Influence of Sisal fiber's treatment on the kinetics of hydration, morphological and thermophysical properties of the composite cementitious mortar

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Abstract:

Currently, cement-based bio-composite is a relevant concept for researchers in the building. However, these researches highlighted some handicaps. Plant fibers are acting as a retarder in the setting time of the cement. In this study, Sisal fiber (SF) (4% by mass of cement) was subjected to different treatments to improve bio-composites hydration kinetics (K_H) "tested by isotherm calorimetry". The treatment slowed down both alkaline hydrolysis and mineralization of fiber cell walls by promoting the hydration of cement. This result was coherent with morphological properties. In fact, the images obtained by scanning electron microscopy (SEM) showed a tinier calcium layer around the (SF) treated with NaOH and Paraffin oil on the adhesion surface. The Fourier transform infrared spectroscopy (FTIR) test revealed a disparity in the peaks of the absorption strips of $CaCO_3$ and $Ca(OH)_2$ and thus cement hydration. In addition, the tests results showed a decrease in thermal conductivity (λ) and volumetric heat capacity ($\rho.C_V$) after treatment of (SF). Resistance (R_{Th}) and thermal diffusivity (α) slightly increased with treated fiber. Considering that, the bio-mortar with treated Sisal fiber can be promising material from an insulation point of view.

Keywords: Hydration kinetics; Sisal fiber; Surface treatment; Cement-based composites; Morphological properties; Thermophysical properties;

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