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Editorial

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Editorial

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It is a great pleasure for us to welcome readers to this themed issue of *Construction Materials* on the third International Conference on Bio-Based Building Materials (ICBBM2019) held in Belfast in 26–28th June 2019 with approximately 150 people. Following up the great success of ICBBM2017 and ICBBM2015, the conference also provided an excellent platform for networking with more than 260 participants from all over the world, as well as an exhibition. Biomaterials are processed or engineered products obtained partially or fully from renewable bio-based resources, such as natural fibre composites, bioplastics and so on. The purpose of ICBBM2019 was to present the latest available scientific and technical information in the field of bio-based building materials, including natural fibres, rammed earth, innovative hybrid composites of natural fibres, sustainable binders for sustainability and energy efficiency of buildings and life-cycle analysis of bio-based building materials.

In Europe, households are responsible for 32% of greenhouse gas emissions and 42% of energy. Cement production alone contributes to 5% of manmade carbon dioxide emissions (EEA, 2019).

By contrast, bio-based insulation typically has much lower 'embodied energy' levels compared with more conventional building materials. Furthermore, the source materials themselves sequester atmospheric carbon dioxide by way of photosynthesis.

The beauty of bio-based materials is that they are often a by-product of growing our food: sunflowers, straw, rapeseed and so on. We can build our homes with carbon. Instead of seeing carbon as a problem, we can recast our relationship with it to one of positive innovation.

This June 2021 issue of *Construction Materials* is themed on bio-based building materials and consists of six extended papers from ICBBM2019.

In the first paper, Bohuchval *et al.* (2021) have studied the effect of mix composition on the fresh behaviour of three-dimensional (3D) printing mortar. The paper reported the investigation of replacement of cement (by weight) by 20% metakaolin, 24% fly ash, 24% limestone powder, addition of natural fibres (sisal) at 3.6 and 6 kg/m^3, the dosage of superplasticiser and nano-clay as viscosity-modifying admixture on the rheological proprieties and the extrudability of 3D printing mortar. The variation of these properties with time was also investigated. Finally, the authors developed a printability box which allowed a successful 3D printing of mortar layers by specifying the ranges of flow table spread, penetration, time gap and estimated yield stress to obtain successful 3D printing mortar in order to avoid the risk of drainage, no printability or surface defects on the printed layers.

The next paper, by Reuge *et al.* (2021), reported an investigation on the theory and simulation of kinetics of sorption of a prototype wall made with bio-based materials. The wall was developed in the framework of the European IsoBio project: it was a multilayered wall made mainly with bio-based materials. The measurements were compared with simulations based on the instantaneous local equilibrium model (TMC code) and on the local kinetics of sorption model (TMCKIN code). It resulted that TMC significantly underestimated the dynamics of the local relative humidity variations; however, TMCKIN code successfully predicted these dynamics and produced results close to experimental measurements.

The third paper reports the use by Verdier *et al.* (2021) of glycerol esters to prevent microbial growth on sunflower-based insulation panels, as, in the indoor environment, the growth of microorganisms on building materials led to the deterioration of both the materials and indoor air quality, particularly with bio-based building materials, the fibres of which contain cellulose or derivatives. They also investigated the sorption capacity and fire reaction of these materials. It was reported that

bio-based materials with glycerol esters presented physical, thermal and hygroscopic properties similar to those of bio-based materials made with hemp or bio-aggregates. In addition, the glycerol esters showed significant antimicrobial effects but also a susceptibility to flammability. It was found that material made of sunflower pith was classified as non-flammable.

Guihéneuf *et al*. (2021) conducted tests to optimise earth blocks in compliance with modern standards without hydraulic binder. They investigated a series of processing methods and the use of dispersant and concluded that these can be efficient ways to enhance the mechanical properties of the selected soils. This study highlights that some of these methods could be used in the near future at a semi-industrial scale to produce a structural material that can achieve compliance with modern standards without hydraulic binders. The dispersant could be replaced by bio-based additions such as tannins, which led to the highest-level mechanical properties combined with the optimal processing methods.

The fifth paper, by Ajouguim *et al*. (2021), reports the study of the effectiveness of using alfa fibres as reinforcement of a cementitious material for panel facade applications. The use of ground alfa fibres thus seems promising, constituting an important pathway to determine a procedure to produce facade panels reinforced with alfa fibres. To optimise the results, it is important to treat the surface of alfa fibres in order to reduce the non-cellulosic compounds present in the fibres which can significantly affect the hydration reaction of the composite. This led to an improvement of the mechanical properties.

The final paper in this issue, by Fantilli and Jóźwiak-Niedźwiedzka (2021), reports on an investigation of the effect of Portland cement alkalinity on wool-reinforced mortar. The chemical compatibility and the effects of alkalinity on mechanical performance were investigated by testing the beams under three-point bending, and the microstructure of the mortars using energy-dispersive X-ray spectroscopy was used to analyse the structure of mortar containing wool. It was found that the alkalinity of the cement paste is low and the resistance of wool fibres in the cementitious matrix was higher, which led to a larger post-cracking residual stresses in the wool-reinforced mortars.

The next conference, ICBBM2021, will be held in June 2021 in Barcelona, Spain. Details can be found at https://sites.google.com/view/icbbm2021/.

REFERENCES

Ajouguim S, Page J, Djelal C, Waqif M and Saâdi L (2021) Investigation on the use of ground alfa fibres as reinforcement of cement mortars. *Proceedings of the Institution of Civil Engineers – Construction Materials* **174(3)**: 161–171, https://doi.org/10.1680/jcoma.20.00001.

Bohuchval M, Sonebi M, Amziane S and Perrot A (2021) Effect of metakaolin and natural fibres on three-dimensional printing mortar. *Proceedings of the Institution of Civil Engineers – Construction Materials* **174(3)**: 115–128, https://doi.org/10.1680/jcoma.20.00009.

EEA (European Environment Agency) (2019) *Consolidated Annual Activity Report 2019*. EEA, Copenhagen, Denmark. See https://www.eea.europa.eu/about-us/documents/annual-reports (accessed 10/06/2021).

Fantilli AP and Jóźwiak-Niedźwiedzka D (2021) Influence of Portland cement alkalinity on wool-reinforced mortar. *Proceedings of the Institution of Civil Engineers – Construction Materials* **174(3)**: 172–181, https://doi.org/10.1680/jcoma.20.00003.

Guihéneuf S, Rangeard D and Perrot A (2021) Processing methods for optimising the mechanical strength of raw earth-based materials. *Proceedings of the Institution of Civil Engineers – Construction Materials* **174(3)**: 150–160, https://doi.org/10.1680/jcoma.19.00115.

Reuge N, Collet F, Pretot S *et al.* (2021) Kinetics of sorption in bio-based materials: theory and simulation of a demonstrator wall. *Proceedings of the Institution of Civil Engineers – Construction Materials* **174(3)**: 129–139, https://doi.org/10.1680/jcoma.19.00094.

Verdier T, Balthazard L, Montibus M *et al.* (2021) Using glycerol esters to prevent microbial growth on sunflower-based insulation panels. *Proceedings of the Institution of Civil Engineers – Construction Materials* **174(3)**: 140–149, https://doi.org/10.1680/jcoma.20.00002.