Improvement of Strength Due To Replacement of Cement with Ceramic Waste by Using Self Compacting Concrete

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Abstract-*The main focus of this research is to study the strength of self compacting concrete with ceramic waste as Binding material(cement replacement). Ceramic waste is one of the most active research areas that encompass a number of disciplines including civil engineering and construction materials. In this study is concerned with the experimental investigation on strength of concrete and optimum percentage of the partial replacement by replacing cement via 0%, 15%, 30% of ceramic waste in M30 grade of concrete. The different mixtures of concrete were produce and testing of compressive strength test had done. As a result, the strength achieved up to 15% replacing cement with ceramic powder. Above 15% replacing of cement with ceramic waste the strength goes down as compared of 15% replacement cement with ceramic waste.*

Keywords-OPC Cement, Ceramic waste, compressive strength, flexural strength.

I. INTRODUCTION

In India ceramic production is 100 Million ton per year. In the ceramic industry, about 15%-30% waste materials generated from the total production of ceramic items. These wastes are bigger headache for the ceramic industry to dump. These industries are dumping the waste powder and slurry in any nearby pit or vacant spaces , near their own units. This leads to serious environmental and dust pollution and occupation of vast area of land, especially after the ceramic waste dries up to it's necessary to dispose the ceramic waste quickly and use in the construction industry. As the ceramic waste piling up every day, there is the pressure on the ceramic industry to find a solution for its disposal.

The Advancements of concrete technology can reduce the consumption of natural resource. In this paper , a possible usage of ceramic waste in concrete production.

II. EXPERIMENTAL MATERIALS

A. Materials

a) Ceramic waste

The principal waste coming into the ceramic industry is the ceramic slurry and powders both the forms, especially in the slurry form. This type of ceramic wastes is generated as a waste during the process of dressing and polishing. It is estimated up to 15% to 30% waste produced of total raw material used, and rather then a portion of this waste may be utilized on-site, such as for excavation pit refill, the disposal of these waste materials acquired large land areas remain scattered all around, spoiling the aesthetic of entire region. It is very difficult to find a use of ceramic waste produced.

Ceramic waste can be used in concrete to improve its strength and other durability factors. Ceramic waste can be used as a partial replacement of cement and other fine materials as a supplementary addition to achieve different properties of concrete. Specific gravity of ceramic powder is 2.33 and water absorption is 2.4%.

Figure: 1. Ceramic waste powder
Source: REGENT Factories, Himmatnagar, GUJARAT

Table-1 CHEMICAL PROPERTIES OF CERAMIC WASTE
Laboratory: Central glass and ceramic research institute, Ahmedabad

Materials	**Ceramic Powder(%)**
SiO_2	63.29
Al_2O_3	18.29
Fe_2O_3	4.32
CaO	4.46
MgO	0.72
P_2O_5	0.16

K_2O	2.18
Na_2O	0.75
SO_3	0.10
CL	0.005
TiO_2	0.61
SrO_2	0.02
Mn_2O_3	0.05
L.O.I	1.61

b) Binding material (Cement (OPC))

The ordinary Portland cement of 53 grade conforming to IS: 8112 is be use. Many test were conducted on cement like as consistency test, setting time test , soundness test,etc.

TABLE-2 physical properties of cement(OPC)

PROPETY	**RESULT**
Specific Gravity	3.12
Consistency	33%
Initial setting time	35 min
Final setting time	255 min

c) Water

Water is an important ingredient of concrete as it actually participates in the chemical reaction with cement. it helps to from the strength giving cement gel, which quantity and quality of water are required to be looked into very carefully.

d) Fine Aggregate

For the experimental study, sand acquired from Yamuna River near Allahabad. Fine aggregate was confirming to IS 383: 1970. It was pass through 4.75 mm size of IS sieve having specific gravity of 2.5 was used.

e) Coarse Aggreagte

Coarse aggregate obtain from local sources divided in two fractions i.e. 20 mm and 10 mm for experimental purpose. Coarse Aggregate used in experimental study was confirming IS 383: 1970. The fraction of these aggregate was in a ratio 60:40. Both aggregate are sieved separately. Specific gravity and water absorption of these aggregate were 2.81 and 0.68 respectively.

f) Super plasticizer

Masterglenium SKY 8549 is a synthetic super plasticizer based on sulphonated naphthalene. It is a brown liquid instantly dispersible in water. It can provide up to 25% reduction in Water, thereby reducing permeability and increasing strength. The amount of plasticizer is such that it should not be used more than 1% of cement used during casting of a batch of concrete.

III. MIX DESIGN

Table-3 Design Mix Propertion M30

MATERIALS	**CONETNT (Kg/m3)**
Cement	435
Water	174
Fine Aggregate	933.53
Coarse Aggregate	840.26
Admixture	3.48
Water –cement ratio	0.4
Viscosity modifying agent	0.44

Table-4 Mix Design Propertion For Concrete M30

Materials	CW0% M1	CW15% M2	CW30% M3
Cement	435	369.75	304.5
Fine Aggregate	933.53	933.53	933.53
Coarse Aggregate	840.26	840.26	840.26
Ceramic waste	00	65.25	130.5
Water	174	174	174
Admixture	3.48	3.48	3.48
VMA	0.44	0.44	0.44
w/c ratio	0.4	0.4	0.4

V. EXPERIMENTAL METHODOLOGY

The evaluation of ceramic waste for use as a replacement of cement material begins with the concrete testing. Concrete contains cement, water, fine aggregate, coarse aggregate and grit. With the control concrete, i.e. 0%, 15%, 30% the cement is replaced with ceramic waste, the data from the ceramic waste is compared with data from a standard concrete without ceramic waste. Three cube samples were cast on the mould of size 150*150*150 mm for each concrete mix with partial replacement of cement with a w/c ratio as 0.40 were also cast. After about 24 h the specimens were de-moulded and water curing was continued till the respective specimens were tested after 7 and 28 days for compressive strength test.

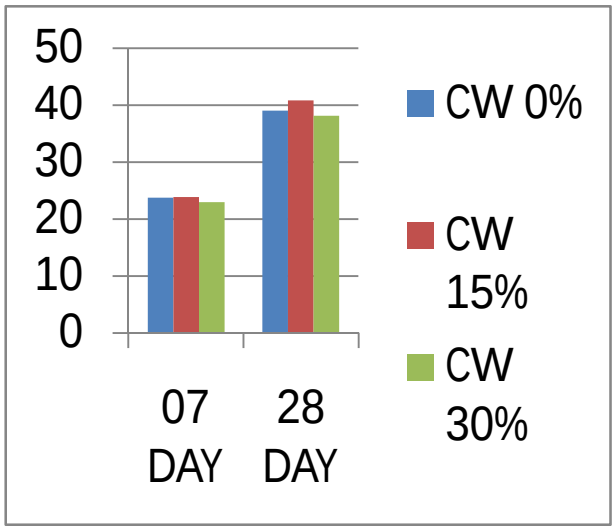
Compressive Strength

Compressive strength tests were performed on compression testing machine using cube samples. Three samples per batch were tested with the average strength values reported in this paper. The loading rate on the cube is 35 N/mm2 per min.

TABLE-5 Compressive Strength Results For M30 Garde At 07 And 28 Day

SR.NO	MIX	At 07 day(N/mm2)	At 28 day(N/mm2)
1	CW0%	23.79	39.12
2	CW15%	23.84	40.85
3	CW30%	22.95	38.21

TABLE-6 Graph Reprenstation Of Compressive Strength Results



VI. ECONOMIC FEASABILITY

There is most important factor is the cost of materials in construction. Here, ceramic waste cost is very very as compared of cement.

TABLE-7 Cost Of Materials

SR.NO.	MATERIALS	RATE(Rs/Kg)
1	Cement(OPC)	6.40
2	Fine Aggregate	0.60
3	Coarse Aggregate	0.65
4	Ceramic Waste	0.20

VII. CONCLUSION

As par experimental investigations concerning the compressive strength of concrete in M30 grade , the following observation are made:

(a) Compressive strength of M30 grade of concrete increase when the replacement of cement with ceramic waste up to 15% replaces by weight of cement.
(b) Further replacement of cement with ceramic waste is decreases. We show in table -5 30% replacement of cement with ceramic waste so the strength was decrease.
(c) Concrete on 15% replacement of cement with ceramic powder , compressive strength obtained is 40.85 N/mm2 and similarly the cost of cement reduce up to 14.05% in M30 grade of concrete.
(d) There are cement become more economical without compromising concrete strength then standard concrete.
(e) It will become a more feasible and viable for technically and economically. It is the possible alternative solution of safe disposal of ceramic waste.
(f) In the construction industry , utilization of ceramic waste and its application are used for development.

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