



Utilization of Palm Oil Fuel Ash and Eggshell Powder as Partial Cement Replacement - A Review

Ashfaqe Ahmed Jhatial ^{a, b*}, Wan Inn Goh ^a, Noridah Mohamad ^a, Samiullah Sohu ^{a, c},
Muhammad Tahir Lakhiair ^a

^a Jamilus Research Centre, Faculty of Civil and Environmental Engineering, Universiti Tun Hussein Onn Malaysia, Parit Raja, Batu Pahat 86400, Johor, Malaysia.

^b Department of Civil Engineering, Mehran University of Engineering and Technology, Shaheed Zulfiqar Ali Bhutto Campus, Khairpur Mir's, Sindh, Pakistan.

^c Department of Civil Engineering, Quaid-e-Awam University College of Engineering, Science and Technology, Larkano, Sindh, Pakistan.

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Abstract

The increase in population leads to increase in construction of houses and other buildings to accommodate these people. The extensive use of concrete for constructional purposes leads to release of Carbon Dioxide (CO₂) gas into the atmosphere which adds to the already increased global warming. The increase in urbanization has also lead to increased generation of waste materials. These waste materials are by-products, which are disposed in landfills causing environmental and health issues. The utilization of agricultural wastes as cement substitute is a great alternative for reducing the use and production of cement, which contributes to 5% to 7% of global CO₂ emissions alone. Palm Oil Fuel Ash (POFA) Eggshells are two major agricultural wastes, which are generated in abundance in Malaysia. This paper reviews the combined utilization of Eggshells Powder (ESP) and POFA as potential partial cement replacement material and development of bio-concrete, which may help in reducing the environmental issues that are caused by the agricultural by-products. They have been used successfully but individually in concrete. The pozzolanic activity triggered by POFA requires Calcium Hydroxide which cement provides to a limit. Eggshells when grinded into Eggshells Powder (ESP) are rich in calcium oxide and can provide the required calcium hydride and enhance the pozzolanic reaction.

Keywords: Pozzolanic Activity; Solid Waste Management; Partial Cement Replacement; Sustainable Concrete; Supplementary Cementitious Material (SCMs).

1. Introduction

Since its invention in early 1824, cement has been used in almost all the structures of the world as a major component of concrete. Cement, due to its cohesive properties is a well-known binding material. It is one of the ingredients which make concrete, others being fine aggregates, coarse aggregates and water. While each and every ingredient has its significant role in the mix, cement plays the most important role and it will remain the key material which satisfies the global housing demand [1]. When water is mixed with cement, a cement paste is created which glues together fine and coarse aggregates and hardens to become a solid component known as concrete. Though cement gives concrete its strength, its production however causes harm to the environment. The production of cement requires materials such as calcium, silica, alumina and iron which are extracted from limestones, rocks, chalks, shales and clay, thus reducing the natural resources. Furthermore, carbon dioxide (CO₂) gas is released during the manufacturing process in which the raw

* Corresponding author: ashfaqeahmed@muetkhp.edu.pk

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