

Eggshell as a partial cement replacement in concrete development

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Research on the reuse of waste materials in the concrete industry has been quite intensive in the past decade. The objective of this research is to identify the performance of oven-dried eggshell powder as a partial cement replacement in the production of concrete under both water-cured and air-cured regimes. Eggshell powder of various amounts, namely 5%, 10%, 15% and 20% by volume, was added as a replacement for ordinary Portland cement. The results showed that water-cured eggshell concrete greatly improved the compressive and flexural strength of concrete, by up to 51.1% and 57.8%, respectively. The rate of water absorption of eggshell concrete was reduced by approximately 50%, as eggshell powder filled up the existing voids, making it more impermeable. However, the compressive strength of the eggshell concrete decreases gradually when the amount of eggshell powder increased, during immersion in acid and alkali solutions, because eggshell contains a high amount of calcium, which reacts readily with acid and alkali solutions. As the eggshell content increases, the solution reacts with the paste so the bonding of the paste reduces, and therefore the strength also reduces. The reduction of compressive strength during immersion in sulphuric solution and sodium sulphate solution was 27.5% and 31.2% respectively when 20% eggshell powder was used to replace cement. It can be concluded that the optimum percentage of oven-dried eggshell powder as a partial cement replacement is 15%.