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AN EXPERIMENTAL STUDY ON FLEXURAL BEHAVIOUR OF CONCRETE BY PARTIAL REPLACED SAND BY USING CERAMIC POWDER

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ABSTRACT

An experimental investigation of Common river sand is expensive due to excessive cost of transportation from natural sources. Also large amount of depletion of these sources creates environmental problems. A Replacement product for concrete industry needs to be found. To made of concrete to most commonly using for fine aggregate in the production of concrete. It poses the problem of acute shortage in many areas. During the past few years river sand has become expensive due to excessive cost due to excessive cost of transport from natural sources. Increase in industrialization and urbanization, the use of buildings also increased which results in continuous usage of construction material leads to scarcity of the concrete materials. To overcome the issues many research were to be done to use for industrial waste as alternative or substantial material for concreting. The present work is an experimental investigation to check the suitability of using ceramic waste like a powder as a substitute for fine aggregate in the construction of concrete. Various concrete mixes with different percentages of sanitary ceramic waste were prepared for the investigation. Having been ready, in the first stage of the study, the ceramic powder with percent's of sand replaced 0%, 10%, 20%, 30% and 50% were in M25 Grade of Concrete.

Keyword: **Ceramic tiles waste , compression strength, flexural strength, tensile strength.**

INTRODUCTION

GENERAL

Concrete, as a constructive material, has been used in construction industry for about two centuries. Approximately, the whole bulk of the

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concrete is used in one year is more than one ton apiece. Therefore, doing research about using modern technologies in production concrete is of great importance. Furthermore, one of the most critical problems of the world has been related to remove the wastage and reusing of it. In all countries, large amount of wastage is produced annually. most of these wastage are not reusable or if they are, their recycling leads to wasting energy and pollution which is turn increase the risk of these materials for the environment. Moreover, a good strategy to achieve the two purposes of removing the wastage material and also obtaining the positive qualities of concrete Tile and constructive ceramics are among the most commonly used materials in structures. The ceramic waste from ceramic and construction industries is a major contribute to construction and demolition waste, representing a serious environmental, technical and economical problem of society nowadays. It has been estimated that about 30% of the daily production in the ceramic industry goes to waste. This waste is not recycled in any form at present. However, the ceramic waste is durable, hard and highly resistant to biological, chemical and physical degradation forces. As the ceramic waste is piling up every day, there is pressure on the ceramic industries to find a solution for its disposal.

OBJECTIVES OF THE WORK

To develop a suitable mix design using ceramic sand as a replacement for fine aggregate.To prepare concrete mixes using varying contents of ceramic sand.To study the fresh and hardened properties of concrete prepared using varying amount of ceramic sand.

SCOPE OF THE WORK

Using ceramic wastage in concrete production causes no remarkable negative effect in the properties of concrete. In this experimental study, first the grinded waste ceramic tile and then its grading were done in a way that the tile grading curve of the natural aggregates used in control concrete was completely in compatible with the ceramic aggregates. After that, a range of experiments were done .Having been ready, in the first stage of the study, the ceramic tiles with percent's of 0, 10, 20, 30, and 50 were substituted for sand. Christo Ananth et al. [6] proposed a system, this fully automatic vehicle is equipped by micro controller, motor driving mechanism and battery. The power stored in the battery is used to drive the DC motor that causes the movement to AGV. The speed of rotation of DC motor i.e., velocity of AGV is controlled by the microprocessor controller. This is an era of automation where it is broadly defined as replacement of manual effort by mechanical power in all degrees of automation. The operation remains an essential part of the system although with changing demands on physical input as the degree of mechanization is increased.

CONSTITUENT MATERIALS

MATERIALS USED

The ingredients used in this work are same as those used in conventional concrete. But here we introduce ceramic waste as a partial replacement for fine aggregate. The materials used are cement, sand, ceramic waste, coarse aggregate and water.

CEMENT

In the present work, Ordinary Portland Cement of 53 grade conforming to IS: 12269-1987

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has been used. The physical properties of the cement obtained on conducting appropriate tests as per IS: 269/4831.

Table .1: Properties of Cement

Grade	OPC 53
Specific Gravity	3.1
Initial Setting Time	60 min
Final Setting Time	440 min
Standard Consistancy	33%
Fineness	4.95

FINE AGGREGATE

Table.2: Properties of Fine Aggregates

S.No	Particulars	Values
1	Specific Gravity	2.7
2	Fineness Modulus	2.37

CERAMIC WASTE

Fig . 1: Powdered ceramic waste

Table .3: Chemical Properties of Ceramic Waste

CHEMICALS	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

Table.4: Properties of Ceramic Fines

S.No	Particulars	Values
1	Specific Gravity	2.43
2	Fineness Modulus	2.53

COARSE AGGREGATE

The fractions from 20 mm to 4.75 mm are used as coarse aggregate. The Coarse Aggregates

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from crushed Basalt rock, conforming to IS: 383 is being use. The Flakiness and Elongation Index were maintained well below 15%.

Table .5: Properties of Coarse Aggregates

S.No	Particulars	Values
1	Specific Gravity	2.79
2	Fineness Modulus	8.26

WATER

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

Table.6:Mix design : Materials for 1 m^3 concrete

Mix Designation	% of sanitary ceramic waste	Cement (kg/m^3)	Fine Aggregate (kg/m^3)	Coarse Aggregate (kg/m^3)	Sanitary Ceramic Waste (kg/m^3)	Water (litres)
MIX 1	0	359	860	1096	0	168
MIX 2	10	359	750.98	1096	109.02	168
MIX 3	20	359	630.67	1096	90.31	168
MIX 4	30	359	560.56	1096	70.11	168
MIX 5	50	359	430.20	1096	60.58	168

CASTING AND CURING

INTRODUCTION

The mould specification, preparation of mould method of casting and curing are discussed below.

CASTING

During moulding, the human is formed and concrete is conveyed in pans from hand to hand. The concrete shall be put gently in the Ace shape mould thickness not exceeding 6cm and compacted by the mechanical compressive machine with help of unskilled labour.

The materials were weighed as per the designed mix proportion and they were mixed using concrete mixer. The mixing operation was continued till a good uniform, homogeneous concrete was obtained. General mixing time of 5 to 10 minutes was followed. Steel moulds were used for casting the specimens.

MOULD PREPARATION

The cube mould was placed in position on an even surface. All the interior faces and sides were coated with mud oil to prevent the sticking of concrete to the mould.

MIXING

The grade of concrete selected is M25 and water cement ratio adopted was 0.5. The selection of this low water content of 0.5 was done because of spherical nature of FAs. The mix proportion taken was and mixing satisfies the requirement of IS 456-2000. Concrete is mixed in roller type of mixing machine.

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RESULTS AND DISCUSSION

Compressive strength

Concrete cube specimen used to find out the compressive strength of concrete.

Testing on concrete cubes

Fig . 2: compressive strength test for specimen cubes

Table .7 : Testing results: compressive strength

%	3 days		7 days		28 days	
M25 grade	Failure load (KN)	Compressive Strength (N/mm^2)	Failure load (KN)	Compressive Strength (N/mm^2)	Failure load (KN)	Compressive Strength (N/mm^2)
0	480	21.35	490	21.76	714	31.75
10	488	21.50	496	21.96	725	31.92
20	494	21.84	501	22.12	737	32.16
30	499	22.22	509	22.39	749	33.38
50	505	22.45	520	23.14	800	35.58

Compressive strength : Bar Charts

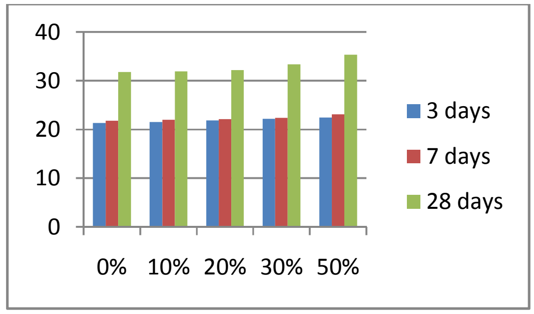

fig. **3:** Compressive strength (x) vs various mix design (y)

Flexural strength

Fig. 4: Testing on beam

Table.8 :Testing Results : Flexural Strength

%	3 days		7 days		28 days	
M25 Grade	Failure load (KN)	Flexural strength (N/mm^2)	Failure load (KN)	Flexural strength (N/mm^2)	Failure load (KN)	Flexural strength (N/mm^2)
0	15.25	2.95	17.3	3.33	23.08	4.45
10	15.56	2.98	18.0	3.41	23.46	4.52
20	15.95	3.06	18.8	3.54	24.0	4.68
30	16.04	3.10	19.0	3.65	25.08	4.82
50	16.33	3.16	19.5	3.76	26.40	5.12

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Flexural strength : Bar Charts

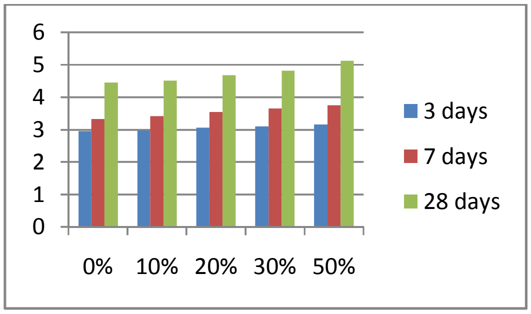

Fig.5 : Flexural strength(x) vs various mix design (y)

Split tensile strength

The split tensile strength test obtained from 3 days,7 days ,& 28 daysof curing in water.

Fig. 6: Cylindrical specimen test

Table.9 : Testing Results

%	3 days		7 days		28 days	
M25 Grade	**Failure load (KN)**	**Split tensile strength (N/m m^2)**	**Failure load (KN)**	**Split tensile strength (N/m m^2)**	**Failure load (KN)**	**Split tensile strength (N/m m^2)**
0	377.67	5.36	388.33	5.50	573.33	8.12
10	358.56	5.25	377.45	5.35	555.75	8.01
20	348.33	5.10	360.33	5.22	537.60	7.79
30	339.50	4.90	345.43	5.01	510.50	7.50
50	320.67	4.60	338.63	4.80	488.83	6.95

Split tensile strength : Bar Charts

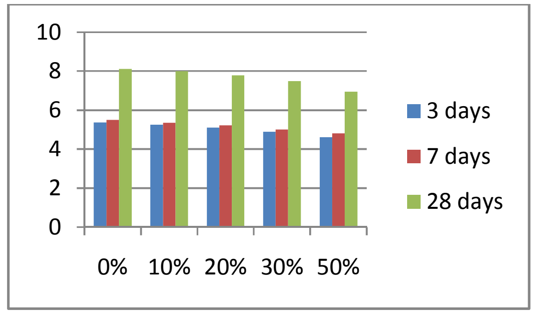

Fig.7 :Split tensile strength strength(x) vs various mix design (y)

CONCLUSIONS

- ✓ The Safe effect on the workability of concrete can be seen for the partial replacement of fine aggregates with ceramic powder.
- ✓ The compressive strength of concrete slightly decreases with increase in percentage of ceramic fine aggregate in concrete.
- ✓ Compressive Strength of concrete increases upto 10% of partial replacement of sand with waste ceramic Powder and upto 50 % .
- ✓ The split tensile strength of concrete slightly decreases with increase in percentage of ceramic fine aggregate in concrete.
- ✓ The flexural strength of concrete slightly decreases with increase in percentage of ceramic fine aggregate
- ✓ but there is no much variations in compressive strength , flexural strength and split tensile strength of concrete with the variation of cement content.

REFERENCES

[1] Andres Juan et.al (2006) Reuse of ceramic waste in construction, Ceramic material (Page 204 – 214)

[2] T. Felixkala And P. Partheeban "Granite powder concrete", Indian Journal of

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Available online at www.ijartet.com
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Science and Technology, Vol. 3 No. 3 (Mar 2010).

[3] Dr.R.Ilangovan, Dr.N.Mahendran And Dr.K.Nagamani, " Strength and durability properties of concrete containing quarry rock dust as fine aggregate" arpn Journal of Engineering and Applied Sciences. Vol.3, No.5, OCT2008.

[4] Bahoria B.V., Parbat D.K. and Naganaik P.B "The replacement of natural sand in

[5] A.M.Neville & J.J.Books, "Concrete technology" international student edition 1999, ISBN 981-35-840-4, Addison Wesley Longman Ltd.

[6] Christo Ananth, M.A.Fathima, M.Gnana Soundarya, M.L.Jothi Alphonsa Sundari, B.Gayathri, Praghash.K, "Fully Automatic Vehicle for Multipurpose Applications", International Journal Of Advanced Research in Biology, Engineering, Science and Technology (IJARBEST), Volume 1,Special Issue 2 - November 2015, pp.8-12.

[7] Gambhir.M.L, "Concrete Technology" Theory and Practice Tata Mcgraw hill Education Publisher,2012.

[8] Dr.M.S Shetty, "Properties of concrete theory and practice", fourth edition, is be 81 -219- 0348- 3, S. chant & company Ltd.

[9] IS – 456 – 2000 "Indian code of practice for plain and reinforced concrete.

[10] IS 10262:2009 "The Indian Standard code of practice for Mix Design".

[11] Nagabhushana and h. Sharada bai"Use of crushed rock powder as replacement of fine aggregate in concrete" Aug 2011.

[12] Batayneh.M, Marie.I, Asi.I 'Use of selected waste materials in concrete mixes'. Waste Manag. 27, 1870–1876 (2007).

[13] Shetty M.S., "Concrete Technology" Theory and Practice S.Chand & Company Ltd Publisher,2009.

[14] Swamy RN., "Cement replacement material – concrete technology and design". Survey, vol.3.London: Univesity Press; 1986.

[15] Arun Kumar R (2010) Strength and Durability studies of metakaolin incorporated high volume fly ash concrete. Thesis report, TKM college of Engineering, Kollam.