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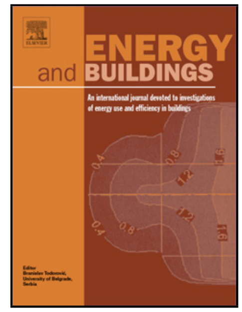

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Thermal characterization of different substrates under dried conditions for extensive green roofs

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Highlights

- Thermal properties of different substrates for extensive green roofs were analysed.
- Two experimental transient parameters; TSC and Time Lag, can be calculated.
- Representative differences in U_{value}, C_p and TSC were found between the substrates.
- Equal thermal properties cannot be assumed for different substrates mixtures.

Abstract

Extensive green roofs have been consolidated as ~~a~~ good tools for passive energy saving~~s~~ systems in buildings, providing a more sustainable trend in the building field. However, as the growth of vegetation is variable depending on external factors such as weather conditions, disease, etc. the coverage of plants cannot ensure uniformity and consequently the "shadow effect" cannot be considered as a constant parameter. On the other hand, materials used in substrate and drainage layers should provide a constant "insulation effect" depending only on their physical properties and water content. In spite of this, the complexity of disaggregated materials used in internal layers of extensive green roofs implies a lack of real data about their thermal properties. The main objective of this study is to determine experimentally the physical properties of different disaggregated materials from the internal layers of extensive green roofs commonly used in Mediterranean climates. The experimentation presented in this paper allows to calculate the thermal transmittance in steady-state (U-value), the heat storage capacity (C*p*), and the dynamic thermal response under a daily thermal oscillation.

Keywords: Extensive green roofs; Substrates; Thermal properties; Passive system; Energy savings.

1 Introduction

In Europe the building sector represents 40% of the overall energy consumption and 36% of the overall CO_2 emissions [1]. Within the target to reduce the energy demand of buildings and preserve the environment, innovative technical solutions have to be proposed and adopted.

Among the systems available in the sustainable and bioclimatic architecture context, green roofs have an important role as it has been demonstrated in many cities with the increment of these features in new and refurbished building projects [2].

Green roofs have significant advantages. Considering from an energy and architectural point of view, green roofs offer an additional thermal insulation contributing to the reduction of energy consumptions. During summer, green roofs can control and mitigate the heat flux entering through the roof, by the evaporative effect and by reducing the ~~overall~~ total amount of solar energy absorbed by the building [3-5]. The benefits of green roofs are correlated to the shadow effect produced by the vegetation, the insulation effect and the thermal storage due to the substrate and drainage layers depending on their physical properties (density, thickness, thermal conductivity, and specific heat capacity) [6].