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EXPERIMENTAL INVESTIGATION ON STRENGTH PROPERTIES OF CONCRETE BY PARTIAL REPLACEMENT OF CEMENT WITH CERAMIC WASTE POWDER

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Abstract : : In this experimental investigation stands for improving the properties of concrete with respect to strength characteristics especially in this aggressive investigation review states on replacing of cement with ceramic waste powder. Proper introduction of CWP in concrete improves the strength characteristics of the concrete. The effects of CWP on various strength properties of concrete M30 of grade concrete have been studied. The ceramic waste powder content varies from (5%, 10%,15% and 20%) by volume of cement is used in concrete. For this purpose along with a Control Mix, 5 sets were prepared to study the compressive strength, tensile strength and flexural strength. Each set comprises of 6 cubes, 3 cylinders and 3 beams. All specimens are water cured and tested at the age of 7 and 28-days. Compression Strength,Tensile Strength and Flexural Strength tests were performed in the hardened state. The strength properties of M30 grade of concrete was studied.

Index Terms **- Ceramic Waste Powder,Compressive Strength, Split tensile Strength, Flexural Strength**

I. INTRODUCTION

Concrete is the most important material used for construction. In the modern world, the use of concrete has be increasing and hence demand for special types of concrete is also in large quantity. One among those special types of concrete is High Strength Concrete (HSC). HSC is defined as a concrete meeting special combination of strength and uniformity requirements that cannot always be achieved routinely using conventional constituents and normal mixing, placing, and curing practice. The term High Strength Concrete (HSC) is suggested for concrete mixtures that possess high workability, high-strength, and high-durability. But the proportions are designed or engineered to provide the strength and durability needed for the structural and environmental requirements. The raw materials needed for the manufacture of Portland cement (PC) are available in many places, and the energy requirements for its production may be considered to be relatively modest. They are responsible for substantial “environmental unloading” because their disposal can be hazardous to be environment and higher utilization of them can result in reduction of greenhouse gas emission from cement industry. Some of them or condensed silica fume (SF), Fly ash. In this paper these two mineral admixtures are replacing cement by certain percentage.

II. LITERATURE REVIEW

In a study conducted by Prof. SHRUTHI H. G, GOWTHAM PRASAD M. E, SAMREEN TAJ**,** and SYED RUMAN PASHA, the potential of REUSING CERAMIC WASTE AS AN AGGREGATE IN CONCRETE was examined. The utilization of crushed ceramic tiles as a coarse aggregate in concrete was found to have a positive impact on the economy. Moreover, the reuse of ceramic waste in concrete production could prove to be an effective measure in preserving the environment and enhancing the properties of concrete.

B.KAVITHA and M.LENINSUNDAR**'s** research on "PARTIAL REPLACEMENT OF COARSE AGGREGATE WITH CERAMIC WASTES AND CEMENT WITH GLASS POWDER" aims to contribute to sustainable construction practices by utilizing waste materials in concrete production. The study explores the potential of glass powder and ceramic waste as partial replacements for cement and coarse aggregate, respectively.The experimental investigation includes the preparation of concrete mixes with varying percentages of ceramic waste, ranging from 0% to 35%, to assess the properties of the resulting concrete. The mix design was based on M30 grade concrete, and tests were conducted to evaluate various properties, including compressive strength, flexural strength, and split tensile strength.

In their research on "CERAMIC WASTE: EFFECTIVE REPLACEMENT OF CEMENT FOR ESTABLISHING SUSTAINABLE CONCRETE",Amit KUMAR D. RAVAL, DR. INDRAJIT N. PATEL, and Prof. JAYASH KUMAR PITRODA investigated the use of ceramic waste powder as a replacement for cement in M20 grade concrete. The study involved replacing cement with

ceramic waste powder in various proportions ranging from 0% to 50% by weight. The resulting concrete mixtures were cured and tested for compressive strength over periods of 7, 14, and 28 days to evaluate their mechanical properties. The primary aim of the investigation was to study the behaviour of concrete when ceramic waste is used to partially replace cement at different proportions. The researchers sought to determine the optimum percentage of ceramic waste that could be used to replace cement without compromising the strength and durability of the resulting concrete. By establishing sustainable and environmentally friendly solutions for concrete production, the study sought to contribute to the ongoing efforts to mitigate the negative impacts of conventional building materials on the environment. The research findings provide valuable insights into the potential use of ceramic waste as a viable alternative to traditional cement in the production of sustainable concrete.

III. EXPERIMENTAL INVESTIGATION

Experimental investigation consists of casting and testing of 5 sets along with control mix. Each set comprises of 6 cubes, 3 cylinders and 3 beams for determining compressive, tensile and flexural strengths respectively. Ceramic waste powder content varies from (05%,10%,15% and 20%) by volume of cement is used in concrete. All specimens are water cued and tested at the age of 7and 28-days. Cube section dimension is of 15cmx15cmx15cm, cylinder section dimension is 15cmx30cm and beam dimension is 50cmx10cmx10cm. The moulds are applied with a lubricant before placing the concrete. After a day of casting, the moulds are removed. The cubes, cylinders and beams are moved to the curing tank carefully.

3.1 Materials

The constituent materials used in these studies are given below:

1. Cement (Ultra-tech gold OPC 53 grade)
2. Fine aggregate
3. Coarse aggregate
4. Ceramic waste powder
5. Water

IV. RESULTS AND DISCUSSIONS

4.1 COMPRESSIVE STRENGTH

TABLE 4.1: COMPRESSIVE STRENGTH TEST RESULTS FOR VARIOUS PERCENTAGES OF CERAMIC WASTE POWDER

S.No	% Of Ceramic Waste	Compressive Strength at 7Days (N/mm^2)	Compressive Strength At 28Days (N/mm^2)
1	0	25.73	38.41
2	05	28.98	42.62
3	10	30.94	44.85
4	15	33.27	47.54
5	20	20.74	33.47

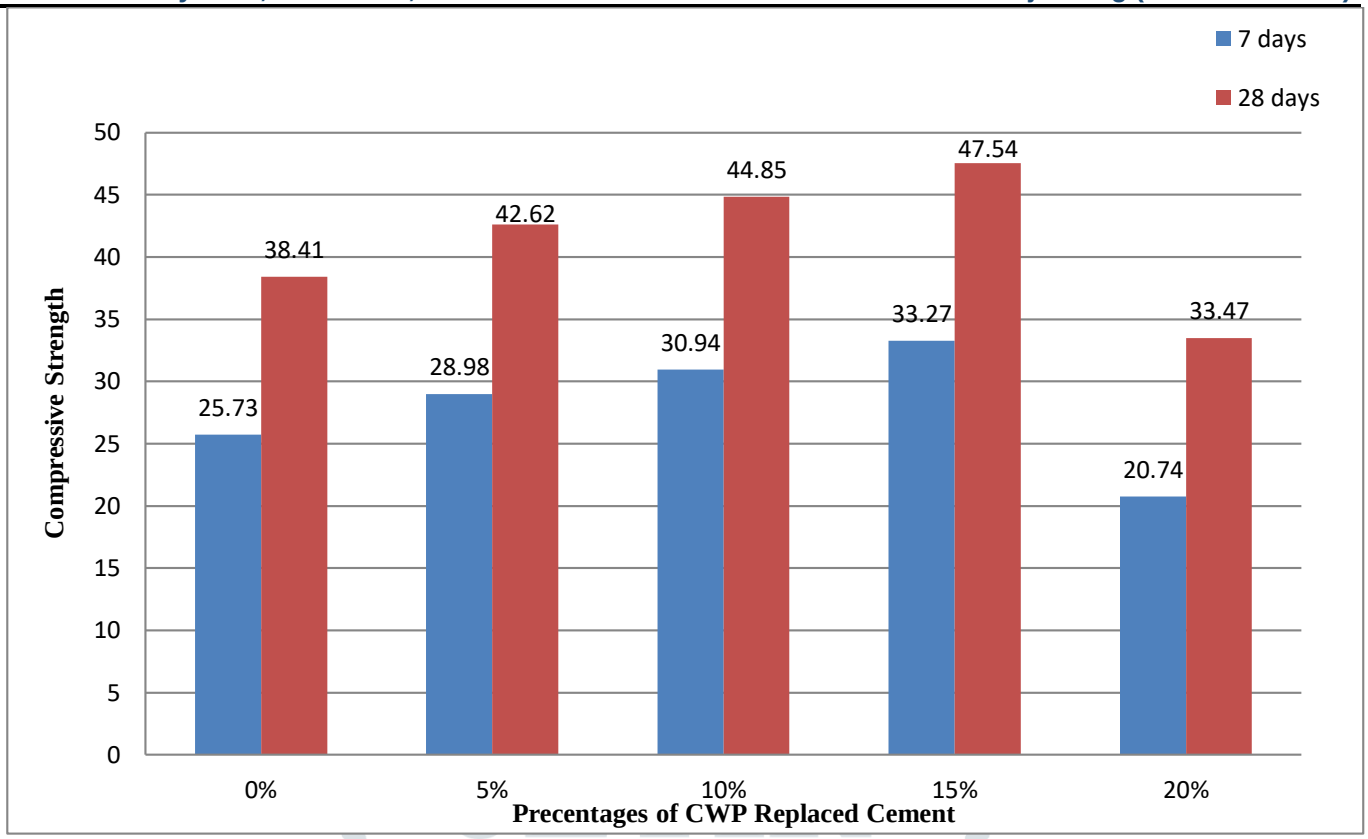

Fig4.1: Compressive Strength for various percentages of Ceramic Waste Powder

4.2 Split Tensile Strength

Table 4.2: Split Tensile Strength Test Results for for various percentages of ceramic waste powder

S. No	% Of Ceramic Waste	Split tensile StrengthAt 28 Days (N/mm^2)
1	0	2.89
2	05	3.04
3	10	3.12
4	15	3.21
5	20	2.71

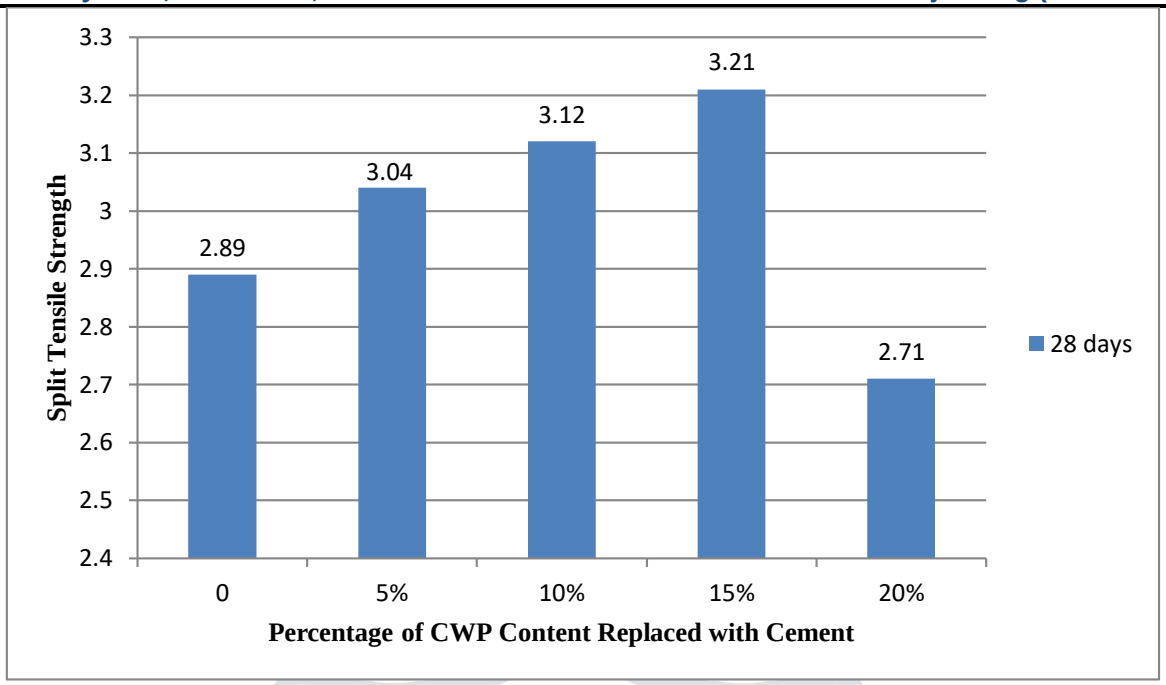

Fig4.2: Split Tensile Strength for various percentages of Fly ash and Silica fume

4.3 Flexural Strength

Table 4.3: Flexural Strength Test Results for various percentages of ceramic waste powder

S. No	% Of Ceramic Waste	Flexural Strength At 28 Days(N/mm^2)
1	0	4.33
2	05	4.56
3	10	4.68
4	15	4.82
5	20	4.04

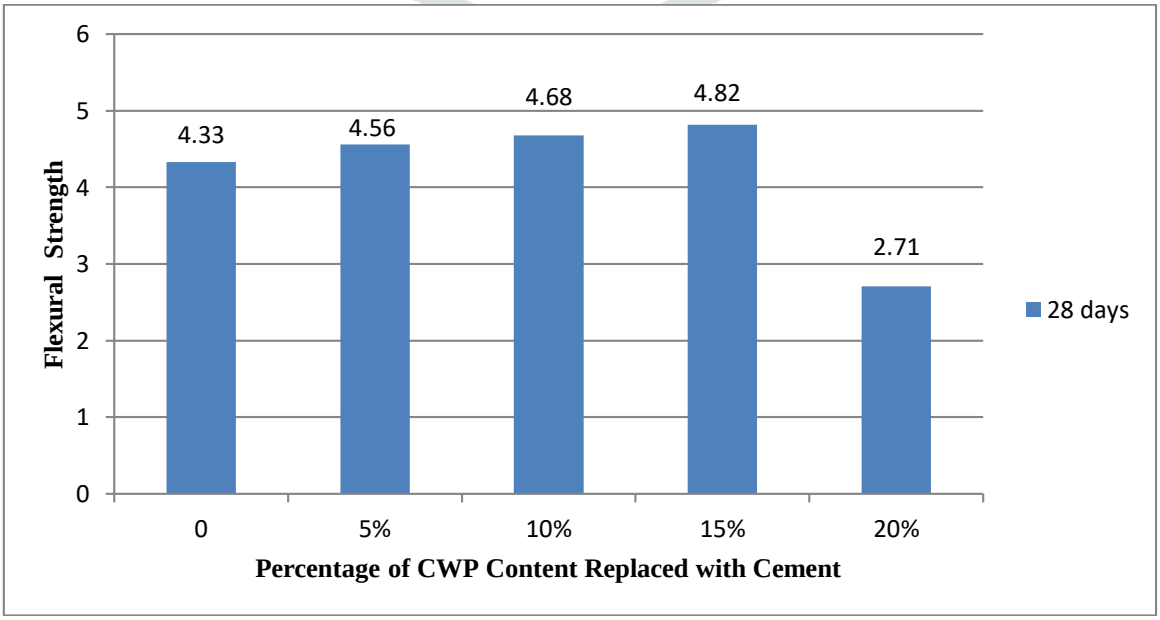

Fig4.3: Flexural Strength for various percentages of Fly ash and Silica fume

V. Conclusions

Based on the analysis of experimental results and discussion there upon the following conclusions can be drawn:

1. Replacement of 15% Ceramic Waste Powder with the cement in M30 Conventional concrete mix, there is an increase in compressive strength up to 23.76% over conventional concrete.
2. Split Tensile Strength increases by 11.07% with replacement of 15% Ceramic Waste Powder with cement in M30 Conventional concrete.
3. Flexural strength increases by 11.31% with addition of 15% Ceramic Waste Powder with cement in M30 Conventional concrete.

VI. References

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