Effect of Oil Bean Stalk Filler on the Thermo-Mechanical Properties of Developed Aluminium Dross Composites for Building Ceilings

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Abstract

Standard quality building material is the demand of this present age. It is a good attempt to draw some ideas about the use of composites in modern building materials. This study experimentally investigates the effect of varying oil beanstalk (OBS) filler and Portland cement (Cmt) additives on thermo-mechanical properties of aluminium dross (Aldr)-Portland cement oil bean-reinforced composites. The specific heat capacity, thermal conductivity, thermal resistivity, thermal diffusivity, thermal effusivity, and compressive strength were determined at a different variation of filler content to investigate its effects on the developed composites' behaviour building ceilings application. Result shows that the physical and mechanical properties of triad $_{0.6}Aldr_{0.3}Cmt_{0.05}G_{0.05}OBS$, $_{0.6}Aldr_{0.32}Cmt_{0.05}G_{0.03}OBS$ composites are better than $_{0.6}Aldr_{0.34}Cmt_{0.05}G_{0.01}OBS$ composites. Developed samples with Portland cement binders were observed not supporting combustion in the combustion calorimeter, confirming their flame-retardant characteristics. Thermal analysis indicates that reduced additive results in poor thermal performance despite an increment in Portland cement content. The least thermal conductivity value (0.0195 W/m^2K) was obtained for sample 2 produced with 60% aluminium dross, 32% Portland cement and 3% oil bean stalk. The developed ceiling materials specific heat capacities increased by 10.33–386.83% compared to asbestos. Compared to Polyvynylchloride (PVC) ceiling material gave a 40.81% reduction in sample 2. The calorific value of oil bean stalk obtained using the combustion calorimeter is 17.80 MJ/kg, lower compared to pulverized coconut shells. It is observed that the best performance of the composite is achieved at moderate Portland cement and filler ratios. A new method of curbing fire spread and providing thermal comfort is essential in this new age of building composite, sustainable cities, and communities; this will come to the fore when inbred exceptional thermal, combustion, and mechanical properties are found in developed building ceilings. The percentage variation of filler on the matrix material necessitates improvement in their behaviour in performance.