

Utilization of Calcium Carbide Residue-Fly Ash Mixture as a Cementing Material in Concrete

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Abstract

This paper presents the use of ground calcium carbide residue (CR) and fly ash (OF) mixture as a cementing material in concrete. Calcium carbide residue is a by-product from acetylene gas production process, while fly ash is a by-product from thermal power plant. The calcium carbide residue was ground by ball mill to increase its fineness (CR) and was mixed with fly ash (OF) at a ratio of 30:70 (CR:OF) by weight to use as a binder without Portland cement. Effects of water to binder (W/B) ratios on setting times, compressive strength, modulus of elasticity, and splitting tensile strength of CR-OF concrete were investigated. The results revealed that the initial and final setting times of CR-OF concretes were much longer than the normal concrete. The highest compressive strength, 19.0 and 24.7 MPa, respectively at 28 and 90 days, of CR-OF concrete was occurred in 0.45OF specimen. This compressive strength could be achieved without Portland cement. In addition, the lower was the W/B ratio, the higher was the compressive strength of CR-OF concrete. Moreover, hardened concrete from CR-OF mixtures had the same properties as that of the normal concrete.

Keywords: Calcium Carbide Residue; Fly Ash; Setting Times; Compressive Strength; Elastic Modulus; Splitting Tensile Strength.

1. Introduction

Generally, Portland cement is used as a major cementitious material to produce concrete. Since the construction industry in every country is growing, the large amount of concrete has been produced to make various structural members. In 2005, it is estimated that the world cement demand is 2.2 billion tones and the expected demand for 2010 is estimated at 2.8 billion tones [1]. It is well-known that the production process of the cement industry causes the environmental severe effect, especially releasing of CO₂ gas to the atmosphere. Therefore, in order to eliminate the CO₂ emission, this research focuses on the use of new cementing material obtained from a mixture of calcium carbide residue and fly ash to cast concrete. This new binder does not contain any Portland cement.

Calcium carbide residue is a by-product generated by acetylene gas production process. This gas is used in welding industries and ripening fruit. The products from the reaction between calcium