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Fabrication of sustainable geopolymer mortar incorporating granite waste

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Abstract. The objective of the present paper is to valorize granite powder wastes generated from granite mining and processing industry which cause vast environmental pollutions, in production of valuable building materials using of geopolymer technology by alkaline activating. The current work focuses on the effect of incorporation of granite waste from 0 up to 15% on the characterization of the formed geopolymer and track the formed hardened materials using Fourier transform infra-red (FTIR) and X-ray diffraction technique (XRD), whereas the compressive strength and water absorption were used to estimate the optimum ratio of granite waste that can be used without a negative effect on the hardened mortar. Also, the effect of various compaction loads at 12.5 and 25 MPa on the physico-mechanical properties of the hardened mortar using low liquid to solid ratio. The results showed clear enhancement in the structure and performance of the produced geopolymer mortar up to 7.5% granite waste addition giving compressive strength values more than 46 MPa, while the compaction positively enhanced the compressive strength of the formed mortar with increasing of pressure loads with about 20-25% and decreasing the water absorption values by about 70% which can be related to better compaction of the matrix.

Keywords: granite waste; geopolymer; compact; composite

1. Introduction

Sustainability is a several definitions concept (Rao 2000), the common one declares that today's generation should not compromise the future generations' ability to meet their requires. The three leaders of sustainable development are economic and environmental protection as well as social development. It is known though that the Earth's capacity to support people is determined by natural constraints and human priorities (Egger 2006, Cohen 1995). Three-quarters of the world's energy consumed today by cities which also responsible for global pollution. Furthermore, United Nations predict that 60% of the world's population will live in cities by the year 2030 (United Nations Centre for Human Settlements 2001).

Geopolymers are amorphous three dimensional aluminosilicate materials with ceramic-like properties that are produced and hardened at ambient temperature and widely used in building sectors due to their wide sustainable applications. Up on alkaline activation using alkali hydroxide and silicate solution, polymerization takes place when reactive aluminosilicate are rapidly dissolved

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Temuujin, J., van Riessen, A. and Williams, R. (2009), "Influence of calcium compounds on the mechanical properties of fly ash geopolymer pastes", *J. Hazard. Mater*., **167**(1-3), 82-88.
United Nations Centre for Human Settlements (2001), The State of the World's Cities, United Nations. Nairobi.
Xavier, G.C., Saboya, F., Maia, P.C. and Alexandre, J. (2012), "Durability of fired clay bricks containing granite powder", *Materiales de Construccion*., **62**(306), 213-229.
Yip, C.K., Lukey, G.C. and van Deventer, J.S.J. (2005), "The coexistence of geopolymeric gel and calcium silicate hydrate at the early stage of alkaline activation", *Cement Concrete Res*., **35**,1688-1697.

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