Effect of Ceremic Waste in Concrete by Partial Replacement of Cement

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Abstract- *Ceramic waste is one of the most pronound research areas that include many area of engineering. Ceramic waste act as pollutants. It is producing dust which is harmful for public health as well as agricultural growth.*

Utilization of ceramic waste is the best way to protect the environment and also improve the quality of product where it will use industries like construction agriculture, paper, and glass are the best utilizer of ceramic waste. In construction industries ceramic waste can be used to produce ecofriendly concrete.

To get the eco-friendly and economical concrete with optimum dose of ceramic waste.

To achieve the target strength and workability with optimum replacement of cement with ceramic waste by In this project work ordinary Portland cement has been replaced by ceramic waste powder accordingly in the range of 0%, 15%,25%,35%,45% and 55 % by weight of cement in M : 25 and M:40 grade of concrete. Concrete were produced and tested with different proportion of ceramic waste and with super plasticizer for M:40 and result were compared. These test were carried out for 7 days, 14 days and 28 days. Result was an increase in strength in properties of concrete up to replacement of 25% and 15 % for M: 25 and M: 40 respectively.by weight of cement.

Keywords- CSTR-PID-ZN-Fuzzy-MRAM-MATLAB.

I. INTRODUCTION

Indian ceramic production is million ton. Per year along with 10-15% waste material generated

This waste cannot be recycled and also hazardous to health and agriculture and affect many other factors.Ceramic waste management is the most relentless problem in the world. Production is high and utilization is very less.

In India lack of disposal site to achieve the target of management of waste produced

Best management technique is the only use of waste product. Ceramic waste is the durable, hard and resistant having cohesion properties when mixed with water and slightly binding properties. Ceramic waste may available in coarse as well as in powder form , which makes it suitable to replace with coarse aggregate, fine aggregate and with cement. Ceramic waste having so many properties like durability fire resistant , soundness, cohesion, fineness, light weight etc., which makes it suitable to sustain physical and chemical changes useful for various industries.

Various types of ceramic products are:

Tiles
Roof Tiles and Bricks
Table-And Ornamental ware (Household Ceramics)
Refractory Products
Sanitary ware
Vitrified Clay Pipes
Expanded Clay Aggregates

Ceramic waste may come from two sources. The first source in India is the ceramics industry, and this waste is classified as non-hazardous industrial waste (NHIW). According to the Integrated National Plan on Waste 2008-2015, NHIW is all waste generated by industrial activity which is not classified as hazardous in Order MAM/304/2002, of the 8th February, in accordance with the European List of Waste (ELW) and identified according to the following sources : Waste from thermal processes. ,Waste from the manufacture of ceramic products, bricks, roof tiles and construction materials. ,Ceramic, brick, roof tile and construction materials waste (fired)

Compressive strength is the most important property of hardened concrete and workability, bleeding and segregation is the property of green concrete

Ceramic waste may mix in concrete in many forms such as fine aggregate, coarse aggregate or may replace with cement as binding material.

When ceramic waste replaced with cement different aspect may require attention such as strength, cost and environment.Strength depend upon proportion of ceramic waste mixed with concrete but if will definitely reduce the cost of concrete and save the environment.

II. LITRETURE REVIEW

Khalid Najim, Ibrahim Al-Jumaily, AbdukhaliqAtea (Elsevier-2015)

The aim of their study was to investigate the use Cement Kiln Dust (CKD) as cement replacement material in producing high performance/self- compacting concrete. Different percentages of replacement by cement weight were tried including 10%, 20%, and 30% with keeping other constituents content constant.

TILE POWDER AS PARTIAL REPLACEMENT OF CEMENT IN CONCRETE

By Ponnapati. Manogna, M. Sri Lakshmi

The concluded that the compression, split tensile and flexural strength of M30 grade concrete increases when the cement is replaced with tile powder up to 30% and further replacement of cement with tile powder decreases the strength gradually. 2. Tile powder concrete has increased durability performance.

MECHANICAL PROPERTIES AND DURABILITY OF CONCRETE WITHPARTIAL REPLACEMENT OF PORTLAND CEMENT BY CERAMIC WASTES

F.Pacheco Torgal A. Shahsavandiand S. Jalali

concrete with ceramic waste powder although has minor strength loss possessincrease durability performance. Results also show that replacement of traditional sand by ceramicsand is a good option because does not imply strength loss and has superior durabilityperformance. As for the replacement of traditional coarse aggregates by ceramic coarseaggregates, the results are promising but require further investigations

The Potential Pozzolanic Activity of Different Ceramic Waste Powder as Cement Mortar Component (Strength Activity Index)" Jay Patel et al.

Based on pozzolonic strength activity index test , all three ceramic materials have pozzolonic property index greater than 80 % but the material from Gopi industry (sanitary ware products) have a continuous better performance for 7,28 days and in accelerated tank curing also. ♣ Hence, here possibility of Waste ceramic as recycled material used in concrete production increases and may beneficial to decreases further CO2 burden to the environment and helpful for conserve natural resources.

Object

To find the optimum proportion of ceramic waste with respect to strength and workability.

To achieve the production of economical concrete by use of ceramic waste.

To know the feasibility of utilization and disposal of ceramic waste

III. METHODOLOGY

Pozzolonic material

Pozzolona is a natural siliceous and aluminous material. calcium silicate hydrate and calcium aluminate hydrate are formed when pozzolonic material reacts with calcium hydroxide in presence of water which possessing cementitious properties.It can classified in natural pozzolona and artificial pozzolna.But both are in finally divided form of parent sources.

Testing of ceramic waste

Ceramic material is hard, rigid. It is estimated that 15 to 30% waste are produced of total raw material used, and although a portion of this waste may be utilized on-site, such as for excavation pit refill. The material and the chemical composition is obtained from Arvind Ceremics,Raipur(C.G). Chemical properties of ceramic waste are as per table 3.2.

Table 3.2 chemical constituents of ceramic waste

Material	Ceramic powder (%)
Sio_2	63.28
Al_2o_3	18.22
Fe_2o_3	4.53
Cao	4.46
Mgo	0.78
P_2o_5	0.16
K_2o	2.18
Na_2o	0.75
So_3	0.11
cl^-	0.005
Tio_2	0.62
Sro_2	0.02
Mno_3	0.05

Typical Properties OF material

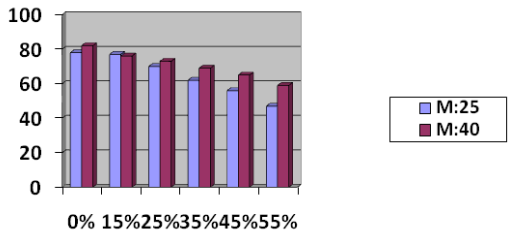
Brown liquid Specific gravity	1.18 @ 25°C
Air entrainment	Less than 2% additional air is entrained at normal dosages
Chloride content	Nil to BS 5075 / BS:EN934
Freezing point	Approximately -2°C

Physical and mechanical properties of cement Properties Results

Properties	Result	Standard Limits
Consistency	32%	
Soundness	Expansion 4 mm	<10mm
Initial setting	115 mm	>30 min
Final Setting Time	295 mm	<600 min
Specific gravity	3.123	
Fineness	1.5 % on 90 micron sieve	<10%
Compressive strength 3 days 7 days 28 days	N/mm² 17.30 22.30 33.40	N/ mm² >16 >22 >33

IV. RESULTS AND DISCUSSION

Results based on different test perform in laboratory and cost analysis by market analysis



it is found that as the percentage of ceramic waste increased in concrete the value of slump gradually.

In this project the slump value was taken as 50-75 mm and the slump value obtained is approximately lies between above mentioned value.

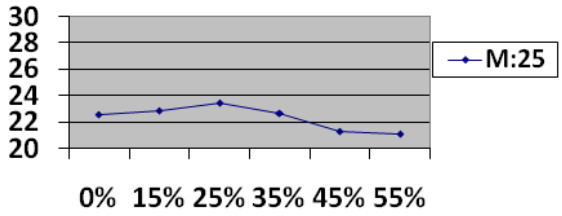


Fig shows that compressive strength of concrete with different proportion of ceramic waste replaced with cement. The result indicates an increase in strength up to a certain limit the maximum value of strength has been observed for 25% replacement of ceramic waste with cement for 7 days strength. The strength of concrete increased up to 25%. Replacement of ceramic waste and then decrease further.

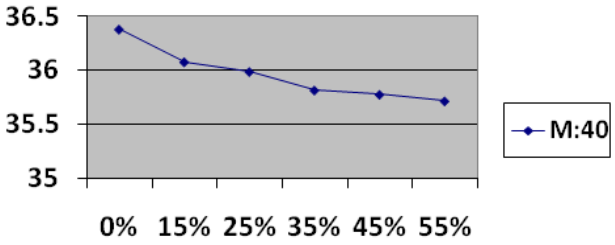


Fig shows that compressive strength of concrete with different proportion of ceramic waste replaced with cement. The result indicates an decrease in strength after 7 days curing of M: 40 grade concrete.

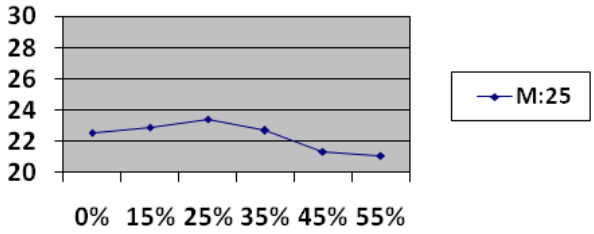


Fig shows the compressive strength of normal concrete and concrete with ceramic waste at different proportion of ceramic waste replaced with cement after 14 days curing of 25 grade concrete. Results indicate that increase in compressive strength up to certain limit of ceramic waste mixed with concrete. The maximum strength of concrete obtained with 25% Replacement of ceramic waste by weight of cement.

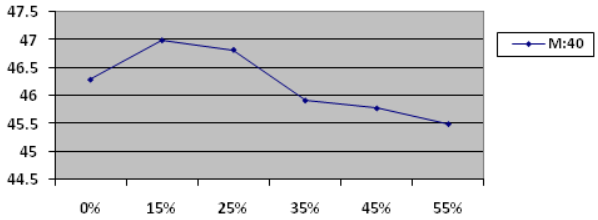


Fig shows the compressive strength of normal concrete and concrete with ceramic waste at different proportion of ceramic waste replaced with cement after 14 days curing of M:40 grade concrete. Results indicate that increase in compressive strength up to certain limit of ceramic waste mixed with concrete. The maximum strength of concrete obtained with 15% Replacement of ceramic waste by weight of cement.

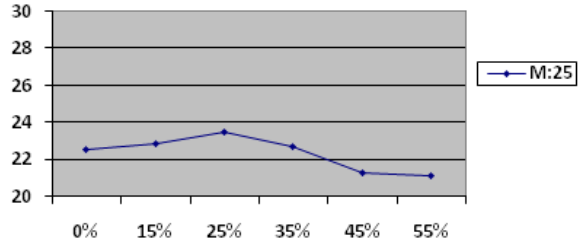


Fig shows the compressive strength of normal concrete and concrete with admixture at different proportion of ceramic waste replaced with cement after 28 days curing. Results indicate that increase in compressive strength up to certain limit of ceramic waste mixed with concrete. The maximum strength of concrete obtained with 30 % Replacement of ceramic waste by weight of cement.

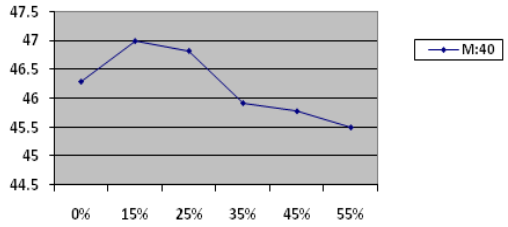


Fig shows the compressive strength of normal concrete and concrete with admixture at different proportion of ceramic waste replaced with cement after 28 days curing of M:40 grade concrete. Results indicate that increase in compressive strength up to certain limit of ceramic waste mixed with concrete. The maximum strength of concrete obtained with 15 % Replacement of ceramic waste by weight of cement.

Cost analysis

cost analysis for material used in concrete for 1 m^3 volume of M :25 grade

Rate of cement takes as 6 rupees / kg and rate of ceramic waste taken as 2 rupees / kg

mix	Cement	Ceramic waste	Cost	Cost of ceramic waste	Total Cost	Cost saved
F_0	288	0	1728	0	1728	0
F_1	244.8	43.2	1468	86.4	1555.2	173
F_2	216	72	1296	142	1438	290
F_3	187.2	100.2	1123	200.4	1323.4	404.6
F_4	158.4	129.6	950.4	259.2	1209.6	519
F_5	129.6	158.4	777.6	316.8	1094.4	634

Cost analysis for material used in concrete for 1 m^3 volume of M :40 grade

Rate of cement takes as 6 rupees / kg and rate of ceramic waste taken as 2 rupees / kg

mix	Cement	Ceramic waste	Cost	Cost of ceramic waste	Total Cost	Cost saved
F_0	346	0	2076	0	2076	0
F_1	294.1	51.9	1764.6	103.8	1850.4	196
F_2	259.5	86.5	1557	173	1730	316
F_3	224.91	121.1	1349.4	242.2	1591	455
F_4	190.3	155.7	1141.8	311.4	1453.2	592.3
F_5	155.7	190.3	934.2	280.6	1214.8	831.2

From cost analysis it's found that ceramic waste is very suitable admixture for economical aspect.

It saved the cost of concrete up to 10 % to 15 % without compromising the strength and also it proved eco-friendly so definitely it will be beneficial for environmental point of view it is very good to use ceramic waste as pozzolonic material in concrete.

Ceramic waste is also available very easily because of its very high rate of production.

Which also reduces the cost of transportation and storage.

V. CONCLUSION

1. According to these results Super Plasticizers, for high-strength concretes by decreasing the w/c ratio as a result of reducing the water content by 20–30%.
1. 2. By adding of ceramic waste at 0, 15, 25, 35, 45 and 55% at 25% gives optimal result for M:25 and 15% for M:40 grades at 14 and 28 days strength and increases strength up to 25% and 15% respectively after that further gives addition decreases in strength
2. For 7 days strength it shows that strength is decreasing.
3. Replacement of ceramic waste reduces the cost of concrete , hence it is more economical with little compromise the strength of concrete.
4. Utilization of ceramic waste protects the environment and reduce the load of waste management in country.
5. Ceramic waste when mixed with concrete it found economical because of its availability
6. Market cost .it makes concrete cheap without compromising strength.

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