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## Evaluation of Hybrid-Short-Coir-Fibre-Reinforced Composites via Full Factorial Design

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### Abstract

A full factorial design ( $2^23^1$ ) has been used to investigate the effect of the use of sodium hydroxide fibre treatment, Portland cement and uniaxial pressure on the physical and mechanical properties of hybrid short coir fibre reinforced composites (HSCoirFRCs). The response variables considered in this work were the apparent density, porosity, tensile and flexural strength, the modulus of elasticity and the Charpy impact resistance. The alkali treatment contributed not only to reduce the apparent porosity, but also to increase the mechanical properties of the HSCoirFRCs. A reduction of the impact resistance and an increase of the apparent density was also identified after treatment. Cold pressing significantly affected the physical and mechanical properties of the HSCoirFRCs. Higher pressure levels enhanced the wettability of the fibres and, consequently, the mechanical performance of the composites. The incorporation of cement microparticles as a second reinforcement phase was however not effective, leading to decreased strength and an increased apparent density of the materials. The HSCoirFRC structure can be considered an economical and sustainable alternative for future secondary structural parts in lightweight transport applications.

Keywords: coir fibre; hybrid composites; full factorial design; alkaline treatment; Portland cement; compaction.

### 1. Introduction

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