

Improving the Performance of Lightweight Crumb Rubber Mortar Using Synthetic, Natural, and Hybrid Fiber Reinforcements

ABSTRACT

The global market for tires is ever-growing, and partially replacing sand with crumb rubber (CR) as fine aggregates in concrete could reduce environmental pollution. However, the main barrier to the complete usage of recycled tire crumbs in construction is the deterioration effect of CR on the mechanical properties of cement-based composites. Therefore, this paper attempts to improve the fresh and hardened properties of crumb rubber mortar (CRM) by incorporating polypropylene-polyethylene synthetic fibers with coconut and kenaf natural fibers as reinforcements. A total of 18 mix designs were developed with varying fiber combinations and rubber crumb replacement. Subsequently, parametric studies with chemical admixture were conducted at 3, 7, and 28 days to improve the flowability and resulting mechanical properties of the fiber-reinforced CRM. According to the results, the single and hybrid fibers positively improved the mechanical properties of cement mortar at 5–15% CR replacement. It can be concluded that adding single and hybrid fibers enhanced the performance of cement mortar modified with tire crumb rubber aggregates by providing varying degrees of improvement.