# Mechanical properties of sustainable concrete due to the use of steel-kenaf fiber

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**Abstract**

This paper presents an experimental study on the mechanical properties of the steel-kenaf hybrid fiber concrete mixture. Two types of fibers, steel hooked-end fiber and kenaf fiber were considered. To have reference concretes, a plain mixture without fibers was considered and two mixture containing of steel-kenaf hybrid fiber with 1% and 2% by volume were prepared. Mechanical properties, compressive strength and flexural strength were studied. In this study, kenaf fiber were treated by (NaoH) concentration at 6%, immersion duration at 24 hours under conditions of laboratory temperature. The results showed that improve was observed for all the mixtures with hybrid fiber on the compressive and flexural strengths of steel-kenaf hybrid fiber concrete mixture. Specimens with hybrid fibers show the best flexural performance. Moreover, an increase in volume fractions of steel fibers leads to increase in the compressive and flexural strengths of concrete. In addition, specimens with steel -kenaf hybrid fibers exhibit a better failure behavior than specimens without fibers.

## 1. Introduction

Generally, concrete is a material that is strong in compression and weak in tension, limited ductility and little resistance to cracking eventually leading to brittle fracture of the concrete. Concrete is characterized by brittle failure, the loss of loading capacity, once failure is initiated. Addition of fibers to concrete will act as crack arrester and substantially improve its static and dynamic properties of the concrete. Fibers are usually used in concrete to control cracking. Fiber reinforced concrete (FRC) is widespread used in civil engineering construction [3, 8, 9, and 10]. Steel fiber reinforced concrete has the ability of excellent tensile strength, flexural strength, shock resistance, fatigue resistance, ductility and crack arrest. Hybrid fiber reinforced concrete is a material that contains different types of fibers [2, 3, 5, and 8]. Advantages of natural fibers include low density, low cost and biodegradability are make it potentially to use in concrete mixtures. However, the main disadvantages of natural fibers in composites are the poor compatibility between fiber and matrix and the relative high moisture sorption. Therefore, chemical treatments are considered in modifying the fiber surface properties. Types of chemicals used in the treatment play a vital role in the extent of the improvement in terms of water absorption of the natural fibers. The chemical treatment of fiber aimed at improving the adhesion between the fiber surface and the matrix may not only modify the fiber surface but also increase fiber strength [6, 7]. Furthermore, the use of different types of fiber in a suitable combination have the potentially to improve the mechanical properties of concrete [2-4]. In this paper, an experimental investigation was carried out on the concrete mixtures containing the steel-kenaf hybrid fiber to provide more information about the effects apply natural materials (kenaf fiber) in hybrid fiber of concrete mixture. The details of the experimental program are presented below.

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