Experimental Analysis on The Sustainable Effects of Magnetic Water in Self Compacting Concrete With Partial Replacement of Constituent Materials

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Abstract

In this experimental analysis, conventional Self Compacting Concrete (SCC) of M30 grade was compared to SCC mix prepared with Magnetic Water of 0.8 Tesla in its fresh and hardened states. The Magnetic Water improved workability of concrete by 9.95% and compressive & tensile strength by 12.61% & 12.91%. It also reduced the dosage of viscosity modifying reagent by 13.04% for the same water-cement ratio, improving the efficiency of concrete and there by reducing the cost of concrete. The efficiency of Magnetic Water is further improved with the use of sustainable replacement materials. Copper slag improved compressive & tensile strength by 19.4% & 19.63% at 30% replacement of sand; while Glass powder improved strength by 14.16% & 14.47% at 20% replacement. Copper slag was more effective than glass powder in terms of strength and economy. Fly ash as a cement replacement improved compressive & tensile strength by 17.02% & 17.31% at 30% replacement.

It is evident that improved technique with Magnetic Water coupled with sustainable materials resulted in a more sustainable, efficient and cost-effective concrete production with better workability and strength, resulting in less energy, material waste and lower carbon emissions, giving better long-term performance and fewer repairs.

Keywords: Self Compacting Concrete (SCC); Magnetic Water; Sustainable Concrete; Partial-Replacement; Super Plasticizer; Copper Slag; Glass Powder; Flyash.

1 Introduction

Self-compacting concrete[1] (SCC) is the concrete that flows through the reinforcements and compacts under its own weight without any external compacting forces. A well graded SCC is highly flowable in nature which aids to its filling ability, passing ability and resistance to segregation. In recent years a variety of materials have been used to partially replace the constituent materials of SCC and have been tested so as to make the mix more sustainable - both in monetary and environmental aspects. In this experimental analysis we intend to test the SCC mix made with Magnetic Water[2] in which cement is partially replaced with Flyash[3] at 10, 20, 30, 40 & 50% while sand is replaced with Copper Slag[4] at 10, 20, 30, 40 & 50% and Glass Powder[5] at 5, 10, 15, 20 & 25%.

1.1 Magnetic Water

Magnetic water is the water which is passed through a magnetic field. The term Magnetic water does not mean that the water has gained magnetic properties. It merely means that the

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