

Use of waste organic fibres in cement composites

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Large quantities of lignocellulose wastes are generated worldwide from various sources, while sustainable building materials are becoming more and more important. Society endeavours to maximize the utilization of wastes in all industrial sectors (known as cyclic economy). These by-products and residues, such as waste wood or agricultural wastes like sugar cane bagasse, coconut fibres and others, can be utilized to manufacture cement-bonded construction materials (Pinto et al, 2012). Wood fibres, in various forms, have been mixed with cement to make composite materials for about a 100 years (Fan et al, 2012). The use of wood and fibre particles has increased rapidly over the past decade, primarily because of the improvement in process technology and due to economic factors and increased sustainability concerns, such as renewability and recycling of organic waste and less consumption of cement (Binici et al, 2014). Nowadays, a large amount of inorganic and organic waste is generated globally with huge potential environmental impact (Karade et al, 2010).

However, the use of lignocellulose fibres, which contain saccharides may have retarding effects on cement hydration, can decrease the strength of the composites. To assess the retarding influence of wood on cement, compatibility indices were developed; these can be a useful tools for the preliminary selection and comparison of various species. The basis for these indices are calorimetric measurements of fibre cement mixtures that are then compared to neat cement pastes (Bin et al, 2014).

In this work the compatibility of several different fibres, such as coconut, sugar cane bagasse and water hyacinth is determined for the first time and compared with systems where the pure saccharides sucrose, fructose, glucose, lignin and cellulose are added (Fig. 1). The hydration products of the cement were then identified using XRD.

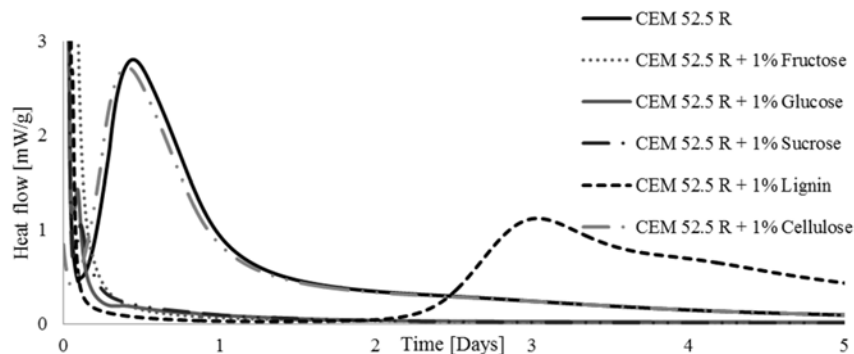


Fig. 1: Effect of 1wt% of simple sugars, lignin and cellulose on the hydration of OPC paste at 20°C

The results of this study will be used to determine the suitability of these organic fibres for wood cement board production. Fibres with low compatibility will be selected for pre-treatments with various salt solutions at different concentrations that reduce the influence of the organic components on the cement.

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