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Optimization of Waste Glass Powder Content to Improve the Mechanical Properties of Concrete Mixers

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Abstract

Concrete is the largest used building material in the world. Use of waste and by product material as partial substitute material in concrete is now trending in the world construction industry in order to produce sustainable concrete and reduce the environmental impact due to over consumption of resources. This study focus to replace the Portland cement by waste glass powder in the concrete mixture. Mechanical properties such as the compressive and tensile strengths were calculated with the laboratory experiment. A 0%, 5%, 10% and 15% volumetric replacement of cement by glass powder is considered and strength was calculated in 7, 21, and 28 days of curing. The results showed the addition of different mixes of glass powder into concrete is an effective solution for the depletion of raw materials and eco-friendly materials. Furthermore, this is the solution for the waste disposal of glass packaging material. Even though correct proportions should be maintained throughout the usage to obtain the desired strength in tensile, and compressive strength. The workability of the concrete is measured with the slump test of the concrete mixes. Slump test results showed that the slump increased when the glass powder percentage increased in concrete. The maximum slump value was 121mm in the addition of 15% of glass powder. Compressive strength increased from 7 days to 28 days of curing. Compressive strength is maximum at the 10% of waste glass powder which is 28.5Nmm^{-2}. Split tensile strength increased along the curing and the maximum tensile stress was obtained when the waste glass powder is 10% such that is 14.1Nmm^{-2}. The study concludes the better mechanical properties can be obtained in concrete with the presence of waste glass powder rather than conventional concrete.

Keywords: *Waste glass powder, concrete compressive strength, split tensile strength*