

The Effect of Rice Husk Ash on the Mechanical and Durability Properties of Concrete

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Abstract : Portland cement is one of the most widely used construction materials in the world today; however, manufacture of ordinary Portland cement (OPC) emission significant amount of CO₂ resulting environmental impact. On the other hand, rice husk ash (RHA), which is produce as by product material is generally considered to be an environmental issue as a waste material. This material (RHA) consists of non-crystalline silicon dioxide with high specific surface area and high pozzolanic reactivity. These RHA properties can demonstrate a significant influence in improving the mechanical and durability properties of mortar and concrete. Furthermore, rice husk ash can provide a cost effective and give concrete more sustainability. In this paper, chemical composition, reactive silica and fineness effect was assessed by examining five different types of RHA. Mortars and concrete specimens were molded with 5% to 50% of ash, replacing the Portland cement, and measured their compressive and tensile strength behavior. Beyond it, another two parameters had been considered: the durability of concrete blended RHA, and effect of temperature on the transformed of amorphous structure to crystalline form. To obtain the rice husk ash properties, these different types were subjected to X-Ray fluorescence to determine the chemical composition, while pozzolanic activity obtained by using X-Ray diffraction test. On the other hand, finesses and specific surface area were obtained by used Malvern Mastersizer 2000 test. The measured parameters properties of fresh mortar and concrete obtained by used flow table and slump test. While, for hardened mortar and concrete the compressive and tensile strength determined pulse the chloride ions penetration for concrete using NT Build 492 (Nord Test) - non-steady state migration test (RMT Test). The obtained test results indicated that RHA can be used as a cement replacement material in concrete with considerable proportion up to 50% percentages without compromising concrete strength. The use of RHA in the concrete as blending materials improved the different characteristics of the concrete product. The paper concludes that to exhibits a good compressive strength of OPC mortar or concrete with increase RHA replacement ratio rice husk ash should be consist of high silica content with high pozzolanic activity. Furthermore, with high amount of carbon content (12%) could be improve the strength of concrete when the silica structure is totally amorphous. As well RHA with high amount of crystalline form (25%) can be used as cement replacement when the silica content over 90%. The workability and strength of concrete increased by used of superplasticizer and it depends on the silica structure and carbon content. This study therefore is an investigation of the effect of partially replacing Ordinary Portland cement (OPC) with Rice hush Ash (RHA) on the mechanical properties and durability of concrete. This paper gives satisfactory results to use RHA in sustainable construction in order to reduce the carbon footprint associated with cement industry.

Keywords : OPC, ordinary Portland cement, RHA rice husk ash, W/B water to binder ratio, CO₂, carbon dioxide

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