IMT Mines Alès
École Mines-Télécom

MOCABIO

Technology platform

Processing and characterisation of biocomposite materials

KEYWORDS: Biocomposites, ecomaterials, biomass, agroresources valorisation, plant fibres, biopolymers, environmental impact, processing, functional properties

OUR AIMS

- Develop innovative composite materials based on agroresources
- Support and assist companies by providing them with a technical support unit and scientific skills in processing and characterisation of biocomposite materials

ACTIVITIES

- Selection and characterisation of plant fillers and fibres
- Modification and characterisation of the surface of plant fibres and the quality of the fibre/matrix interface
- Processing of thermoplastic or thermoset biocomposites
- Characterisation of the functional properties of biocomposites and their evolution under in-service conditions

FIELDS OF APPLICATION

- Construction
- Transport
- Health
- Energy
- Packaging
- Agriculture
- Sport and leisure activities

WHAT WE PROVIDE

- Collaborative research
- Service delivery
- Feasibility studies
- Expert assessments
- Training

Tensiometer for the determination of surface properties of fibres

Lab-scale pad finishing system for fabrics

Lab-scale processing of biocomposites by twin-screw extrusion (0.5 kg/h)

Analysis of smoke emitted during combustion

3 TECHNICAL SUPPORT UNITS

PREPARATION AND CHARACTERISATION OF PLANT FIBRES

Characterisation of plant fibres: bulk density, surface properties, dimensional characteristics
Plant fibre surface treatment systems: automated spraying and pad finishing devices

BIOCOMPOSITES PROCESSING

(THERMOPLASTIC AND THERMOSET)

- Thermocompression
- Vacuum infusion
- Co-rotative twin-screw extruders from pilot scale (5 kg/h) to laboratory scale (0.5 kg/h)
- Injection moulding
- Cutting tools

CHARACTERISATION OF BIOCOMPOSITES

- Characterisation of fire properties: smoke analysis
- Characterisation of fibre/matrix interface (IFSS)

CO-FUNDED BY

l'Europe s'engage en Occitanie
UNION EUROPÉENNE
La Région Occitanie Pyrénées · Méditerranée
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Projects may also use other complementary equipment in connection with polymer and composite materials researches performed at IMT Mines Ales

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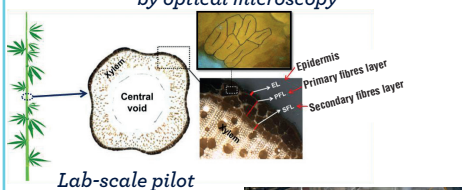
RECENT PROJECTS

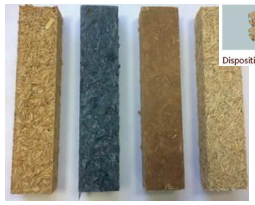
Microstructure of a hemp stem by optical microscopy



Lab-scale pilot unit for controlled dew retting of hemp stems

Improvement in cultivation practices for plant fibres to be used in materials

- **Study of field retting of hemp stems simulated in lab scale pilot-unit:** influence of harvesting period, of pedoclimatic conditions, effect of retting duration on the biochemical composition and mechanical & morphological properties of the fibres, VOC emissions during retting, temporal and spatial dynamics of microbial communities (PhD B. Mazian 2016-2019, PhD E. Bou Orm 2020-2023)
- **Genotypic diversity of sorghum** and its influence on the properties of fibres and of associated biocomposites (Fondazione Cariplo / Fondation Agropolis project ID#2013-1890 BIOSORG)



BMH

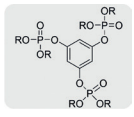
ALGIMOUSSE

Design of a Multifunctional Hybrid Biomaterial (BMH) for various industrial applications in construction, urban infrastructure, household furniture and transport

Triple-patented product, confirming the innovative and industrial characteristics of BMH in a context of reducing environmental and health impacts: more than 90 % bio-sourced biocomposite with all the required functionalities (heat and sound insulation, fireproof and mechanical properties, durability)

ALGIMOUSSE: a biocomposite with exceptional properties

Porous materials derived from alginate with closed-pore diameter between 100 and 200 µm: density adjustable from 30 to 180 kg/m3, biodegradable by household composting, thermal insulation, good sticking and joining properties



Intumescent layer formed by presence of phosphorated phloroglucinol

Multi-scale approach to fire reaction

Development of bio-based flame retardants and of fire resistance bio-based polymers, biocomposites and plant fibres

- Phosphorylation or boration of bio-based polyphenols extracted from plants (phloroglucinol, PhD R. Menard 2014-2018) or from chestnut wood sawdust (gallic and ellagic acids, PhD V. Karaseva 2015-2019) to improve the fire reaction of biopolymers: an additive approach vs a reactive approach
- Fire behaviour of polybutylene succinate/natural fibres composites (PhD G. Dorez 2010-2013), modification of natural fibres for enhanced fire resistance (PhD R. Hajj 2015-2018)
- Multi-scale approach of the fire reaction of household materials (PhD C. Vincent 2013-2016)

SCIENTIFIC EXPERTISE & KNOWHOW

- **Valorisation of agroresources** (plant fibres, agricultural by-products, biomass extracts or waste…) in (bio) polymers to reduce environmental impact
- **Functionalisation of the surface of plant fibres** with regard to targeted performances and development of environmentally-friendly treatments adapted to short fibres (batch), yarns (sizing line) or fabrics (pad finishing, spraying)
- Expertise in the **development of innovative methods for characterising plant fibres:** bulk density of fibres, measurement of morphology by automated laser scanner, mechanical properties by micro-traction in a controlled environment (relative humidity), and surface properties by tensiometry, fibre-matrix adhesion/ adherence
- Control of thermoplastic (extrusion, injection) or thermoset (vacuum infusion, thermocompression) **biocomposites processing**
- Study and improvement of **biocomposite properties** (mechanical and thermal properties, fire reaction, in-service durability...)

You would like to develop a project?

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