

The Use of Palm Kernel Shell and Ash for Concrete Production

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Abstract : This work reports the potential of using Palm Kernel (PK) ash and shell as a partial substitute for Portland Cement (PC) and coarse aggregate in the development of mortar and concrete. PK ash and shell are agro-waste materials from palm oil mills, the disposal of PK ash and shell is an environmental problem of concern. The PK ash has pozzolanic properties that enables it as a partial replacement for cement and also plays an important role in the strength and durability of concrete, its use in concrete will alleviate the increasing challenges of scarcity and high cost of cement. In order to investigate the PC replacement potential of PK ash, three types of PK ash were produced at varying temperature (350-750 degrees) and they were used to replace up to 50% PC. The PK shell was used to replace up to 100% coarse aggregate in order to study its aggregate replacement potential. The testing programme included material characterisation, the determination of compressive strength, tensile splitting strength and chemical durability in aggressive sulfate-bearing exposure conditions. The 90 day compressive results showed a significant strength gain (up to 26.2 N/mm²). The Portland cement and conventional coarse aggregate has significantly higher influence in the strength gain compared to the equivalent PK ash and PK shell. The chemical durability results demonstrated that after a prolonged period of exposure, significant strength losses in all the concretes were observed. This phenomenon is explained, due to lower change in concrete morphology and inhibition of reaction species and the final disruption of the aggregate cement paste matrix.

Keywords : sustainability, concrete, mortar, palm kernel shell, compressive strength, consistency

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