Ceramic Waste Powder in Structural Concrete

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1.1 Background Of The Study

Ceramic industries produce much waste regardless of the enhancements the enterprises have been introducing in the manufacturing process. Ceramic sectors generate about 15%-30% of the residues (Correia 2004). The wastes when released into the environment, pose environmental problems (Ahmad 2015). Therefore, a suitable method of managing the ceramic waste powder is required to avoid polluting the environment. When polishing ceramic tiles, ceramic waste powders are produced and dumped in to the landfills and can cause air, soil, and water pollution hence can create a significantly severe environmental deterioration (Correia, 2004).

Many construction companies have ruled out waste from ceramic industries and deemed them unfit for sale due to their mechanical and dimensional defects. However, the results from this study demonstrated that the ceramic waste powder could be used to produce concrete by replacing the CWP with cement (Giridhar et al., 2015). Hence, ceramic waste powder is one of the most important materials used in increasing the quality of ordinary cement. The ceramic waste powders have other advantages other than environmental protection, for example, the wastes reduce the use of other raw materials, impacting the economy of natural resources positively (Gambhir, 2013).

The ceramic waste powder is one of the admixtures used to strengthen concrete, and it is mainly made of SiO_2 and Al_2O_3, making it the best material for manufacturing concrete(Gambhir, 2013). The admixture is a material other than fine aggregate, cement, coarse aggregate and water used as an ingredient of concrete and is annexed to the group instantly before and during mixing (Kamala and Rao, 2012). The ceramic waste powder is hard, durable, and highly resistant to physical, chemical, and biological degradation forces. Therefore, nowadays, construction engineers use ceramic waste powder to modify ordinary concrete to increase its durability, strength and quality performance.

The ceramic waste powder comes from two sources. First, from ceramic industries, the waste is known as non-hazardous industrial waste (NHIW). According to Kamala and Rao (2012), non-hazardous industrial wastes are all waste produced by industrial activities that are not categorized as hazardous by the European list of waste in Order MAM/304/2002 (p. 74). Another source of ceramic waste powder comes from construction and demolition activities. The waste consists of a significant percentage of demolition and construction waste (Kamala and Rao 2012).

The negative impact of ceramic waste powder on the environment made researchers investigate the use of the waste (CWP). A recent study done by Giridhar et al. (2015) found that construction

engineers can use a ceramic waste product as an ingredient in the production of concrete to replace cement (p. 15). In the study, (8, 24, 32, and 40%) of ceramic waste powder was incorporated into concrete, and the performance of ferroconcrete was improved. Therefore, this study investigated the effects and properties of an original concrete mix that has ceramic waste powder instead of cement.

1.2 Aim Of The Study

The central purpose of this research is to investigate and examine the effects and properties of the architectural concrete mix that has ceramic waste powder instead of cement. The research could achieve its aim by investigating if the ceramic waste powder could improve the quality of the concrete when mixed. Two, by studying and looking at the structure and properties of the ceramic waste powder and comparing them with that of cement. Lastly, by analyzing the structure and properties of ordinary concrete and comparing them with the concrete mix that has ceramic waste powder.

1.3 Objectives Of The Study

The specific goals of this study are:

- To examine whether it is possible to design a concrete mix using ceramic waste powder in place of cement
- To investigate the other benefits and uses of ceramic waste powder.
- To determine how to manufacture concrete mix of the highest performance and of low cost using ceramic waste powder reducing environmental pollution and reducing the use of natural resources.

1.4 Methodology

The study was done using mix design. The study used experimental, comparative and correlational type of research designs. The research designs used in the study were significant and helped the study fulfill its aims. A stratified method was used to choose the variables for the study because the study's variable is countable. Materials used in the research were cement, ceramic waste powder and concrete.

Five concrete mixes that have a different replacement for ceramic waste were designed. Furthermore, 40 specimens of numerous shapes and sizes, such as 500mm X 100mm X 100mm beam samples and 200mm X 200mm X 200mm cube samples, were constructed for flexural tests and compression. The tests were done both after 7 days and 21days. The results were observed and shown at the end of this study.

1.5 The Structure Of Dissertation

The research dissertation has five chapters, and the sections are as follows,

- The first chapter is the introduction part of the research project on the effects and structure of concrete mix that has ceramic waste powder to replace cement. Under the introduction, there is the background of the study, the primary purpose of the study, and then the objectives of the thesis, accompanied by the methodology part that outlines the methods used to conduct the research. Lastly, in chapter one is the structure of the dissertation.
- The second chapter of the thesis is the review of literature or the literature review. In the section, there is reviewing of current writing on the concrete and ceramic waste powder. Numerous materials were used to evaluate the literature. The documents include books, journals and electronic sources that touch on the subject.
- The third chapter of the paper outlines the methodology and research design used in the study. The methods and models used in the study were explained widely in this chapter.
- After chapter three, the paper goes to section four, where there is a discussion of the results of the study. All the results collected during the research were presented and analyzed in this chapter.
- The last section of the thesis is chapter five. In this part, the conclusion of the study was made, and recommendations for future works were also stated.

References

Ahmad, S., 2015.Application of Waste Ceramic Tile Aggregates in Concrete. International Journal of Innovative Research in Science, Engineering and Technology, pp.12808– 12815.

Correia, J.., 2004. Effects on concrete durability of using recycled ceramic aggregates. Waste Management.

Gambhir, M.L., 2013. Concrete Technology: Theory and Practice.

Giridhar, V., Rao, H.S. & Kumar, P.S.P., 2015.Influence of Ceramic Waste Aggregate Properties on the strength of Ceramic Waste Aggregate Concrete.IJERT, pp.15–24.

Kamala, R. &Rao, B.K., 2012.Reuse of Solid Waste from Building Demolition for the Replacement of Natural Aggregates. International Journal of Engineering and Advanced Technology, 2(1), pp.74–76.