Enhancement of Concrete Properties by Replacing Cement Partially with Ceramic Waste

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Abstract **- Waste utilization has become an attractive alternative to disposal now days. There are number of research, for use of waste in industry most of them related to use the waste in construction are or use of waste in concrete to develop new type of concrete. Use of waste producing is not only makes it economical but also a very good and attractive solution of disposal problem. Ceramic waste from ceramic industry is used to produce a new type of concrete by replacing the cement. According to a report in India 30% of the daily production goes on waste during the manufacturing, usages, and transportation. Ceramic waste increases day by day because of its usages in construction, so it is necessary for ceramic industry for diminishing the waste dump at ceramic industries is recycling, reusing and substitution of concrete ingredients. Ceramic waste produce from industry is durable, hard, and highly resistant to biological, chemical and physical degradation forces. Ceramic waste powder can be used to produce lightweight concrete, without affecting the compressive strength of concrete. This study summarizes the studies on ceramic waste as a partial replacement of cement in concrete.**

Index Terms **- Ceramic Waste, Compressive Strength, Partial Replacement of Cement.**

1.INTRODUCTION

In a rapidly growing world population and toward meeting consumers' needs, solid waste landfills will continue receiving huge volumes of waste. Therefore, waste management is becoming increasingly mandatory for the promotion of environmental sustainability. Numerous regulations have been imposed worldwide by governments and environmental organizations in order to reduce the negative environmental impact resulting from large numbers of solid waste landfills. The transformation of a large amount of solid waste into an alternative resource will preserve the reducing nonrenewable resources of materials; maintain the required energy and also will help solve environmental and exhausted landfill problems. Until today, researchers are investigating new solid waste materials and the potentials of recycling either in other industries or new products.

We all know that concrete is an important construction material made of coarse aggregate, fine aggregate and binding material, Crushed stone and river sand are natural resources limited in quantities and production of cement adds CO2 to the atmosphere. As the use of concrete increases, natural resources decrease, and addition of pollution leads other environmental related problems. The replacement of cement in concrete can cause a great impact on the economic side of the construction as well as the ecological side. Various research have been conducted on the utilization of recycled waste as replacement of cement in concrete. One such material is ceramic waste. Various properties of ceramic waste that contribute to its utilization in concrete as a partial replacement of cement have been studied by the researchers across the world. It is found that to a certain extent the use of ceramic waste has imparted compressive strength to the concrete.

2. LITERATURE REVIEW

Amit Kumar D. Raval. al. [1] have performed the research study in which (OPC) cement has been replaced by ceramic waste powder accordingly in the range of 0%, 10%, 20%, 30% 40%, & 50% by weight for M-25 grade concrete. The wastes employed came from ceramic industry which had been deemed unfit for sale due to a variety of reasons, including dimensional or mechanical defects, or defects in the

firing process. The results demonstrate that the use ceramic masonry rubble as active addition endows cement with positive characteristics as major mechanical strength and the economic advantages. Reuse of this kind of waste has advantages economic and environmental, reduction in the number of natural spaces employed as refuse dumps. Indirectly, all the above contributes to a better quality of life for citizens and to introduce the concept of sustainability in the construction sector.

Rashmi Rawat. al. [2] have performed the work whose aim was to reduce the environmental impact, reduce the cement consumption in the concrete by the replacement of ceramic material as a supplementary cementitious material. In this work first investigate the pozzolanic activity of ceramic electrical insulator waste material by three tests i.e., strength activity test, Frattini test and saturated lime test. According to these result in ceramic electrical insulator material pozzolanic activity of material has been found and it can be replaced in mortar and for that exact limit further investigation is required i.e., durability etc. After that its successful in mortar gives pozzolanic activity test result, here research work is done in concrete for the same ceramic electrical insulator material partial replacement with cement in the concrete and check its mechanical properties, workability, durability and microstructure (by FE-SEM test only). In the concrete cement has been partially replaced by 5%, 10%, 15% and 20% of ceramic waste. For utilization of these ceramic waste investigate the test performance in the concrete, here workability test (by slump cone test), mechanical properties test (compressive strength test, flexural strength test, split cylinder tensile strength), durability test (water absorption and water penetration test) and micro-structure analysis (by FE-SEM test images) has been tested in the replacement of the ceramic waste material. In concrete according to the test result of mechanical properties and durability test of ceramic insulator waste material replacement has been successful up to the limitation of 15% replacement with cement.

Ishita Soni. al. [3] have performed the research study, the aim of this dissertation work is that to reduce the environmental impact, reduce the cement consumption in the concrete by the replacement of ceramic material as a supplementary cementitious material. The study is done in concrete for the ceramic electrical insulator material partial replacement with cement in the concrete and checked its mechanical properties, workability and durability. In the concrete grade M25 cement has been partially replaced in 5%, 10%, 15% and 20% by weight of cement in ceramic waste. Utilization of these ceramic wastes the test performance has been checked by the concrete, here workability test (by slump cone test), mechanical properties test (compressive strength test, flexural strength test, split cylinder tensile strength) and durability test (water absorption and water penetration test) has been tested in the replacement of the ceramic waste material. In concrete according to the test result of mechanical properties and durability test of ceramic insulator waste material replacement has been successful up to the limitation of 15% replacement with cement.

S. Aswin. al. [4] have performed the research study in which the Ordinary Portland Cement (OPC) has been replaced by crushed ceramic tile powder of various percentage such as 10%, 20%, 30%, 40%, 50%. Concrete cubes and paver block were casted, tested and compared with conventional cubes and blocks by finding their compressive strength through experimental investigation. The test was carried out to evaluate the hardened properties of cubes and blocks for 14 and 28 days. The main objective of this study is to find the performance characteristics of cubes and paver block by using ceramic waste as a replacing material for cement. From the results it has been found that the compressive strength of cubes and paver blocks get improved by replacement of cement with ceramic tile powder while comparing to the conventional specimen.

In cubes, the replacement of 10%, 20%, 30% of ceramic tile powder enhance the strength and further replacement such as 40% and 50% decreases the strength of cubes. So, it has been found that 30% replacement of cement by ceramic tile powder is optimum. In paver blocks, the replacement of 10%, 20%, 30%, 40% of ceramic tile powder enhance the strength and further replacement such as 50% decreases the strength of paver blocks. So, it has been found that 40% replacement of cement by ceramic tile powder is optimum for casting paver blocks.

3.CONCLUSION

From the above given reviews of the research, it can be seen that ceramic waste can be utilized as a replacement for cement in concrete. It is also seen that it can be used to cast cubes and paver blocks with good mechanical properties, durability, and workability. The study shows how ceramic waste can be reused to cause positive environmental impact as well as economic impact.

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