

Evaluation of Heat of Hydration and Strength Development in Natural Pozzolan-Incorporated Cement from the Gulf Region

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Abstract : Globally, the use of pozzolan in blended cement is gaining great interest due to the desirable effect of pozzolan from the environmental and energy conservation standpoint and the technical benefits they provide to the performance of cement. The deterioration of concrete structures in the marine environment and extreme climates demand the use of pozzolana cement in concrete construction in the Gulf region. Also, natural sources of cement clinker materials are limited in the Gulf region, and cement industry imports the raw materials for the production of Portland cement, resulting in an increase in the greenhouse gas effect due to the CO₂ emissions generated from transportation. Even though the Gulf region has vast deposits of natural pozzolana, it is not explored properly for the production of high performance concrete. Hence, an optimum use of regionally available natural pozzolana for the production of blended cement can result in sustainable construction. This paper investigates the effect of incorporating natural pozzolan sourced from the Gulf region on the performance of blended cement in terms of heat evolution and strength development. For this purpose, a locally produced Ordinary Portland Cement (OPC) and pozzolan-incorporated blended cements containing different amounts of natural pozzolan (volcanic ash) were prepared on laboratory scale. The strength development and heat evolution were measured and quantified. Promising results of strength development were obtained for blends with the percentages of Volcanic Ash (VA) replacement varying from 10 to 30%. Results showed that the heat of hydration decreased with increase in percentage of replacement of OPC with VA, indicating increased retardation in hydration due to the addition of VA. This property could be used in mass concreting in which a reduction in heat of hydration is required to reduce cracking in concrete, especially in hot weather concreting.

Keywords : blended cement, hot weather, hydration, volcanic ash

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