



Quantification of Water Flux and Insulation Dynamic of Newly Roof Structures with Recycled Materials

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ABSTRACT

The thermal performance of an extensive green roof can be influenced by the initial hygrothermal conditions of substrate and drainage layers. Moreover, coarse recycled materials can affect the thermal resistance of green roof layers, while there is a demand for optimizing their thickness. Therefore, the main objective of this study is to optimize the green roof layers' thickness and apply outside weather conditions of Liège city to green roof models, once coarse recycled materials are used for substrate and drainage layers: WUFI software can be used for such application, which is suitable for modeling the initial hygrothermal conditions (heat and moisture properties) of green roof layers.

KEYWORDS

Coarse recycled materials, substrate, drainage layer, hygrothermal modeling, parametric study.

PROBLEM AND POSSIBLE SOLUTION

The overuse of natural resources and aggregates for green roof layers has harmed the environment in recent decades. This environmental issue maybe somewhat solved by partial replacement of natural materials and aggregates with coarse recycled materials in the substrate and drainage layers of green roof systems.

OBJECTIVES

- Evaluating the thermal performance of green roof layers including coarse recycled materials (proposed design) and then comparing their results with green roof layers including natural materials (baseline design).
- Hygrothermal modeling of green roof layers and then optimizing the substrate and drainage layers.
- Applying outside weather conditions of Liège city to green roof models to assess their insulation performance.

AUDIENCE

Building designers and engineers, educational administrators, students and teachers.

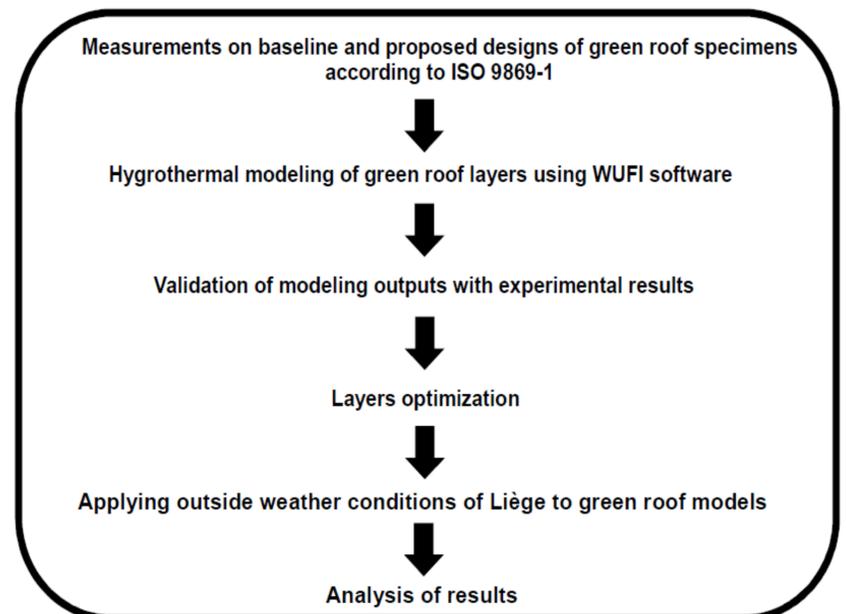
RESEARCH QUESTION

- Can the coarse recycled materials with a great porosity provide sufficient hygrothermal conditions for the substrate and drainage layers?
- To what extent the use of coarse recycled materials can provide an adequate thermal performance for the green roof systems?

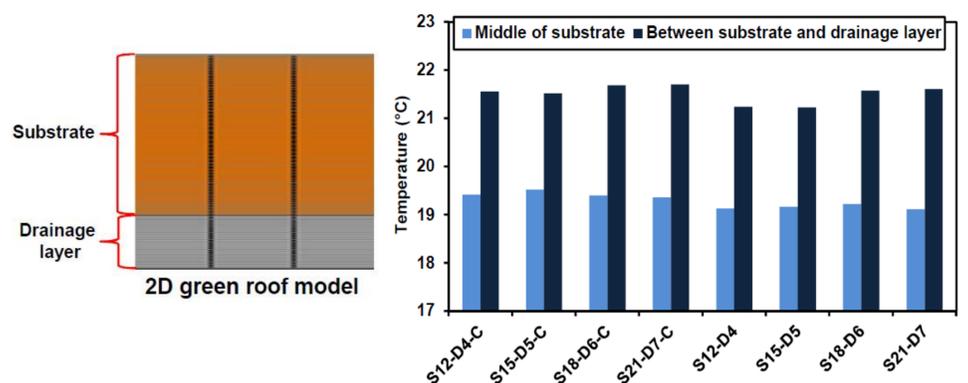
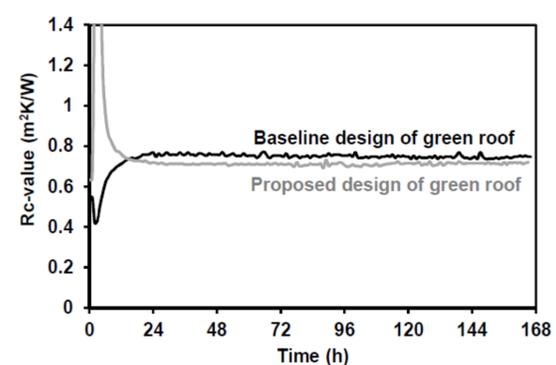
ORIGINALITY

Few studies have assessed and simulated the hygrothermal conditions of green roof layers, mainly including coarse recycled materials. Therefore, the thermal performance of green roof with substrate of coarse recycled material and the drainage layer of recycled coarse aggregate is tested and evaluated concerning ISO 9869-1. After that, the hygrothermal performance of green roof layers can be assessed and simulated using WUFI software.

METHODOLOGY



RESULTS



CONCLUSION

- There is no significant difference between the R_c -value graph of the baseline and the proposed green roof specimens.
- It is possible to partially replace the natural materials and aggregates with coarse recycled materials in the substrate and drainage layers in order to provide an adequate thermal performance for green roof systems.

Resources

Kazemi, M., & Courard, L. (2021). Simulation of humidity and temperature distribution in green roof with pozzolana as drainage layer: Influence of outdoor seasonal weather conditions and internal ceiling temperature. *Science and Technology for the Built Environment*.

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