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EXPERIMENTAL RESEARCH ON THE VALORIZATION OF BIOCHAR PRODUCED FROM WASTE BIOMASS AS BUILDING MATERIAL

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SPOKE, WP AND TASK

Spoke 8 - Circular economy in agriculture through waste valorization and recycling
WP 8.1 - producing new products to upgrade waste value
Task 8.1. 3 - Valorisation of the waste to obtain biomaterials

BACKGROUND & SCOPE OF WORK

Biochar is considered a method of carbon sequestration as long as it can be used in applications that can maintain its stability while avoiding the re-emission of CO_2 into the atmosphere. Typically, the main application of biochar is as a soil amendment, but there are other interesting non-agricultural applications for biochar as an additive to inert mixes such as cement. [1]

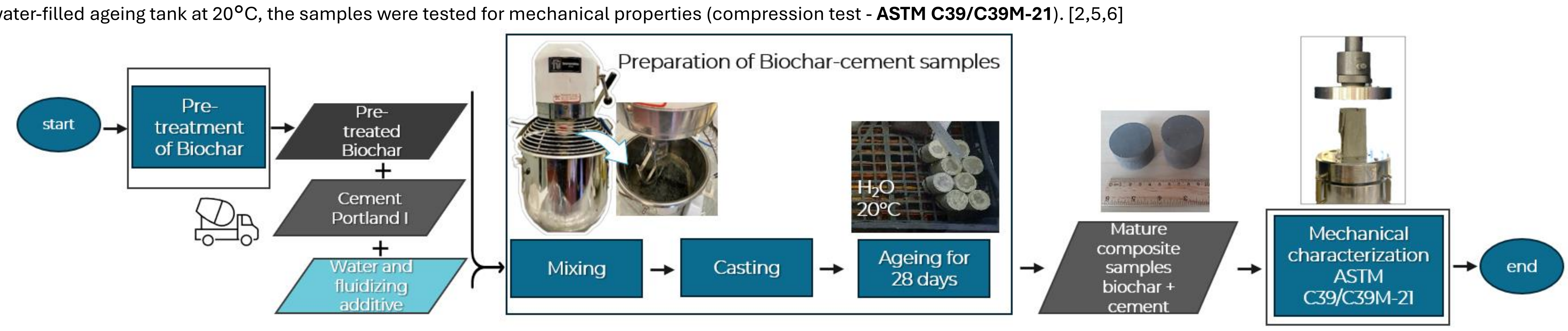
The construction industry is a difficult sector to mitigate; global cement production contributes more than 8% of global CO_2eq. Replacing some of the cement with biochar could be one way of reducing the CO_2 emissions of the cement mix or other materials, for both structural and non-structural applications. To date, there is no clear regulation for this application, the addition of biochar can change the properties of the samples, so it is necessary to characterise the biochar-cement product. [2-4]

In this study, low value/waste biochar from different feedstocks, chestnut and pinewood, were characterised, added as a replacement to cement at several percentages, and then the biochar-cement samples were subjected to mechanical characterisation.

MATERIALS & METHODS

In the substitution of cement type 1, **chestnut and pinewood biochar** were used to carry out the first test of substitution of cement mixtures: three formulations were prepared for each type of biochar, the biochar was substituted to the total cement, with percentages by weight equal to **0.5, 1, 4% by weight**.

The mechanical properties of biochar-based cementitious materials depend on both the amount and the chemical/physical properties of the biochar, which in turn depend on the type of feedstock, seasonality and pyrolysis conditions (e.g. temperature, pressure, time and pyrolysis rate). Therefore, once the biochar had been characterised, it was pre-treated to obtain comparable data by vacuum drying at 120°C for 24 h and grinding to a granulometry of 10 µm. The biochar cement samples were then prepared and poured into moulds. After 28 days of ageing in a water-filled ageing tank at 20°C, the samples were tested for mechanical properties (compression test - **ASTM C39/C39M-21**). [2,5,6]

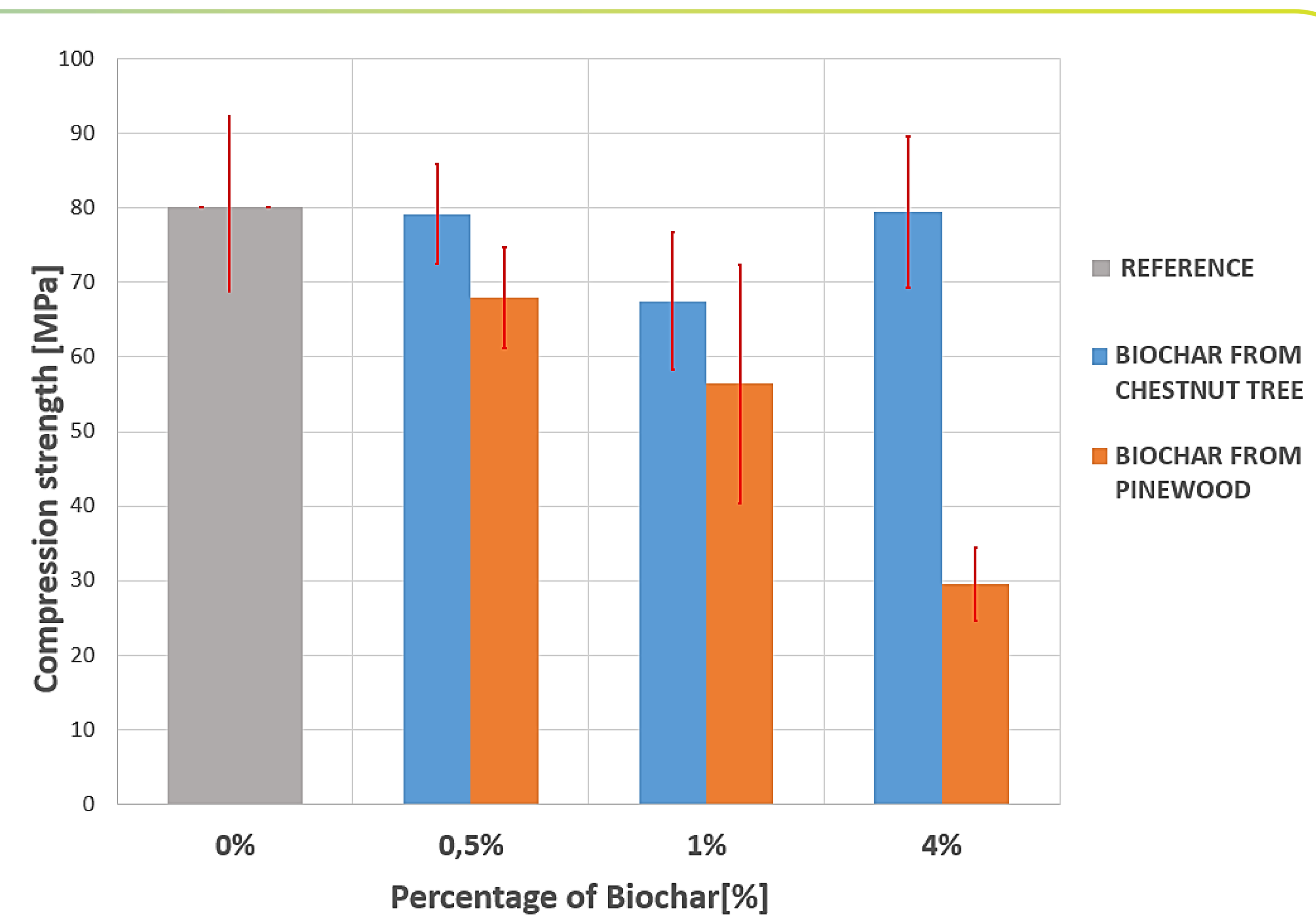


RESULTS

The initial results obtained for chestnut biochar replacing cement type 1 are consistent with those reported in the literature and confirm that the replacement with biochar up to 4% w/w does not affect the strength of the cement. On the other hand, when looking at the data from the pinewood biochar used as a replacement for type 1 cement, a difference in the compressive response can be seen, even though the biochar was subjected to the same pre-treatments. [2]

Way forward

- Various low value/waste biochar from a different feedstock will be investigated and characterised, and then potentially substituted to cement mixes;
- Increase the percentage of chestnut biochar replacement in the cement up to 7% by weight, as the mechanical test results obtained with the replacement up to 4%;
- Comparative analysis of the differences between biochar from different feedstocks.



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