Development of Fine Aggregate Using Coal Fly Ash with Internal Curing Characteristics

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Abstract

Fly ash is produced as a byproduct from Lakvijaya coal power plant, Norochcholai, Sri Lanka. The daily production of fly ash at Lakvijaya power plant is 950 – 1000 tons. Some part (around 40%) of fly ash is consumed by cement manufacturers, the balance of fly ash is stored without any means of disposal inside the plant. This research study discusses the development of fine aggregate replacement material using sintered coal fly ash with internal curing characteristics. A series of samples were prepared with different composition of fly ash and reservoir sediment material and sintered from 800^{0}C to 1300^{0}C temperatures in the interval of 100^{0}C for 30 minutes of sintering time then crushed to prepare fine aggregates. Here reservoir sediment material was used as a binder material and it improved green strength of solidified fly ash. TGA – DSC and XRF analysis was used to investigate the thermal and chemical properties of raw materials, respectively. The microstructure of produced fly ash aggregate was observed using SEM photographs. Water absorption, water desorption and relative density of fine aggregate were measured. Water absorption and relative density aggregates were the range of 21 – 40%, 1.2 – 1.55, respectively. The aggregate with 80% of fly ash and 20% of reservoir sediment material which heated at 1100^{0}C had 21.4% water absorption and 74.12% water desorption was selected as suitable replacement material instead of natural river sand. concrete was prepared using wetted fly ash aggregate by replacing 23.5% of natural river sand and external curing has not been done for that concrete. Concrete with wetted fly ash aggregate achieved lower strength at an early stage then after 28 days, it achieved more strength than conventional concrete. Fly ash aggregate supplied internally stored water for hydration reaction of cement after finish the free water present inside the concrete and gave internal curing behavior to the concrete therefore concrete with fly ash aggregate gained more strength than conventional concrete without external curing.

Keywords: *Coal fly ash, Reservoir sediment material, Sintering, Fine aggregate, Water desorption, Water desorption, Internal curing concrete*

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