

## Hygrothermal Performance of Sheep Wool in Cold and Humid Climates

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**Abstract :** When selecting insulation materials, not only should their thermal efficiency be considered, but also their impact on the environment. Compared to conventional insulation materials, bio-based materials not only have comparable thermal performance, but they also have a lower embodied energy. Sheep wool has the advantages of low negative health impact, high fire resistance, eco-friendliness, and high moisture resistance. However, studies on applying sheep wool insulation in cold and humid climates are still insufficient. The purpose of this study is to simulate the hygrothermal performance of sheep wool insulation for the Quebec City climate, as well as analyze the mold growth risks. The results show that a sheep wool wall has better thermal performance than a reference wall and that both meet the minimum requirements of the Quebec Code for the thermal performance of above-ground walls. The total water content indicates that the sheep wool wall can reach dynamic equilibrium in the Quebec climate and can dry out. At the same time, a delay of almost four months in the maximum total water content indicates that the sheep wool wall has high moisture absorption compared to the reference wall. The hygrothermal profiles show that the sheathing-insulation interface of both walls is at the highest risk for condensation. When the interior surface gypsum was replaced by stucco, the mold index significantly dropped.

**Keywords :** sheep wool, water content, hygrothermal performance, mould growth risk

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