

Article

Agricultural Residues of Lignocellulosic Materials in Cement Composites

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Abstract: Lignocellulosic material residues in cement composites are a favourable option for new fibre cement formulations in building materials, because they combine good mechanical properties with low density. This study aimed to evaluate the chemical, physical, anatomical, and mechanical properties of five cement panels reinforced with the following lignocellulosic materials: eucalyptus, sugarcane bagasse, coconut shell, coffee husk, and banana pseudostem. Lignocellulosic cement panels were produced with each lignocellulosic material residue, and three replicates of each type of lignocellulosic material were examined (15 panels in total). The lignin, extractives, ash, and holocellulose were examined. After 28 days of composite curing, the following physical properties of the panels were evaluated: density, porosity, water absorption after immersion for 2 and 24 h, and thickness swelling after immersion for 2 and 24 h. Mechanical tests (compression strength, internal bonding, modulus of rupture, and modulus of elasticity) were performed before and after the accelerated ageing test with a universal testing machine. Scanning electron microscopy and supervised image classification were performed to investigate the morphologies of the different materials and the filler/matrix interfaces. Eucalyptus and sugarcane panels had the best results in terms of the evaluated properties and thus, could potentially be used as non-structural walls. However, banana pseudostem, coconut shell, and coffee husk panels had the worst results and therefore, under these conditions, should not be used in building.

Keywords: lignocellulosic panels; chemical properties; physical-mechanical properties; residue materials

1. Introduction

The growing global population density has increased industrial development and intensified agricultural methods. The high productivity of agricultural species is the main cause of the large volume of agricultural residues generated [1]. Currently, these residues are either burnt or landfilled, thus resulting in several problems such as air pollution, emission of greenhouse gases, and occupation of useful land [2]. Given the worldwide population increase, housing problems are becoming a priority [3]. Thus, solutions to make sustainable houses more affordably are desirable. Many studies have focused on the use of natural materials in buildings, because these materials have high sustainability [4].

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