Titre : Modelling of the hygrothermal behavior of hemp concrete: from material to building

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Abstract/ Résumé

Global warming, the scarcity of natural resources, the polluting emission became a major concern for the human community. The construction sector especially has a significant impact on the environment and has therefore a role to play in the development of innovative sustainable solutions. Bio-based materials are known to be an interesting solution to address energy and environmental issues. In particular, hemp, fast growing renewable raw vegetal, has the qualities to be a serious alternative to modern insulation solutions. Hemp wool using the fibres and hemp concrete using the shivs of the plant have interesting hygrothermal properties and a good thermal insulation level. Their porous, hygroscopic and permeable structure gives them high moisture transfer and storage capacities, improving the hygrothermal comfort felt by the inhabitants.

In order to answer to the future environmental and energy regulations, expanding the use of hemp in the building sector depends on a better knowledge of its hygrothermal behaviour and its response to climatic variations.

Hemp concrete presents a significant hysteretic behaviour. This complex behaviour influences the evolution of the moisture content inside the material which is a key factor of the evolution of the hygrothermal properties and transfer. Recently, the consideration of numerical models suited to the hemp concrete hygric behaviour implemented in a heat, air, and moisture transfer model has improved the knowledge and prediction of the hemp concrete hygrothermal response. Especially, the modelling of the temperature-dependence of sorption mechanism allows to better represent the effective response of hemp concrete subjected to real weather conditions. The predicted local daily variations of temperature and relative humidity through a wall are found to be consistent with the experimental ones. Moreover, experimental campaigns lead *in situ* show that hemp concrete helps to maintain a good level of hygrothermal comfort.

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