



PROPERTIES OF OPTIMIZED CEMENTITIOUS COMPOSITES INCORPORATE PRECIPITATED CaCO_3 PARTICLES

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ABSTRACT

Calcium carbonate and its derivatives are used broadly in the cement and construction industry. It hereby provides a reasonable and active solution for reducing the earth's carbon footprint. In the current work precipitated CaCO_3 (PCC) particles are prepared by precipitation technique, characterized, and added to cement at different concentrations (0.076-0.92) wt. % of cement, and w/c ratio: 0.36-0.50. The fresh cement composites were tested for setting time and temperature rise during the early hydration stage, and the hardened composites for compressive strength, density, and water absorption. The results obtained showed that at a constant w/c ratio increasing the content of the PCC up to 0.25 leads to an increase in the initial setting time, density, and compressive strength. However, more PCC content has negative effects on the properties. Increasing the w/c ratio increased the setting time and water absorption of the composites. Low concentrations of PCC lead to a decrease in the tendency of water absorption, while high concentrations showed diverse effects. At a constant w/c ratio, samples with PCC content (0.92 and 0.076 wt. %) showed temperature rising at about 25 and 75 minutes respectively after batching, while the control samples showed the temperature rising at about 105 minutes. The observations confirmed that the hydration reaction of both the control and cement composite samples incorporated with PCC are exothermic, and the PCC particles have a positive impact on the hydration rate. Overall, the incorporation of PCC in cement at appropriate concentration and w/c ratio contributes to obtaining strong and durable cement composite for structural applications.



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1. INTRODUCTION

Compared to stone and steel, concrete is considered a newer construction material. It has been worldwide used for more than one century. Nevertheless, a broad range

of cementing materials including Pozzolans (Robalo et al., 2021) and nanomaterials have been used to improve concrete mechanical properties and durability characteristics (Kamal et al., 2021), (Goel et al., 2022). Calcium Carbonate (CaCO_3) obtained directly by

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