

**Title :**

3D printing for hemp/polypropylene agro-composite

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**Subject :**

Understanding the mechanical behavior of agro-composite is a key for their development. There is an increasing demand for the production of green composites reinforced with hemp fibers. Hemp fibers with a polypropylene matrix are very interesting due to their environmental benefits, their low cost, and the physical performance especially mechanical and thermal.

3D printing is a tool of the futur factory due to its agility and the need of no specific tool. However, polymers using hemp fibers only use short lenthg fibers making the material not that efficient.

The aim of this work is to develop high performance hemp composite using mid and long hemp fibers with 3D printer. The thesis can be treated in two steps:

1. Mid length hemp fibers

To simplify the filament manufacturing, most polymer-fibers filament used in 3D printing uses short lenthg fibers. A new approach is to manufacturing its own filament based on existing pellets. The laboratory has its own filament manufacturing system in order to produce filament with pellets of various composition.

This first part of the thesis consists in setting the filaments manufacturing and printing parameters, characterize the filament and the printed material and optimize the mechanical behavior of the printed part.

2. Long length hemp fibers

The aims of using long lenth hemp fibers is to print structure wich mechanical propeties tends to the woven composites properties. Some printing machine have the ability to print high performance continuous long fibers, but trajectories are limited and complex depositing are not reachable.

This second part of the thesis aims to generate printed woven composites made entirely from 3D printing and characterize its behavior.