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Ph.D. thesis (2022-2025)
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DESICELL : Design approach for new recyclable cellulosic based materials in building industry

Nouveaux procédés d'obtention de matériaux cellulosiques et terre crue recyclable en architecture

MatBio

Context / Objectives

Building sector is very polluting

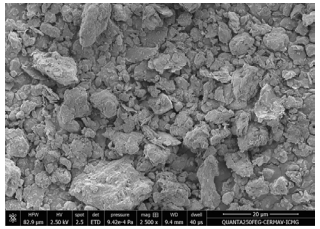
- 23% of the French carbon footprint[1]
- 60% CO_2 emission of building : finishing elements[2]

References:

1. *Ministère de la transition écologique - **2022***
2. *OID - Penser l'immobilier responsable - **2019***

Reversible earth-fibers based panels

- Raw earth coming from quarry waste: washing sludge, rich in silts and clay: slightly cohesive.
- Cellulose fibres coming from virgin or recycled fibres: eucalyptus or old newspapers.
- Producing cohesive, hygroscopic and flame retardant materials for finishing elements.



MEB: Raw earth

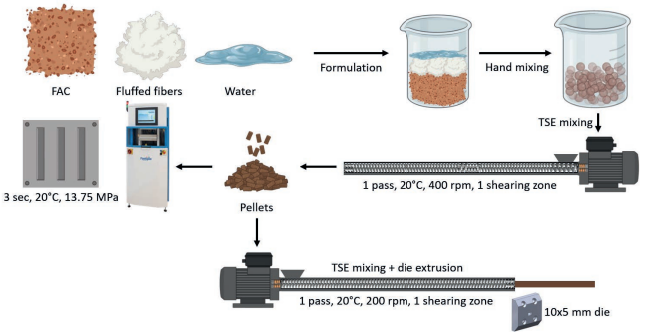
Microscope: eucalyptus fibres

In collaboration with: CRAterre

Funded by: Glyco@Alps Université Grenoble Alpes, France 2030

Methods

Panels production process



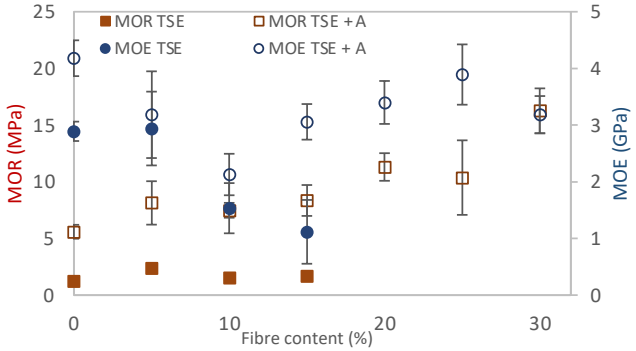
- Formulation with various fibres content and water (+ bio-based additive).
- Mixing process is done using a twin-screw extruder with one shearing zone.
- Samples are produced using compression or extrusion. Leading to very different final materials.
- Compressed and extruded samples are then dried at room temperature for 5 days.

Compressed sample

Extruded sample

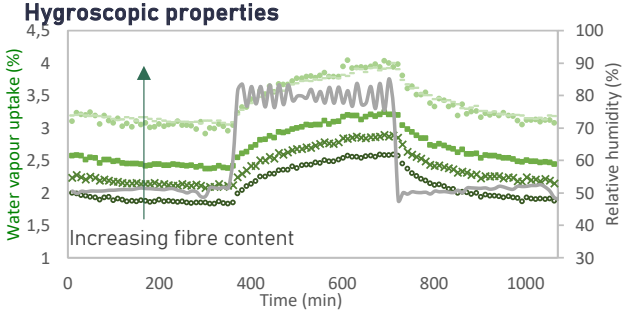
Results

Mechanical properties



The addition of bio-based additive improves significantly the mechanical properties.

Hygroscopic properties



Addition of fibres increases the water vapour uptake. This can have a potential application for indoor humidity regulation.