

Innovative sustainable solutions for eco-building using rice by-products

Summary

The development of innovative sustainable materials for the construction industry is a strategic priority of the European Community. Applying the concept of sustainability to the construction sector has stimulated the development of unconventional materials that use waste and renewable resources. In this context, incorporating 'natural fibres and agricultural by-products in construction materials is a relevant strategy to achieve a more circular economy. Rice by-products such as rice husk and straw are locally available in Portugal and have unique characteristics that encourage their utilization. These by-products have no commercial interest and are not suitable for animal feed; they are often incinerated or landfilled, with negative environmental impacts. Using rice husk and straw in building solutions could thus offer a great opportunity to improve the sustainability of both the construction sector and agro-industries.

The goal of the present work is to develop innovative materials to be applied in different construction solutions, using rice husk and straw. Other by-products and recycled materials, such as expanded cork and rubber granules, have also been included in composite materials to explore the useful properties of each material. A wide range of numerical simulations and experimental tests were performed on the materials, composites and building solutions. These solutions were also characterised by means of a life cycle assessment (LCA) and compared with conventional solutions.

Polymer-based composite materials made with rice husk and expanded cork by-products were produced for wall and floor applications. Polymer-based composite boards containing rice husk and recycled rubber granules were also produced to mitigate vibrations and improve the impact sound insulation of floor solutions in buildings. Cement-based composites that included rice husk were produced for application as a thermal insulation layer and as a coating for acoustic barriers. The construction of sustainable building walls from rice straw bales is also proposed.

The results suggest that construction solutions using rice by-products can be used in buildings, thereby helping to reduce energy consumption during a building's service life and improving the acoustic and vibration performance. Overall, the results contribute to increase confidence in the use of these unconventional materials.

Keywords

Agricultural by-products, waste, rice husk, rice straw, sustainable materials.



Samples of the composite materials, made from rice husk, expanded cork and recycled rubber.



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