




Article

Physical and Mechanical Properties Performance between Untreated and Treated with CCA Treatment at Different Age Groups of Fast-Growing Acacia Hybrid of Sarawak

Gaddafi Ismaili ^{1,*}, Ellyne Enduat ¹, Nur Syahina Yahya ¹, Fanthly Moola Malek ¹, Noor Azland Jaimudin ¹, Khairul Khuzaimah Abdul Rahim ², Mohd Effendi Wasli ³, Meekiong Kalu ³, Iskanda Openg ⁴, Ahmad Nurfaidhi Rizalman ⁵, Jack Liam ⁶ and Biha Razali ⁶

¹ Department of Civil Engineering, Faculty of Engineering, Universiti Malaysia Sarawak, Kota Samarahan 94300, Sarawak, Malaysia

² Sarawak Forestry Corporation, Kuching 93250, Sarawak, Malaysia

³ Department of Plant Resource Science and Management, Faculty Resource Science & Technology, Universiti Malaysia Sarawak, Kota Samarahan 94300, Sarawak, Malaysia

⁴ Faculty of Civil Engineering, Universiti Teknologi MARA, Kota Samarahan 94300, Sarawak, Malaysia

⁵ Department of Civil Engineering, Faculty of Engineering, Universiti Malaysia Sabah, Kota Kinabalu 88400, Sabah, Malaysia

⁶ Sarawak Forest Department, East Wing Bangunan Baitul Makmur II, Medan Raya, Petra Jaya, Kuching 93050, Sarawak, Malaysia

* Correspondence: igaddafi@unimas.my



Citation: Ismaili, G.; Enduat, E.; Yahya, N.S.; Malek, F.M.; Jaimudin, N.A.; Abdul Rahim, K.K.; Wasli, M.E.; Kalu, M.; Openg, I.; Rizalman, A.N.; et al. Physical and Mechanical Properties Performance between Untreated and Treated with CCA Treatment at Different Age Groups of Fast-Growing Acacia Hybrid of Sarawak. *Forests* **2022**, *13*, 1969. <https://doi.org/10.3390/f13121969>

Academic Editors: Tomasz Krystofiak and Pavlo Bekhta

Received: 15 October 2022

Accepted: 16 November 2022

Published: 22 November 2022

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.



Copyright: © 2022 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

Abstract: An effort was carried out to fully utilise fast-growing Acacia hybrid usage in the timber engineering field; however, the research data are still lacking. This paper aims to evaluate the physical and mechanical properties performance between untreated (control) and treated with 10% copper chrome arsenic of Acacia hybrid collected from Daikin Plantation Sdn. Bhd. Bintulu, Sarawak at air-dry condition at different age groups using the small clear method. Mechanical properties test refers to shear parallel to grain (tangential and radial directions), cleavage (tangential and radial directions), and tension parallel to grain test. Meanwhile, the physical properties test refers to moisture content (MC) and density test. After treatment, mechanical properties increase with an average of 13.67%; meanwhile, moisture content decreased with an average of 0.58% or 0.09% MC, and density slightly increased with an average of 0.44% or 0.002 g/cm³. Results indicate that 10-year-old Acacia hybrid exhibits the highest strength values in shear parallel to the grain, tension parallel to the grain, and cleavage, followed by 13-year-old and 7-year-old. Treated samples in the tangential direction performed better with consistent mean results than that of the untreated samples, while radial direction gave a high average strength increment when treated.

Keywords: Acacia hybrid; fast-growing; copper chrome arsenic; physical and mechanical properties

1. Introduction

Timber was used throughout the history of mankind and provided humans with a broad range of building products and construction materials [1]. It is the most sustainable construction material, as it is renewable and absorbs carbon dioxide as it grows [1]. Malaysia is one of the leading producers of the world's good quality timbers, which are very highly demanded all over the globe [2]. However, over the year, Malaysia was unable to accommodate the huge demand for timber, especially primary hardwood timber, due to a shortage of timber resources. In conjunction with that, Malaysia introduced *Acacia mangium* for forest plantation species due to its fast-growing rate. Sarawak's effort, by planting the fast-growing species tree, began in the 1980s, and includes plantations of *Acacia mangium* with the largest forest plantation area in the country. However, the effort plantations grew and turned out to be prone to several diseases [3].