Abstract

In this research work, we have demonstrated that the physical characteristics and mechanical properties of cement mortar are significantly improved by the jute fibre reinforcement. Different process methodologies were adopted to mix the jute fibre homogeneously in the mortar matrix. By optimizing the processing conditions and fibre loading; the cold crushing strength, flexural strength, flexural toughness and the toughness index of the mortar are found be significantly increased. Therefore, it is assessed that the jute fibers have enough potential to act as reinforcement in cement mortar, but the durability of such fibers in highly alkaline cement matrix and fiber-matrix compatibility must be required to consider. These can be ensured by effective modifications either to the chemical composition or to the surface properties of jute fiber by some chemical treatment. In this context, we have modified both the chemical composition as well as surface properties of jute fibre by mild alkali and combined dilute alkali and polymer emulsion.The treatment is demonstrated to be very effective not only to disperse the modified chopped jute fibre homogeneously in cement mortar matrices, but also to improve the physical characteristics and mechanical properties of cement composite, to control the hydration of cement as well as to enhance long term durability of the fiber in cement medium. The combined alkali and polymer modified jute fibre was found to be more stable as compared to the raw and alkali treated jute fibre. Combined alkali and polymer modified jute fibre retains 93% of its original tensile strength after keeping 360 days in cement medium as compared to that of raw jute (74%) and alkali treated jute (65%). Based on the setting time measurement, hydration test at early age of cement hydration and hydration analysis of hardened samples using different analytical techniques (viz., FTIR, XRD, DSC, TGA and free lime content estimation) of raw jute, alkali treated jute and combined alkali and polymer treated jute cement samples, it was assessed that raw jute retarded the cement hydration reaction. Retardation effect was found to be lower for alkali treated jute and combined alkali and polymer modified jute reinforced cement samples.

Key words: Jute fiber, cement composite, physical characteristics, mechanical properties, long term durability, cement hydration, analytical techniques.