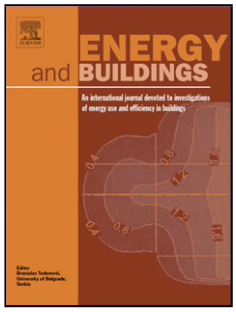

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A life-cycle energy and carbon analysis of hemp-lime bio-composite building materials

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Abstract

Conventional, concrete-based building materials have a high level of embodied energy in their production – as do typical insulation materials, which are crucial for addressing operational energy demands for building climatization. Here, a life-cycle energy (LCEA) and carbon ($LCCO_2A$) analysis is performed to evaluate the potential benefits of using an alternative, bio-composite building material made from hemp shives mixed with a lime binder, in the context of an arid environment. The physical properties and thermal performance of the hemp-lime building material are compared with conventional materials through lab tests, temperature measurements in test cells and thermal simulations. This study concludes that hemp-lime not only has a clear advantage over comparable conventional materials in terms of embodied energy, but also in terms of net CO_2 emissions over the entire life cycle of a typical building. This is primarily due to the active carbon sequestration of the hemp plant during its growing phase, and the gradual sequestration of carbon emitted during the production of lime. The thermal properties and behaviour of a hemp-lime wall material were found experimentally to be virtually identical to those of a commonly-used lightweight concrete insulation material with a similar density.

Keywords: hemp-lime, embodied energy, life-cycle assessment, carbon footprint