



Effect of Waste Marble Powder and Fly Ash on the Rheological Characteristics of Cement Based Grout

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Abstract

This paper shows the results of an experimental study conducted to research the impact of waste marble powder (WMP) and fly ash (FA) on the fluidity (marsh cone flow time (MCFT), mini-slump diameter and plate cohesion meter (PCM)) and the rheological properties (viscosity and yield stress) of cement based grout (CBG) mixtures. The experiments were applied with the CBG mix including 1.00 water-binder (w/b) ratios and combined use of WMP (5-25%), FA (5-25%) and WMP+FA (10-30% + constant 25%). Test results illustrated that the rheological properties of the CBGs importantly have been improved by the addition of WMP, FA and WMP+FA to grout mix at w/b=1 ratio. Strongly shear thickening behaviour was got from the CBG mixtures the all WMP, FA and WMP+FA content. The increase in the percentage of WMP (5-25%) amount reduced the mini-slump flow diameter. Moreover, the increment in the percentage of FA (5-25%) amount increases the mini slum flow. According to the control sample, the increment in the percentage of WMP (10-25%) amount increased the mini-slump flow diameter for constant FA (25%) content. Also, the increase in WMP amount in the CBG mix, there is no effect on MCFT. Also, MCFT decreased with the increase of FA amount. Especially, FA increased the fluidity of CBG, when the WMP showed negative effect in increase the MCFT in WMP+FA content.

Keywords: Waste Marble Powder; Fly Ash; Grout; Rheology; Fresh Properties; Waste Materials.

1. Introduction

Cement Based Grout (CBG) is a widely used method for many applications in the geotechnical area [1]. Some examples of CBG applications are suspension grouting, emulsion grouting, solution grouting, compaction grouting, permeation grouting, displacement grouting and replacement grouting [2-5]. The rheological and permeability properties of the CBG are straightly involved with the penetrability and pumpability in cracks and soil voids.

CBG is mixed of water, cement and admixture. For CBG mix design, different range of water-cement (w/c) ratio can be utilized. For the applications of permeation grout, w/c ratio of CBG range between 0.5 and 1 [6]. The w/c rate of injectable grout ranges from 1 to 2. Also, the grout should be similar to the liquid that can be injected into the rock and soil [4]. CBG mixes have usually water-cement ratios of 1.00 by volume.

Mineral and chemical admixtures are used to develop the properties of CBG like durability, permeability, rheological and fresh properties. Adding mineral admixtures to the CBG at different amount modify the rheological and fresh properties of injections. For various types of grout applications, various additions (Cement kiln dust, silica fume, rice husk ash, metakaolin and bentonite) have been applied. [7-9].

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