

Section Sciences et Ingénierie de l'environnement Design Project 2022 (semestre de printemps)

Proposition n°35

<h3>Sustainable Housing: Utility of Hemp and recycled Mattress as an alternative to cement</h3>
--

Partenaire externe

Martin Kloeti

martin.kloeti@glaernischtexil.ch

Téléphone +41 79 405 69 33

Cooperative Glaernisch Textile

Taille de l'entreprise (nbre de collaborateurs) : 3 - 6

Glärnisch Textil, Hohenstein 7, 8750 Glarus

www.glaernischtexil.ch

Encadrant EPFL (proposition facultative qui sera validée par la Section)

Prof. Ludwig, Christian

christian.ludwig@epfl.ch

Téléphone ++41 (0)56 310 26 96

GR-LUD, Environmental Engineering Institute (IIE)

EPFL ENAC IIE GR-LUD, CH B2 398 (Bâtiment CH), Station 6, CH-1015 Lausanne

<http://people.epfl.ch/christian.ludwig>

Descriptif du projet

The construction industry has one of the highest carbon emissions globally. Growth in demand for cement will only further fuel this pollutant, and consequently the building sector is exploring various avenues to become green. One such direction is to use of renewable material to construct homes from locally sourced biomass/feedstock. To that end, some innovative companies have demonstrated the use of wood/plastic/cement composites as an alternative. The disadvantage of using purely wood is that it suffers from changes in the environment (humidity, temperature etc.), and thus over time the expansion/contraction results in poor heat/noise insulation resulting in a barrier for its broader acceptance.

Given the drive for locally sourced material to fulfil the requirement of a closed loop, circular economy concept, residual hemp biomass grown within the Alpine region offers a great opportunity to meet this. It is understood that a suitable material can be produced by using hemp cellulose, as well as residual hemp biomass. In order to negate the undesirable property of using wood alone, the use of Polyurethane (PU) within the mixture produces a stable and strong matrix to hold these materials together. PU is typically found in mattresses, on average with a mass of 15-20 kg. Recently, mattress (and its individual components) recycling has become important and as such, in this project we combine the use of residual biomass and



recycled mattress to produce a new material for use in the construction industry, particularly for fixing the material produced by Ecocell AG.

Objectif et buts

The overall objective of the project is to perform a technical design and environmental feasibility study to utilise residual hemp biomass (or cellulose), and polyurethane from the mattress industry to produce abovementioned products in Switzerland consistent with the principles of a circular economy. In particular the realised goal should include:

- Quantitative and Qualitative evaluation of produced fittings from the above process, including mass and energy balance. Combine this with existing building material blocks produced by Ecocell AG.
- Economic study on the viability of using hemp/mattress based feedstock and the economic competitiveness against traditional concrete/cement based material for construction.
- Ecological and Economic benefit to Switzerland (quantitative and qualitative) achieved by the above material.

Descriptif tâches

- As an initial step, primary and secondary resources (including www.glaernischtexil.ch) should be used to recognise and grasp the “360 hemp” philosophy and understand its corresponding details. Mattress recycling expertise and construction material information will also be given.
- Design a suitable solution to obtain one or more products via the utility of the above vectors encompassing environmental, ethical and economic aspects.
- Provide technical description and understanding of the performance, qualities and environmental compatibility of the processes above that use cellulose/residual biomass for frame, fittings and board manufacturing.
- Perform an environmental assessment (or a material flow analysis at the least) to quantify the environmental benefits from replacing conventional raw materials with regionally sourced renewable resources.
- Support the design study with an economic evaluation.

Divers

Further information to support for research and knowledge queries can be found on www.glaernischtexil.ch. Glärnisch Textil is working in collaboration with organisations such as 360 HEMP, Ecocell AG, Stroba Naturbaustoffe AG, Schönthaler, Alpen Pionier, CannSol Holding AG, Landi and Pflanzenoel AG.

Further support from Prof. Christian Ludwig (EPFL/PSI) and Dr. Bhavish Patel (Glärnisch Textil /PSI) will also be available.