Development of bio-based particleboards for buildings' indoor use

Summary

The environmental problems are more and more serious, and solutions to moderate climate change are urgently required. The construction sector is widely responsible for energy, water, and raw materials consumption and for pollution; thus, the use of low embodied energy and sustainable building products is an efficient possibility to overcome environmental challenges.

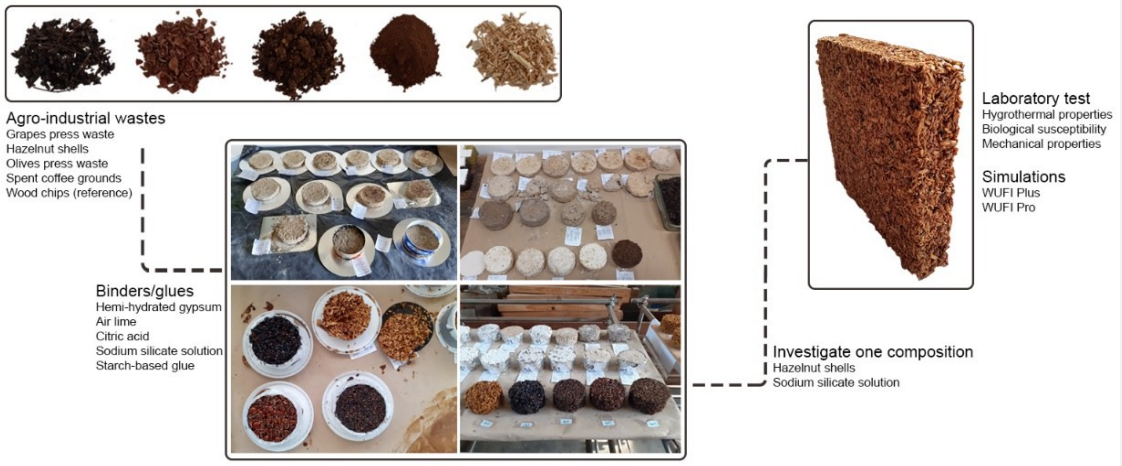
Nowadays, the opportunity of enhancing and re-proposing natural materials for building practices is increasingly catching on. Wastes and by-products seem to be an efficient solution: bio-waste-based products with good quality and ease of use are more and more analysed and proposed, moderating the problem of solid waste disposal as well. Furthermore, they can contribute to passively controlling indoor conditions, guaranteeing both healthy places and user well-being, and lowering the energy demands of buildings.

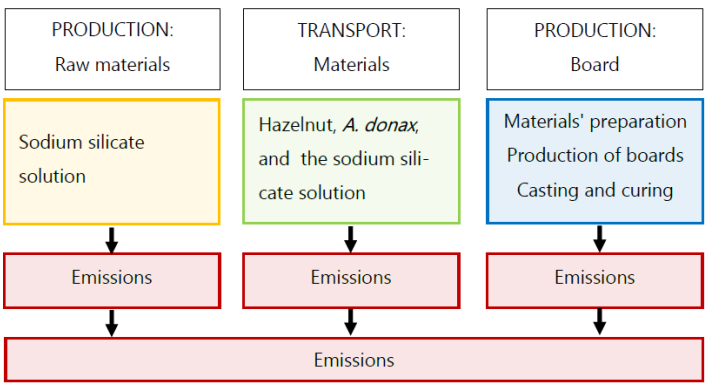
Starting from this knowledge, this thesis aimed to produce sustainable and eco-efficient indoor particleboard reusing agro-industrial bio-wastes and bio-resources as aggregates with a significant contribution to improving indoor conditions. The bio-aggregates were bound by non-toxic adhesives that can secure a low environmental impact in the production process, being able to moderate bio-based materials' drawbacks.

The outcome was the development and assessment of bio-based particleboards for building indoor applications with hazelnut shell, Arundo donax and sodium silicate. A horizontal analysis was carried out; hence, several properties were considered; among others, bio-susceptibility and performance in case of fire were investigated, as they are two of the main drawbacks of using bio-based building materials. Finally, the sustainability of the proposed boards was evaluated qualitatively by considering the Life Cycle Assessment.

Keywords

Arundo donax, acoustic comfort, bio-waste, bio-resource, bio-susceptibility, fire safety, hazelnut shell, hygroscopicity, hygrothermal comfort, sodium silicate.





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