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SELF-COMPACTING GEOPOLYMER CONCRETE WITH SPEND GARNET AS SAND REPLACEMENT

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Abstract: Garnets being the waste spin-off of surface treatment operations remain a major environmental concern worldwide. Robust engineering properties of these waste garnets offer the opportunity to get efficient construction materials via their appropriate recycling. In this spirit, we evaluate the capacity of spent garnets as sand replacement for achieving self-compacting geopolymer concrete (SCGPC). Such SCGPC specimens are prepared using ground granulated blast furnace slag (GGBFS) wherein the river sand is replaced by spent garnet at varying contents (0 to 100%) under constant Liquid/Binder (L/B) mass ratio of 0.4. Performance evaluations of the developed SCGPC samples are made using several tests including durability, workability, flexural, compressive, splitting tensile strength conforming the EFNARC standard. Test results revealed an enhancement in the workability of the proposed SCGPC specimen with the increase of spent garnet contents. Furthermore, other strengths are discerned to be lower compared to the control sample at all stages of replacement. It is established that the spent garnet is prospective candidate for sand replacement up to 25% in terms of environmental amiability, cost effectiveness and conservation of natural resources.

Key words: spent garnet, garnet, geopolymer concrete, self-compacting concrete, sand

1.0 Introduction

Lately, intensive researches have proven that modified concretes obtained via waste materials incorporation can lead to sustainable product development. Such concrete structures not only allow greener environmental growth in the construction sector but also protect the excessive consumption of natural fine aggregates that depletes the innate resources (Temuujin ,2010). Rapid industrial growth has witnessed the ever-increasing utilization of river sand for building purposes where river beds are worn-out. Several problems are emerged including the increase of river bed depth, lowering of the water table, increasing salinity and destruction of river embankments (Gourley ,2003). Thus, exploration of alternative materials as a fine aggregate in concrete to replace the river sand became an absolute necessity. In this regard, garnets are emerged as a promising candidate to fulfil such requirements.