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Research Summary

Can bio composite building materials address health issues associated with fuel poverty?

A comparative investigation was carried out to explore if an innovative low carbon bio composite building material has the potential to reduce the adverse effects of unhealthy homes associated with fuel poverty. The study explored the varying levels of bio matter with binder and how this affects the hygrothermal (moisture and thermal) properties of the composite.

Background

Widespread retrofitting of the current building stock is essential if we are to realise CO_2 emission reductions and create energy efficient homes whilst reducing the levels of fuel poverty. However, if the only focus is to improve the energy efficiency of buildings, the existing research and field observations indicate that the health of the building can be compromised. This creates unhealthy living conditions for occupants.

Poorly designed retrofitting interventions have been shown to have negative 'unintended consequences' relating to the poor management of moisture within the building, and this appears to be due to increasing thermal resistivity of the building fabric and increasing the air tightness of building envelope.

Over 50% of the homes in UK have experienced damp and this is particularly prevalent in fuel poverty areas. Furthermore, this damp leads to mould, leading to chronic diseases such as asthma. If we can develop building materials that deal with the issue of damp and mould, this may have a positive effect on the health of fuel poor occupants.

Aims

To conduct initial investigations into a number of different bio composites to understand the hygrothermal properties in the form of:

- The thermal properties
- Hygric performance (how well it absorbs and desorbs water vapour)

To explore how these two elements may benefit energy savings and reduction of

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condensation and mould, therefore improving the health of the building and ultimately the occupant.

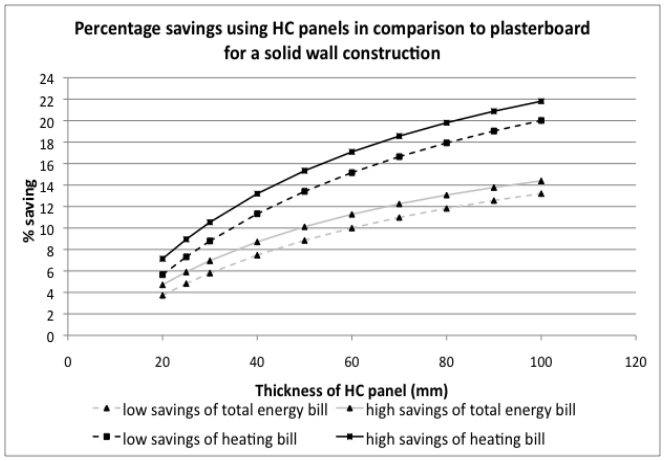
Methodology

The research specifically investigates the increasing inclusion of bio matter with binder and two different lining materials. Hygrothermal performance indicators are quantified for six different composites through controlled comparative laboratory experiments and results obtained are compared to existing research and a performance of a conventional internal lining material: plasterboard.

Findings

Main findings suggest that increased bio matter inclusion makes a difference in both hygroscopic ability and thermal performance. All 6 bio composites tested significantly out perform the thermal performance of plasterboard with the thermal performance of the bio composites being twice as insulating as the plasterboard. In addition, all bio composites have a considerably higher level of hygroscopic action than that of plasterboard.

These thermal performance values were used to indicate energy savings for solid wall constructions in a retrofit scenario. Initial calculations suggest that the like for like replacement of the plasterboard with the novel bio composite could result in ~7% heating bill savings in an average solid walled home.



The impressive hygroscopic ability of the bio composite material suggests this material may be able to deal with peaks of moisture in the home when condensation occurs, reducing the risk of mould, thus improving the health of the home and the occupants.

The increased inclusion of bio matter into the composite compromises the structural integrity of it and this would need further testing to quantify the performance trade off.

Implications

This study implies that this bio-composite has the potential to address some of the negative health issues associated with homes in fuel poverty, especially increasing the thermal performance of the fabric of the building and reducing the likelihood of condensation and mould. Its use in board form in place of plasterboard could have notable energy savings whilst passively managing moisture

within the home regime and within the building envelope.

Not only are there potentially significant 'in-use' energy savings to be made as a result of its use, but also due to the materials in the composite, it has the potential to be a carbon negative building product that could be extensively used in the emerging retrofitting market. Bio composites such as the ones tested could be the building materials of the next generation where we need to reduce the amount of pollutant building materials going to landfill, but develop materials that are totally compostable.

Many thanks go to the Eaga Charitable Trust for their support in this research project. The support helped finance a key piece of apparatus (pictured above) to measure thermal performance of materials. This is now being used by other students at the Centre for Alternative Technology in Wales to develop more low carbon building composites.

Further information

Copies of this research summary can be found on the Eaga Charitable Trust website:

http://www.eagacharitabletrust.org/index.php/projects/item/masters-of-research-dissertation

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