Ben-Gurion University of the Negev
Blaustein Institutes for Desert Research
The Swiss Institute for Dryland Environmental and Energy Research
Department of Man in the Desert

BTMID WEEKLY SEMINAR

ES Seminar

Development, Life-Cycle Energy and Carbon Analysis of a Functionally Graded Biocomposite Building Material

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Abstract:

A significant portion of humanity's energy consumption and carbon emissions may be attributed to buildings – both in their construction and manufacture of their materials, and in their ongoing operation and maintenance as useful and comfortable spaces. Conventional, concrete-based building materials have a high level of energy and carbon "embodied" in their production – as do typical insulation materials, which are crucial for addressing operational energy demands for heating and cooling. Therefore, there is increasing interest in the development of bio-based building materials whose production has a relatively low carbon footprint. Meanwhile, a well-insulated building envelope which also incorporates effective thermal mass (usually applied in two separate layers, with widely varying densities) can form the basis of a thermally efficient building – reducing its operational energy and CO2 emissions.

The proposed research aims to combine these different energy and carbon-related properties in the development of an integrated, variable-density biocomposite building material which can reduce the life-cycle energy consumption and carbon emissions of the building. This biocomposite material combines lightweight aggregate based on the porous woody core of the hemp plant mixed with a lime based binder. Hemp is a non-psychoactive variety of the plant species Cannabis sativa L. which has been utilized historically for countless products due to its unique physical properties. Such hemp-lime (HL or Hempcrete) biocomposites have recently generated interest as eco-friendly and sustainable alternatives to conventional construction materials which can potentially reduce CO2 emissions in the building industry.

The main goal of the research is to develop a variable-density hemp-lime building material and to analyze its mechanical and thermal properties, while assessing the overall life-cycle energy consumption and carbon emissions of buildings incorporating the proposed material in comparison with those based on conventional approaches. This analysis will be based on a range of empirical data, acquired from laboratory experiments, measurements in small-scale test buildings constructed in an arid region, thermal simulation modeling, detailed assessment of raw-material inputs and processes, and a basic economic evaluation of the material's potential for use in the construction industry for both new and existing buildings.

Date & Location:

Tuesday, December 12, 2017, 13:00-14:00
Department of Man in the Desert Seminar Room