Testing the Thermal Properties of Loose-Fill Straw Insulation

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Current research suggests that natural materials such as straw can be a suitable insulation alternative to reduce energy demands in the construction and building industry particularly during service due to its excellent thermal properties, low embodied energy, carbon storage, and acceptable mechanical properties (Chaussinand, Scartezzini, Nik, & Nik, 2015; Maraldi, Molari, Molari, & Regazzi, 2018; Mattila, Grönroos, Judl, & Korhonen, 2012; Sabapathy & Gedupudi, 2019). Traditional construction with straw utilises the material for insulation in the form of straw bales. The objective of this research was to test the thermal properties of straw as loose-fill insulation in traditional wall construction to validate if its thermal performance is competitive against readily available synthetic insulation batts.

A commercially available synthetic batt (15 kg/m3) and three straw samples of densities 31 kg/m3, 54 kg/m3, and 69 kg/m3 were tested between two chambers fitted with thermocouples to measure the increase in heat from a heated chamber to the adjacent chamber over a set time. The results aligned with the literature noting the insulation properties of the straw were dependent on density; even the sample with the lowest density (31 kg/m3) acted as an insulator to the adjacent chamber. The highest density sample (69 kg/m3) resulted in the lowest temperature increase of 0,95°C (20,7°C to 21,65°C) compared to the synthetic batt which prevented any increase in temperature of the adjacent chamber.

This study suggests that the use of straw presents a plausible future application in the construction industry as a natural material for insulation in buildings. When sourced locally, it has low environmental impact and lower costs associated with transportation. However, future research and development is required to determine a standardised building material for its use in buildings.

**Keywords:** Straw,Insulation, Loose-fill, Energy Efficiency.

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