Evaluating Construction Industry Views on Recovered Cellulose as a Component of Building Materials

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Abstract: The construction sector is under increasing pressure to adopt more sustainable products and materials. However, the adoption of new technologies and processes can be risky and complex, with a variety of potential concerns and challenges. Cellulose recovered from wastewater can be used in building materials – namely insulation, asphalt, and polymer composites – to replace certain existing components and help drive down the overall carbon footprint of the construction industry. However, it is unclear how well this innovative material might be accepted and what kinds of concerns those within the construction industry might have about its use. The current study used an online survey, targeted at construction and development professionals, to evaluate perceptions, expectations, and factors which impact the uptake of recovered cellulose materials. Overall, preliminary findings show a support for the use of these materials, however factors such as cost were identified as being a key driver of adoption.

Keywords: recovered cellulose; acceptance; construction industry; perceptions

Interest in the circular economy, which encourages optimum utilisation of resources and recovery and regeneration from traditional waste components, is growing in many areas. While this is promising in terms of progressing towards more sustainable use and supply of materials and products, the issue of adoption and uptake is still a challenge. Some now suggest that the principle challenges to achieving a circular economy are not technological, but governance related (Owen & Liddell, 2016).

Buildings and construction together account for 39% of energy-related carbon dioxide emissions when upstream power generation (embodied carbon) is included, and there is a growing urgency to address the energy intensiveness of this sector if climate change mitigation ambitions are to be achieved (UN EIEA, 2017). Much of the embodied carbon associated with construction is linked with the materials used and how they are sourced (UK Green Building Council, 2015), highlighting a potential area for improvement through more sustainably sourced and produced materials. Recovered cellulose is potentially one such material. Recent research has demonstrated that cellulose fibres (mainly from toilet paper) can be effectively recovered from municipal wastewater and used as a component in building materials (van der Hoek, Fooij & Struker, 2016). Materials that can incorporate cellulose include insulation, asphalt and polymer composites (e.g. for decking and cladding). Moreover, the removal of cellulose can result in energy savings for wastewater treatment plants (Ruiken et al., 2013). The use of materials containing recovered cellulose (in place of other components) is therefore one potential way of reducing embodied carbon in the sector.

Due to the unsystematic nature of the construction industry, it is littered with obstacles preventing the introduction of new materials, such as rotation of stakeholders (Giesekam, Barrett & Taylor, 2016) and the necessity for other companies to be early

innovators (Pinkse & Dommisse, 2009). Early communication with the supply chain has been shown to alleviate barriers to acceptance of new materials (Giesekam et al., 2016). However, the 'liability of newness' associated with being an early adopter of a new product is still a concern (Roos, Woxblom & McCluskey, 2010), and companies may be unwilling to take a risk on a new product before it has been well established.

The current study used an online survey to investigate views from the construction industry around the adoption of materials containing recovered cellulose, potential expectations around those materials when they reach the market, and potential barriers to the wider uptake of such materials. Preliminary findings indicate that construction professionals from all domains were largely supportive, and are highly interested in the use of sustainable building materials. Architects were overwhelmingly identified as the most influential in terms of materials selection, while regulatory requirements, low cost, and reduced carbon footprint were viewed as the most important drivers that determine materials selection. Conversely, key barriers to the uptake of cellulose materials consisted of a lack of relationship between the producers of recovered cellulose and prospective customers in the construction sector, insufficient fit with the culture of the clients and end-users, and money sunk into existing materials. Respondents anticipated that homeowners / homebuyers would be the group with the greatest negative perceptions towards the use of materials with recovered cellulose. Finally, views on cost expectations were highly mixed, with similar levels of expectations that cost should be less, remain the same, and increase.

These findings can help producers of recovered cellulose to navigate the pathway 'from concept to standard practice' by signposting potential mechanisms to help encourage the wider adoption of this material within the construction sector. While the fact that the material was recovered from wastewater did not appear to be an issue, the typical 'liability of newness' issues which occur when attempting to introduce innovative solutions appear to be of greater concern. Important factors which must be considered are also highlighted. The potential barriers to innovation and innovative processes are identified but overall it is evident that there is a demand and an interest for more sustainable materials and some support for circular economy initiatives.

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