

Evaluation of Invasive Tree Species for Production of Phosphate Bonded Composites

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Abstract : Invasive alien tree species are currently being cleared in South Africa as a result of the forest and water imbalances. These species grow wildly constituting about 40% of total forest area. They compete with the ecosystem for natural resources and are considered as ecosystem engineers by rapidly changing disturbance regimes. As such, they are harvested for commercial uses but much of it is wasted because of their form and structure. The waste is being sold to local communities as fuel wood. These species can be considered as potential feedstock for the production of phosphate bonded composites. The presence of bark in wood-based composites leads to undesirable properties, and debarking as an option can be cost implicative. This study investigates the potentials of these invasive species processed without debarking on some fundamental properties of wood-based panels. Some invasive alien tree species were collected from EC Biomass, Port Elizabeth, South Africa. They include *Acacia mearnsii* (Black wattle), *A. longifolia* (Long-leaved wattle), *A. cyclops* (Red-eyed wattle), *A. saligna* (Golden-wreath wattle) and *Eucalyptus globulus* (Blue gum). The logs were chipped as received. The chips were hammer-milled and screened through a 1 mm sieve. The wood particles were conditioned and the quantity of bark in the wood was determined. The binding matrix was prepared using a reactive magnesia, phosphoric acid and class S fly ash. The materials were mixed and poured into a metallic mould. The composite within the mould was compressed at room temperature at a pressure of 200 KPa. After initial setting which took about 5 minutes, the composite board was demoulded and air-cured for 72 h. The cured product was thereafter conditioned at 20°C and 70% relative humidity for 48 h. Test of physical and strength properties were conducted on the composite boards. The effect of binder formulation and fly ash content on the properties of the boards was studied using fitted response surface technology, according to a central composite experimental design (CCD) at a fixed wood loading of 75% (w/w) of total inorganic contents. The results showed that phosphate/magnesia ratio of 3:1 and fly ash content of 10% was required to obtain a product of good properties and sufficient strength for intended applications. The proposed products can be used for ceilings, partitioning and insulating wall panels.

Keywords : invasive alien tree species, phosphate bonded composites, physical properties, strength

Conference Title : ICCM 2016 : International Conference on Composite Materials

Conference Location : Amsterdam, Netherlands

Conference Dates : August 04-05, 2016