Heavy timber construction in Malaysia generally uses heavy and medium hardwood timbers with strength groups between SG1 to SG4. Light hardwood timbers with strength group of SG5 to SG7, which are also known as low-grade timbers are mostly used for non-structural applications and this does not represent an efficient use of available timber. Thus, one of the ways to fully utilize and upgrade the value of these timbers is by converting them into glued laminated timber (glulam). Glulam allows the use of any timber species be it low-grade timber, small diameter trees, plantation and fast growing timber species, as long as the timber species selected have good gluing characteristics and can fulfill the production and structural requirement of glulam. Glulam also offers the opportunity to combine high-grade timber species at the outer laminations, producing a mixed-species glulam. This study investigates the effect of using Malaysian lower grade timber species combined with higher grade timber species in the manufacturing of glulam. Two types of glulam beams were prepared: (i) mono species with uniform layup using Kapur, Merpauh, Resak, White Meranti, Bintangor, and Jelutong and (ii) mixed species with balanced layup whereby higher strength grade timbers i.e. Merpauh and Kapur were equally positioned at the outer layer and the lower strength grade timbers i.e. Jelutong and Sesendok were positioned at the inner layer. Ten-layered glulam beams were prepared in accordance with MS758. A series of tests were performed namely flexural, delamination and block shear tests. Prior to glulam manufacturing, the flexural properties of solid timber beam in structural size and the effect of two different finger lengths on flexural properties of finger jointed beams were determined. The wetting properties of PRF on timber species studied were also tested. Results obtained showed that the order of flexural strength for solid timber beam in structural size is Resak, Kapur, Bintangor, Merpauh, White Meranti, Sesendok and Jelutong. The flexural strength of finger-jointed lamellas with 25 mm finger length was higher than flexural strength of finger-jointed lamellas with 15 mm finger length. All the timber species show contact angle below 90 degrees indicating PRF has good wettability with the timber species studied. Single species glulam manufactured from White Meranti and Resak obtained the highest and lowest MOR value, respectively while Resak and Sesendok obtained the highest and lowest MOE value, respectively. The order of flexural strength for single species glulam is White Meranti, Jelutong, Kapur, Sesendok, Bintangor, Merpauh and Resak. Glulam manufactured from the combination of Sesendok-Merpauh (SMR) obtained higher MOR and MOE values compared to other mixed species glulam and also compared to its single species glulam. Except for Resak and Kapur, all the single species glulam fulfilled the MS758 delamination requirement and all the single species glulam fulfilled the MS758 shear requirement. All the mixed species glulam fulfilled both delamination and shear requirement. The results obtained provide positive indication for using low-grade timber in glulam beams.

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Title : PROPERTIES OF SINGLE AND MIXED SPECIES GLULAM FROM SELECTED LOW-GRADE MALAYSIAN TIMBERS
Supervisor : PROF. DR. ZAKIAH AHMAD (MS)
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Special attention has been given to the second species of oil palm, Elaeis oleifera as it possesses several interesting agronomic traits such as slow growth, higher oil saturation and disease resistance. Studying the variability of E. oleifera germplasm is therefore very important as it serves as a tool to select source of genetic diversity for the oil palm conservation programme. The objectives of this study were 1) to identify the polymorphic E. oleifera gSSRs for E. oleifera, 2) to measure the information content of E. oleifera gSSRs, 3) to unravel the genetic diversity of E. oleifera germplasm, 4) to determine the genetic differentiation of E. oleifera germplasm and 5) to assess the genetic differentiation (FST=0.223). The Nei genetic distance showed the highest variation, which roughly ordinated the E. oleifera individuals into three major groups. Construction of neighbour-joining (NJ) tree separated E. oleifera individuals into two clusters. Model based clustering revealed that E. oleifera population has the highest AK when K was set to 7. The present study provides a diverse pattern of genetic diversity and the existence of genetic differentiation among E. oleifera germplasm. This study highlights the potential contribution of genetic variation of the E. oleifera collection analyzed using E. oleifera gSSRs for germplasm conservation and for utilization in breeding programs. Further conservation should focus on more populations with less number of palms per population development of core collection.

Name : WAN NURHAYATI WAN HANAFI
Title : EVALUATION OF THE SIMPLE SEQUENCE REPEAT (SSR) GENOTYPING OF Elaeis oleifera GERMPLASM
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DR. MAIZURA ITHNIN (CS)