

Physico-Mechanical Properties of Wood-Plastic Composites Produced from Polyethylene Terephthalate Plastic Bottle Wastes and Sawdust of Three Tropical Hardwood Species

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Abstract : This study was carried out to evaluate the influence of wood species and wood plastic ratio on the physical and mechanical properties of wood plastic composites (WPCs) produced from polyethylene terephthalate (PET) plastic bottle wastes and sawdust from three hardwood species, namely, *Terminalia superba*, *Gmelina arborea*, and *Ceiba pentandra*. The experimental WPCs were prepared from sawdust particle size classes of ≤ 0.5 , 0.5 - 1.0, and 1.0 - 2.0 mm at wood/plastic ratios of 40:60, 50:50 and 60:40 (percentage by weight). The WPCs for each study variable combination were prepared in 3 replicates and laid out in a randomized complete block design (RCBD). The physical properties investigated were water absorption (WA), linear expansion (LE) and thickness swelling (TS) while the mechanical properties evaluated were Modulus of Elasticity (MOE) and Modulus of Rupture (MOR). The mean values for WA, LE and TS ranged from 1.07 to 34.04, 0.11 to 1.76 and 0.11 to 4.05 %, respectively. The mean values of the three physical properties increased with decrease in wood plastic ratio. Wood plastic ratio of 40:60 at each particle size class generally resulted in the lowest values while wood plastic ratio of 60:40 had the highest values for each of the three species. For each of the physical properties, *T. superba* had the least mean values followed by *G. arborea*, while the highest values were observed *C. pentandra*. The mean values for MOE and MOR ranged from 458.17 to 1875.67 and 2.64 to 18.39 N/mm², respectively. The mean values of the two mechanical properties decreased with increase in wood plastic ratio. Wood plastic ratio of 40:60 at each wood particle size class generally had the highest values while wood plastic ratio of 60:40 had the least values for each of the three species. For each of the mechanical properties, *C. pentandra* had the highest mean values followed by *G. arborea*, while the least values were observed *T. superba*. There were improvements in both the physical and mechanical properties due to decrease in sawdust particle size class with the particle size class of ≤ 0.5 mm giving the best result. The results of the Analysis of variance revealed significant ($P < 0.05$) effects of the three study variables - wood species, sawdust particle size class and wood/plastic ratio on all the physical and mechanical properties of the WPCs. It can be concluded from the results of this study that wood plastic composites from sawdust particle size ≤ 0.5 and PET plastic bottle wastes with acceptable physical and mechanical properties are better produced using 40:60 wood/plastic ratio, and that at this ratio, all the three species are suitable for the production of wood plastic composites.

Keywords : polyethylene terephthalate plastic bottle wastes, wood plastic composite, physical properties, mechanical properties

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