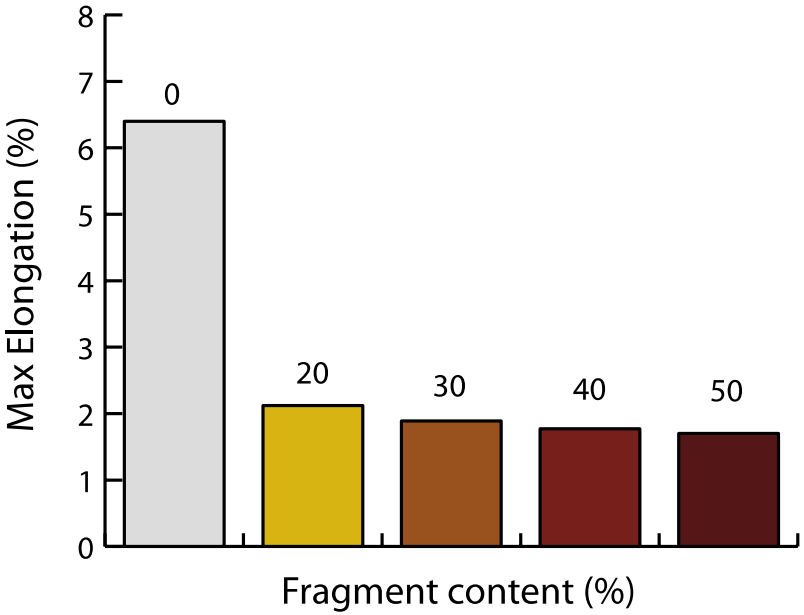
- Tensile Strength et Tensile Modulus

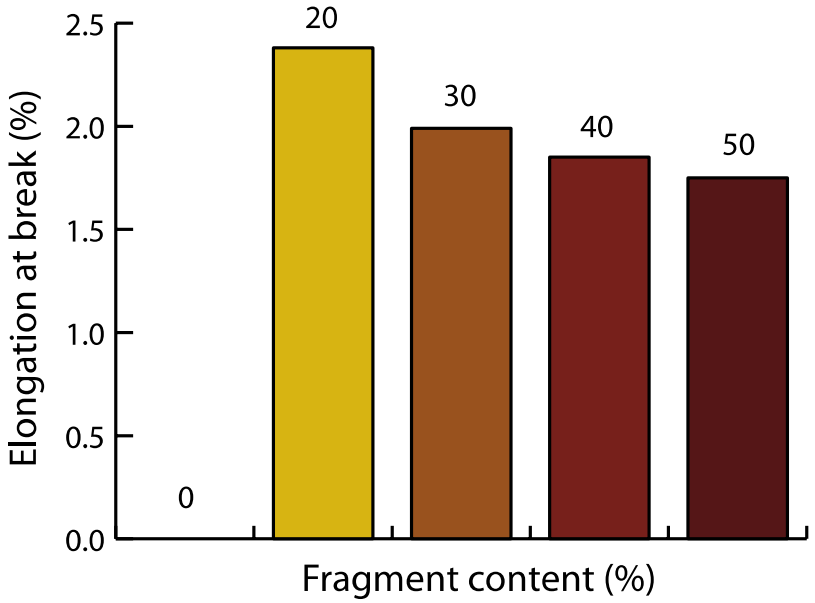




2- Use of dust

- Max. Elongation et Elongation at Break

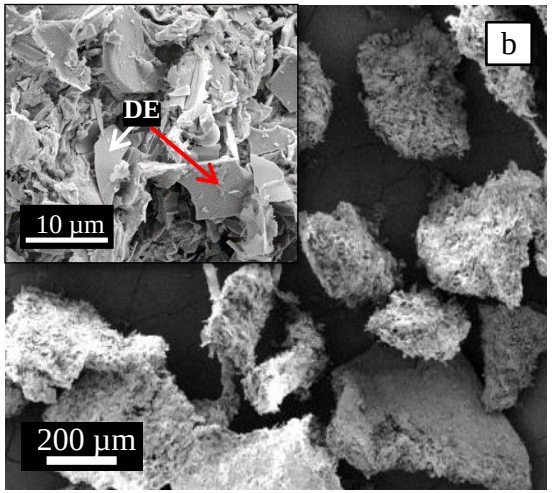




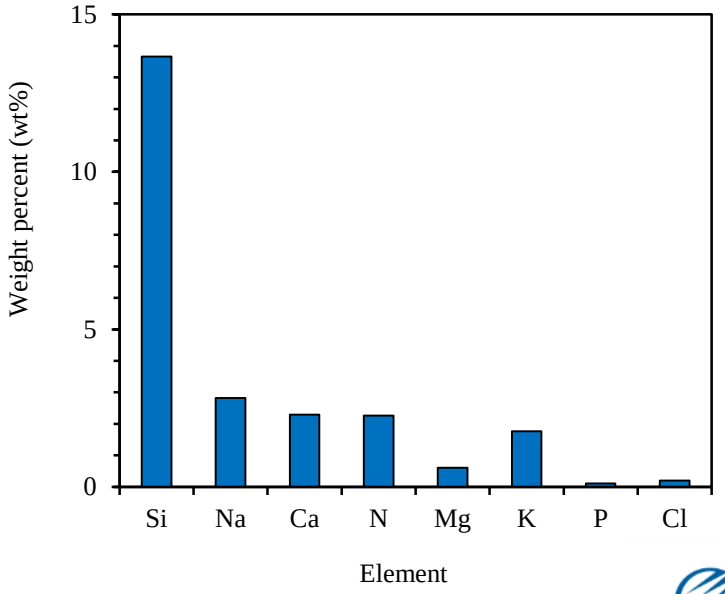
3- Use of by-products of algae-based production of food thickeners

Goals: **use of industrial waste after extraction of polyaccharides from algae as a filler in thermoplastic composites.**

Byproduct after alginates extraction process (residues of brown algae mixed with Diatomaceous earth)
From Cargill

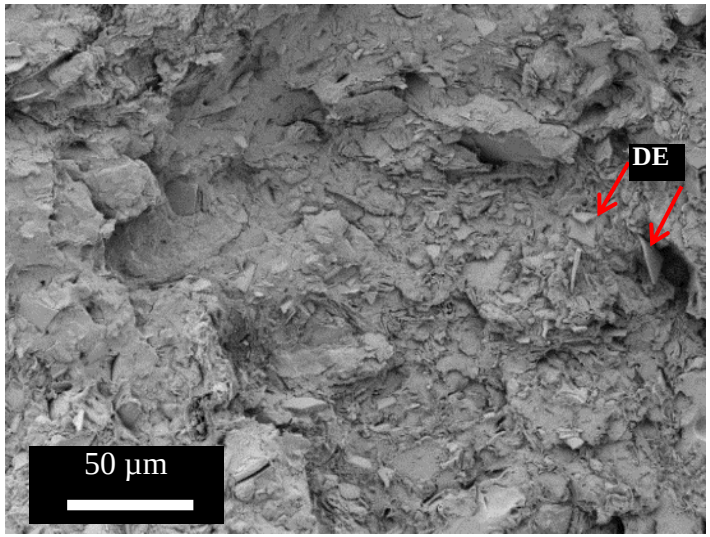


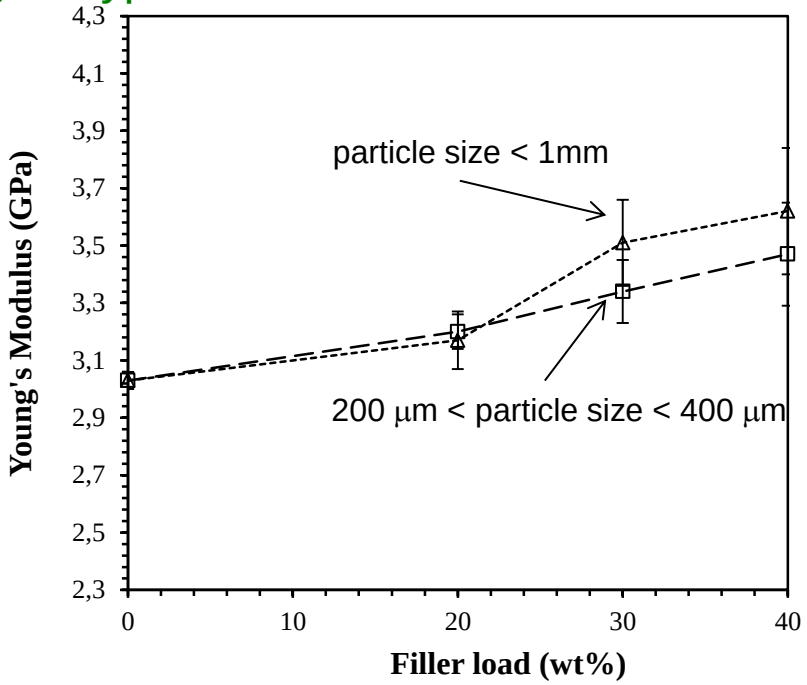
Concentrations (wt%) of the main inorganic elements obtained with elemental analysis



3- Use of by-products of algae-based production of food thickeners

Polylactic acid composite with dispersed algae byproduct with diatomaceous earth





- Young modulus slightly increases as compared with polymer matrix
- Elongation at break and tensile strength decrease (as expected)
- **Possible to make composites with 40 wt% of byproduct**

3- Use of by-products of algae-based production of food thickeners

Polylactic acid composite with dispersed algae byproduct with diatomaceous earth

Fire retardant testing (Schneider Electric, glow wire test EN 60695-2-10/12)

Sample	Start of ignition (s)	Presence of drops on the tissue paper	Ignition of the tissue paper
Neat PLA	1	yes	no
Composite with 20%AW-DE	No ignition	no	no
Composite with 40%AW-DE	No ignition	no	no

Possible to use these composites as other thermoplastic based composites.

Conclusion

La bioéconomie sera l'économie du futur, basée sur une unité de compte **$ucre**: aliment, énergie, matériaux.

IMT est bien positionné pour faire face aux enjeux scientifiques et éthiques de ce nouveau domaine.

epnoe

European Polysaccharide
Network Of Excellence