

USE OF NANO FLY ASH FOR ENHANCING PROPERTIES OF CONCRETE

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This study is focused on the use of fly ash as a cement additive and the value addition attained by the particle size reduction of fly ash to the nano level. Fly ash is a residual material generated from coal power plants. Due to siliceous and aluminous compounds of fly ash, it shows pozzolanic properties which can contribute to a hydrated calcium silicate structure in cement mortar.

Fly ash was collected from the Lakvijaya coal power plant. Scanning electron microscopy and an XRF analyses were carried out on the raw fly ash. Gravimetric determination showed that this fly ash contained 79% silica, and atomic absorption spectroscopy showed the presence of other heavy metals. Fly ash was ground for durations of 12, 24, 36, and 48 hours to obtain different particle sizes. Particle size of ground fly ash was measured by using dual light scattering techniques. Specific surface area of fly ash at each stage was measured by Blaine's air permeability method and their crystal size was investigated through X-ray diffraction. XRD analysis proved that it contained minerals which are favourable for cement hydration reactions. Cement in mortar was replaced by fly ash at each stage of grinding by 0%, 10%, 20%, 30%, and 40%. Mortar trials were carried out using the above combinations of cement mixes. The flow property of the fresh mortar was investigated, and the flexural strength and compressive strength of them were determined.

It was found that grinding fly ash alone was not a good method to obtain fly ash nano particles since agglomeration may take place and the nano particle behaviour afterwards will not differ from large particles. It was not observed any significant improvements of mechanical properties of cement mortar with addition of fly ash with particle sizes in the range of 225.5 nm to 2831.8 nm. However, the achieved optimum cement replacement with fly ash was 10%. An increase of early strength of mortar can be obtained with reducing the particle size of fly ash to 225.5 nm. Increasing cement replacement with fly ash causes a reduction in flexural and compressive strength of the cement mortar. Furthermore, fly ash improves the flow properties of mortar. We recommend further studies on the same trials with a plasticizing agent to disperse fly ash particles evenly in mortar to obtain further improvements in mechanical properties.

