Colloidal silica to improve the interface between lignocellulosic fiber and matrix in the extruded cement based composite

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ABSTRACT

The macro mechanical properties of extruded cement based composites depend on transition zone between fiber and matrix. The nanotechnology in construction materials is a research area with high potential. The objective of this work is to evaluate the treatment of colloidal silica on lignocellulosic fiber surface to improve mechanical performance of fiber-cement composites. In this study the $^{29}$Si SSNMR (solid-state nuclear magnetic resonance) technique was used to evaluate the effectiveness of treatment of lignocellulosic fibers with colloidal silica. It was observed some regions of the fiber where colloidal silica was impregnated by scanning electron microscopy micrographs (SEM). Fiber-cement composites reinforced with sisal fibers and unbleached Eucalyptus Kraft pulp were produced by the extrusion process. Mechanical behavior of the fiber-cement composites was evaluated by means of modulus of rupture and energy of fracture based on load-displacement curves (L-d curves) under continuous loading and 3-point bending arrangement. The average values of modulus of rupture and energy of fracture of fiber-cement increased about 29% and 35%, respectively, with application of the colloidal silica treatment. The use of colloidal silica...
improved the interface bond. The results of this study show an important way to control the adhesion of lignocellulosic fiber at cement matrix.

KEYWORDS: Extruded composites, nuclear magnetic resonance, nanoparticles, sisal fiber, Eucalyptus pulp.