Estimating Efficiency Factor and Durability for Some Supplementary Cementing Materials (SCMs)

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Abstract

Pozzolanic materials have been widely used as substitutes for Portland cement in many applications. This is because of their advantageous properties which include several improvements possible in the concrete composites and due to the overall economy. The effects of a pozzolan on the properties of concrete depend on the type of the pozzolan and the percentage replacement of cement in concrete mixes. The main purpose of this project is to use locally disposed industrial waste materials like (by-product materials) and local natural clays as a supplementary cementing materials (SCMs) in concrete. The materials studied include Cement Kiln Dust (CKD), Sarooj clay (SA) and Copper Slag (CS), to evaluate the cementitious efficiency of these materials in concrete at different replacement percentages. The efficiency factor k can be used for comparing the relative performance of different supplementary materials when added into concrete. The experimental program was designed to vary the supplementary materials substitution from 0 to 40% with a constant water cement ratio of about 0.53. However, control mix (ie. Zero supplementary materials) was used with wc ratio between OA - 0.8. The study included tests on the compressive strength development of the SCMs in concrete, expansion due to alkali-silica reaction (ASR bars), Initial surface absorption. It was concluded that the CKD replacement has the highest compressive strength among all SCMs used in this research, and SA replacement has the best ability to reduce the flow rate absorption in concrete amongst the three materials while CS reduces the expansion in ASR test. It was also found that CKD replacements gave the highest efficiency factor k while CS gave the lowest value.