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Comparison between heat treated sapwood & heartwood from Okan (*Cylicodiscus gabunensis*(Taub.) Harms)

Wahyu Hidayat^{1, 2} · Jae-Hyuk Jang¹ · Se-Hwi Park¹ · Nam-Hun Kim^{1,*}

¹ Department of Forest Biomaterials Engineering, Kangwon National University, Korea

² Department of Forestry, Faculty of Agriculture, University of Lampung, Indonesia

* Corresponding author : Nam-Hun Kim, E-mail : kimnh@kangwon.ac.kr

Abstract

Thermal modification of wood is a heat treatment of wood performed at temperature ranging between 160 - 260°C, with temperatures lower than 140°C resulting in only slight changes in material properties and higher temperatures resulting in unacceptable degradation to the substrate (Hill 2006). Heat treatment can reduce wood hygroscopy, improve wood dimensional stability and durability without any toxic chemicals. However heat treatment generally decreases the mechanical properties of wood. The degradation of tracheid walls during heat treatment agrees with the degradation of the hemicelluloses are responsible for the reduction of weight and density. As a result of weight loss, the strength property of wood is reduced (Awoyemi and Jones 2011). Okan (*Cylicodiscus gabunensis* (Taub.) Harms), also known as Denya and African greenheart, is a large tree native to tropical rain forests of West and Central Africa that grows up to 60 m tall with straight bole up to 24 m (Kadiri et al. 2005). Okan is rated very durable; therefore it is commonly used in heavy construction and harbour works such as lock gates, bridges and railway sleepers (Louppe et al. 2008). The objective of this study is to evaluate the physical and mechanical properties of sapwood and heartwood from Okan after heat-treated at different temperature. Sapwood and heartwood specimens of Okan wood with small grain orientation and variation in density, and free of defect were prepared. The boards dimensions were 300 mm x 90 mm x 20 mm in length, width and thickness respectively. The boards were heat-treated in an electric furnace (L-Series, JEIO TECH Ltd., Korea) at 160°C, 180°C, 200°C, and 220°C for 2 hours. Physical and mechanical properties as colour change, weight loss, density reduction, equilibrium moisture content, water absorption, static bending strength (MOR and MOE), and compressive strength were determined for heat-treated boards and were compared to untreated boards. The results of this study showed that colour change (ΔE^*) values increased with increasing heating temperature in which sapwood had higher ΔE^* than heartwood. Weight loss, volume shrinkage and density reduction of sapwood and heartwood samples also increased with increasing temperature. Heat treatment caused decreases up to: (1) 57.54% in the equilibrium moisture content (EMC); (2) 52.11% in the water absorption; (3) 49.00% and 27.05% in the MOR and MOE, respectively; and (4) 40.31% in the compressive strength. Mechanical strength reduction was acceptable enough at temperature ranging between 160 -

200°C, while heating temperature of 220°C contributed to high decrease in the mechanical strength.

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