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Strength Development and Pozzolanic Reactivity of Silica-Based Waste Glass

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This study investigates on the feasibility of using finely ground waste glass inclusion as partial cement replacement by focusing on the evidence of pozzolanic reactivity and mechanical strength properties. Two types of glass; clear and green colored, with varying particle sizes in the range of 150-75 μ m, 63-38 μ m and <38 μ m were prepared. Cement was replaced with 10%, 20%, 30% and 40% by weight glass powder with constant water to cement ratio of 0.45. The results obtained show the evidence of pozzolanic properties and higher strength for 10% cement replacement by clear and green waste glass powder. The formation of additional C-S-H within the hydrated cement paste suggests pozzolanic reaction in the samples.

Keywords: Pozzolanic reactivity, Compressive Strength, FT-IR, Cement replacement, Waste glass.

1. Introduction

The utilization of waste material in construction industries has been increased significantly in the recent years owing to the short or long term properties of concrete without compromising concrete performance [1]. Recently waste glass has been introduced as cement replacement in concrete production [2-3]. Waste glass can be used as cement replacement if it can show either binding properties or pozzolanic properties [4-7]. A typical pozzolanic material features three characteristics: it should contain high silica, be X-ray amorphous, and have a large surface area. Glass has sufficient silica content and is amorphous in nature. The glass might satisfy the basic requirements for a pozzolan if it is small enough to pacify the alkali silica reaction and to activate the pozzolanic behavior. It was examined that if the glass size was between powders to a particle size of 300 μ m, it can act as a