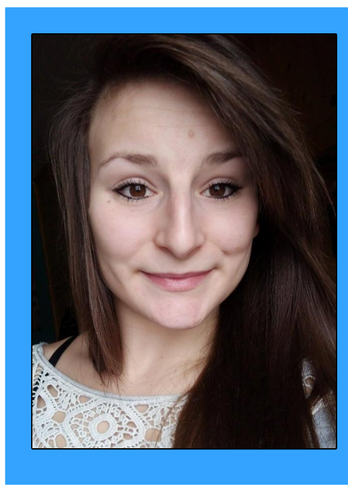

Investigation of the environmental impact and circularity potential of sandwich panels in commercial buildings

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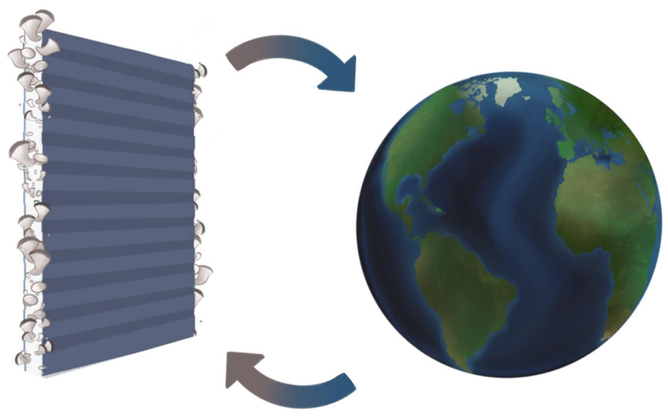


ABSTRACT

This work explored the use of mycelium in a commercialized sandwich panel, but also the use of renewable membranes and adhesives in a real soon to be commercialized module and what it would imply at an industrial level. The need for infrastructure to use renewable materials at an industrial level was analyzed, and so was the dismantling of products including renewable elements. The feasibility of the concept of façade leasing was explored with a real façade system that will soon be commercialized.

KEYWORDS

Leasing, facade, renovation, sandwich, panel, PIR, PUR, steel, prefabrication, environmental, impact, mycelium, renewable, materials

PROBLEM

In Europe, the waste produced by the construction sector is equal to 25% to 30% of the total waste generated. This waste is mostly coming from renovations. 10% to 80% of those waste products are being recycled, depending on which Member state there are produced in. The amount of CO_2 coming from the construction sector is a big issue as the evidence of global warming is increasingly emerging. Some materials have a considerable impact on the CO_2 emissions like cement production which is responsible for 5% of the carbon dioxide emissions worldwide due to the fossil fuels it requires.

OBJECTIVE HYPOTHESIS

This thesis aims to investigate the environmental impact and circularity potential of sandwich panels in commercial buildings through investigating potential renewable materials for sandwich panels, comparing a renewable sandwich panel to its synthetic counterpart and applying the façade leasing concept to a real life module.

AUDIENCE

Companies and researchers that are willing to create sustainable and circular façade systems with the help of plant-based or renewable materials.

RESEARCH QUESTION

How to design an environmentally friendly sandwich panel ?

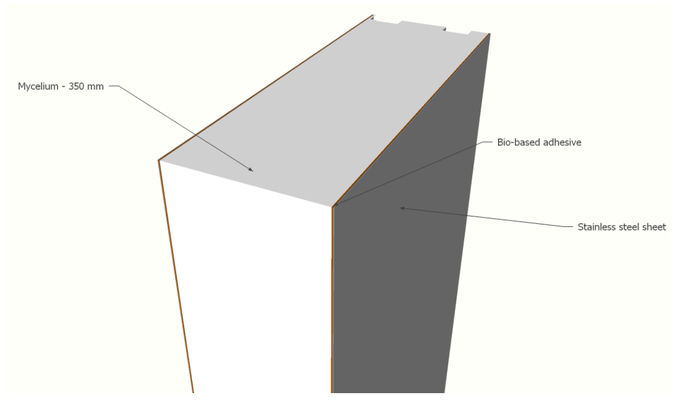
ORIGINALITY

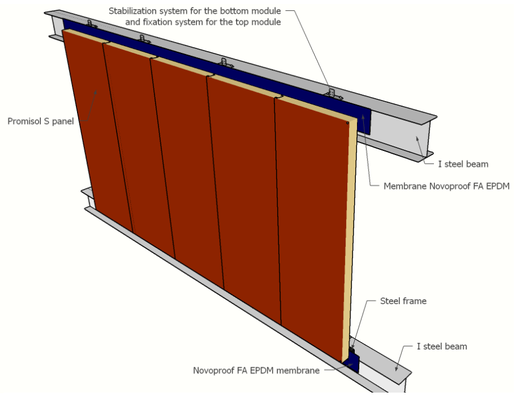
It is the first time that mycelium is used in a real industrial case. It is also the first time that the industrialization of a mycelium based product for the construction sector is assessed. And this thesis also verified the possibility of the façade leasing concept with a soon-to-be commercialized module.

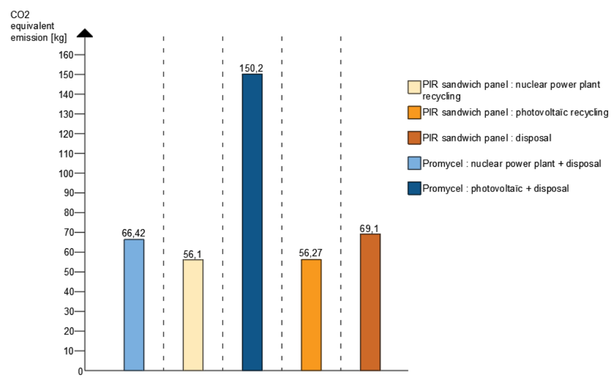
METHODOLOGY

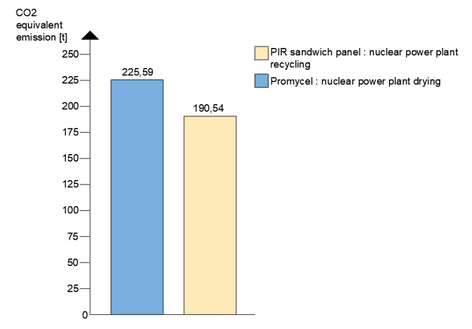
The development of a renewable sandwich panel, its buildability assessment and its environmental impact were thought through an empirical method. This allowed to understand the needs of a potential sandwich with a mycelium core. The development of the deconstruction methods was made through a 3D model but also with an empirical method for the removal of the adhesives and membranes.

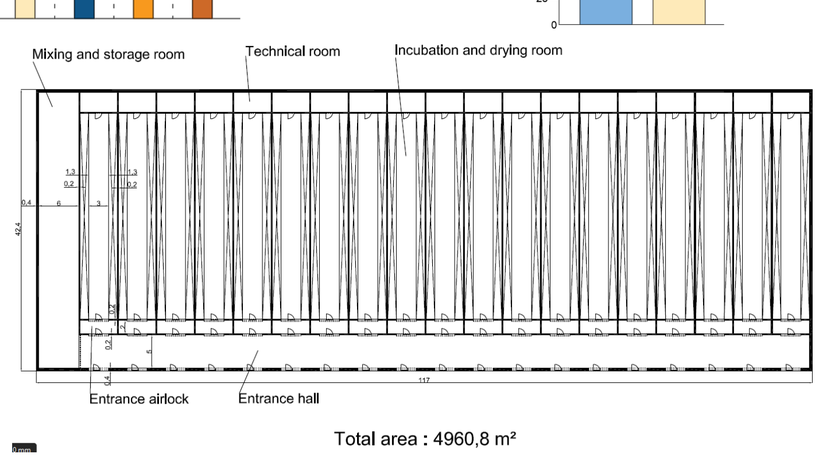
RESULTS











CONCLUSION

The mycelium cannot be used as a metal sandwich panel core and that it is not an environmental friendly alternative to the PIR foam at the moment. Another finding is that the dismantling of a module and sandwich panel including renewable materials would be quite time-consuming. The application of the façade leasing concept showed that it is entirely achievable on a real case. Even though the mycelium cannot be used at the moment in a sandwich panel, it still needs to be investigated as a construction material due to its great properties and biodegradability. Regarding façade leasing, this concept needs to be promoted to companies as it is an excellent alternative to traditional renovation and would push the innovation of façade systems.

Resources

Appels, et al., 2019; Azcarate-Aguerre, 2016; Azcarate-Aguerre, 2018; Alexandre, et al., 2000; Amstislavski, et al., 2017; Arifin, et al., 2013; Detrembleur, et al., 2018; FFB, 2015; Galiano, et al., 2018; Girometta, et al., 2019; Haneef, et al., 2017; Heinrich, 2019; Hiscox, et al., 2015; Huet, et al., 2018; Jenkins, et al., 2017; Jones, et al., 2018; KBOB, 2019; López Nava, et al., 2016; Pelletier, et al., 2013; Santhosh, et al., 2018, Silverman, 2018; Velasco, et al., 2014; Xing, et al., 2018; Yang, et al., 2017.

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