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Title :
Dimensional Shrinkage, Stability and Strength Properties of Oil Palm Lumber in Relation to Sawing Pattern and Resin Impregnation Treatments

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This study focused on the dimensional shrinkage, stability and strength properties of oil palm lumber in relation to sawing pattern and resin impregnation treatments. A total of 26 oil palm trees of high yielding *tenera* variety were obtained from Sungei Kahang Estate, which is located between latitude N 2°12’24” to N 2°12’55” and longitudes E 103°30’59” to E 103°31’05”. The geographical position of oil palm tree in east and west directions was determined and its position was marked onto the trunk before felling. For basic properties, test samples in pith to periphery zone at different tree heights were analysed by using various analytical techniques. All tests were conducted according to standard test procedures. Based on results, basic properties-related parameters that include vascular bundle, moisture content (MC) and basic density of oil palm lumber were highly dependent on the distance in radial plane with tree heights. For dimensional shrinkage, oil palm billets were sawn into lumber scantlings of different nominal sizes using four types of sawing pattern, namely sawing patterns of type A (SP-A), type B (SP-B), type C (SP-C) and type D (SP-D). After drying, the lumber shrinkage in radial, tangential and its cross-sectional area were measured using a mathematical technique of numeral integrations. In general dimensional shrinkage of oil palm lumber from the SP-D sawing pattern was the lowest, followed by the SP-A sawing pattern, while those lumbers sawn using both the SP-B and SP-C sawing patterns were highest (too distorted). With regards the resin treatment, oil palm billets were sawn into lumber scantlings using the SP-D sawing pattern, and dried to 10 ± 2% MC. After drying, dried lumber was impregnated with a phenol formaldehyde (PF) resin using a vacuum infusion system, and followed by a densification process. With the introduction of grooves and channels, the resin flow was dispersed homogenously within the lumber matrix. The dimensional stability of densified resin-treated lumber was determined by measuring its antiswelling efficiency (ASE) while three-point bending procedures were employed for flexural strength properties. A positive ASE value indicated that the PF resin had penetrated into the cell wall and subsequently cross-linked, leading to bulking along interstitial spaces of parenchyma cells. The flexural strength of densified resin-treated lumber was significantly stronger than those lumbers devoid of PF resin, which in turn, was related to their basic properties-related parameters. These results collectively should provide some insight to the understanding of factors that influence the physical and mechanical properties of oil palm trunk, which when combined with a corresponding changes in material handling and processing may point the way forward to a satisfactory conversion and efficient utilisation for sawn lumber productions. Apart from sawn lumber products, information on variation in physical and mechanical properties as a function of the bole position along its radial plane with tree heights could assist to segregate billets from different sections of oil palm trunk for biocomposites such as plywood.

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