Investigation of the Mechanical Properties of Sisal Fiber Reinforced Pervious Concrete

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Abstract:
The limited amount or lack of fine aggregate in previous concrete creates a distinctive pore system that facilitates stormwater infiltration and minimizes runoff volume. Unfortunately, this absence of fine aggregate also results in a less densely packed matrix of concrete, reducing its load-bearing capacity. As a result, conventional pervious concrete often fails to meet the strength and durability requirements necessary for use as a high-traffic pavement material. To address these shortcomings, researchers have sought alternative methods for enhancing pervious concrete's properties while preserving its original purpose of allowing for seepage. In this study, sisal fiber was employed as a reinforcing material in pervious concrete to evaluate its effects on the mechanical properties. To achieve this, 12 concrete mixes were produced by replacing cement with sisal fibres at 0.5, 1.0, and 1.5% by weight and using varying aggregate sizes ranging from 4.5 to 20mm. The resulting composite was cured and tested for compressive and flexural strength, shrinkage, abrasion resistance and porosity. The strength of the resulting sisal fiber-reinforced pervious concrete (SRPC) evaluated at 7, 28, and 56 days showed that while SRPC exhibited early compressive strength gain, there was a decrease in strength at 28 days as the fiber content increased. The decrease in strength became more pronounced with increasing fiber content and curing time. However, the addition of 0.5% fiber and a 4.5-9.5mm aggregate size range achieved the highest flexural strength of 18.2 N/mm2 at 28 days of curing, showing a 7% increase when compared to the control concrete. The optimal fiber replacement was found to be 0.5%, and the results demonstrate that incorporating sisal fiber as a reinforcing material in pervious concrete is feasible, although it did not significantly improve the compressive strength. Nonetheless, the flexural strength of the pervious concrete was significantly enhanced after 28 days of...

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