World Academy of Science, Engineering and Technology
International Journal of Civil and Environmental Engineering
Vol:12, No:02, 2018

Using Recycled Wastes (Glass Powder) as Partially Replacement for Cement

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Abstract : Lately, with the environmental changes, enthusiasts trigger to stop the contamination of environment. Thus, various efforts were exerted for innovating environmental friendly concrete to sustain as a 'Green Building' material. Green building materials consider the cement industry as one of the most sources of air pollutant with high rate of carbon dioxide (CO_2) emissions. Several methods were developed to extensively reduce the influence of cement industry on environment. These methods such as using supplementary cementitious material or improving the cement manufacturing process are still under investigation. However, with the presence of recycled wastes from construction and finishing materials, the use of supplementary cementitious materials seems to provide an economic solution. Furthermore, it improves the mechanical properties of cement paste, in addition to; it modulates the workability and durability of concrete. In this paper, the glass powder was considered to be used as partial replacement of cement. This study provided the mechanical influence for using the glass powder as partial replacement of cement. In addition, it examines the microstructure of cement mortar using scanning electron microscope and X-ray diffraction. The cement in concrete is replaced by waste glass powder in steps of 5%, 10%, 15%, 20% and 25% by weight of cement and its effects on compressive and flexure strength were determined after 7 and 28 days. It was found that the 5% glass powder replacement increased the 7 days compressive strength by 20.5%, however, there was no increase in compressive strength after 28 days; which means that the glass powder did not react in the cement mortar due to its amorphous nature on the long run, and it can act as fine aggregate better that cement replacement. As well as, the 5% and 10% glass powder replacement increased the 28 days flexural strength by 46.9%. SEM micrographs showed very dense matrix for the optimum specimen compared to control specimen as well; some glass particles were clearly observed. High counts of silica were optimized from XRD while amorphous materials such as calcium silicate cannot be directly detected.

Keywords : supplementary materials, glass powder, concrete, cementitious materials
Conference Title : ICCEMCT 2018 : International Conference on Civil Engineering Materials and Concrete Technology
Conference Location : Amsterdam, Netherlands
Conference Dates : February 12-13, 2018