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Mechanical Properties of Polyolefin Fiber-Reinforced Light Weight Concrete

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Abstract

The utilization of polyolefin fibers in reinforced concrete can potentially enhance the properties of the concrete by changing the interfacial properties of the fiber-matrix interface. The objective of this research was to determine the mechanical properties of polyolefin fiber reinforced lightweight concrete (LWC). Compressive, flexural, and splitting tensile strengths of the sample were measured. Polyolefin fibers were added to the reinforced composite in variable amounts (0-2%). The lightweight concrete was designed to achieve compressive strength target of at least 30 MPa with a density value of 1800 kg/m^3 after 28 days of storage. The results showed that the highest compressive strength was obtained in LWC containing 1% fiber led to an increase of about 8%. However, a reduction in compressive strength was observed when the amount of fiber was increased. Moreover, increasing the amount of fiber presented a growth in rupture modulus as well as splitting tensile strength.

Keywords: Fiber Reinforced Concrete; Polyolefin Fiber; Light Weight Concrete; Mechanical Properties.

1. Introduction

The employment of lightweight concrete in a building has many advantages such as saving time, cost effective, handling, and higher thermal insulation [1]. The replacement of natural aggregate with natural or artificial lightweight aggregate unit reduces weight of concrete [2].

The addition of admixture with high quality to concrete could make them inexpensive as well as improvement of strength and durability [3]. Added fibers to concrete reduce the effect of concrete shrinkage and creep [4]. There are always micro or medium cracks in cement based composites, which cause a decrease in durability due to the presence of water, chloride-ion, and carbon dioxide penetrated into the concrete and thereby induce a steel corrosion [5]. Fibers within the cement based materials prevent or control the cracks and improve the tensile strength, ductility, toughness, and durability of the concrete [6, 7]. There are variable fibers including carbon, polyvinyl alcohol, steel, and glass fibers that may theoretically increase the strength as a result of high modulus whereas some low strength fibers such as polypropylene, nylon, and acrylic improve ductility and reduce cracking [8].

Steel fibers have been commonly used to raise the mechanical properties of concrete, on the other hand they suffer from disadvantages. The durability of concrete may be affected by corrosion of steel while high density of steel causes the extra costs to transport and handling as well as an increase in the weight of a structure [4, 9]. Polymer fibers may

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