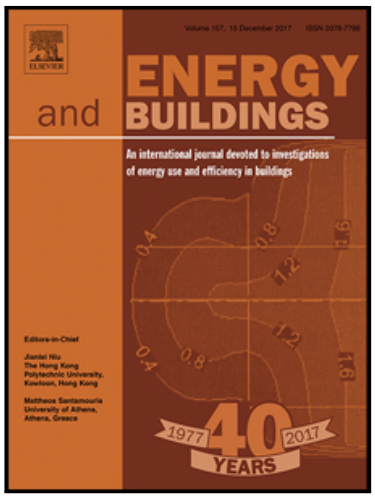

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Impact of climatic factors on evaporative cooling of porous building materials

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Abstract: The evaporative cooling of porous building materials is one of the passive strategies used for building energy conservation. The effect of evaporative cooling strongly depends on the evaporation rate, which is defined as the mass of water evaporated from a unit area of a porous material per unit time. In contrast to previous studies, which focused on the influence of material properties on the evaporation rate, the present work investigates the effects produced by climatic factors. In particular, porous clay tiles with pore sizes of 2.0–6.0 μm and porosity of 27.34% were selected as water storage media, and the impacts of four climatic factors (air temperature, solar radiation intensity, wind velocity, and partial pressure of water vapour) were examined at three different levels. The obtained results indicate that the evaporation process from porous tiles consists of constant evaporation rate, falling evaporation rate, and low evaporation rate stages. Moreover, by conducting range analysis, the studied factors can be ranked by their impact on the evaporative cooling process as follows: the intensity of solar radiation, air temperature, partial pressure of water vapour, and wind velocity.

Keywords: climatic factor; evaporative cooling; orthogonal experiment; building energy efficiency; wind tunnel