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AN EXPERIMENTAL ANALYSIS FOR PARTIAL REPLACEMENT OF COARSE AGGREGATE WITH CEREMIC TILES AND PARTIAL REPLACEMENT OF CEMENT WITH SUGARCANE ASH

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Abstract: The increase in requirement and consumption of concrete led the researchers to search for alternatives in concrete that are economical , eco friendly , and contribute towards environment . The utilization of industrial and agricultural wastes in concrete has been a major step on waste reduction . Ceremic waste (CW) and Sugarcane Baggase Ash (SBA) can be effectively used in concrete as partial replacement of Aggregate and Cement respectively . These materials can be used in concrete due to high quantity of silica and pozzolanic properties which plays an important role in concrete for achieving high strength and durability. In this paper, Ceramic waste are used as partial replacement of coarse aggregate at 0% , 10% , 20% , 30% by weight in M-20 grade of concrete and Sugarcane bagasse ash is used as partial replacement of cement at 10% because of high strength by weight in M -20 grade of concrete.Their Compressive strength , Tensile strength and Flexural strength are observed and compared after curing for 7 and 28 days to determine their effect on usage in concrete.

Keywords: **Sugarcane bagasse ash , Ceremic tiles waste , Economic concrete , Waste management.**

1. INTRODUCTION

Concrete is the most widely used construction material in the world, more so in the developing countries, and there are global concerns such as depletion of non-renewable mineral deposits and emission of the greenhouse gas associate with the manufacture of cement, which is the primary binding agent in the concrete. Therefore, the need for economical and more environmental-friendly cementing materials have increased the interest in other cementing materials that can be used as partial or total replacements of the normal Portland cement.

Bagasse, an abundantly produced agricultural waste, is the residue of sugarcane that is obtained after extraction of juice. Next only to Brazil, India is the second largest producer of sugarcane in the world with annual production in the year 2011 set to exceed 300 Million tonnes. It is estimated that the processing of this sugarcane in sugar mills results in the production of approximately 100 million tonnes of wet sugarcane bagasse ash every year. The bulk amount of bagasse waste produced in sugar factories requires a meaningful disposal scheme.

Ceremic tiles waste , an waste collected from destroyed buildings , tile manufacturing industry and is a waste that have a problem of disposal. It is produced in companied during or after production process due to errors in either construction , human activities , and inappropriate raw materials.It has been estimated that about 30% of daily production in the ceramic industry goes as waste.

ADVANTAGES OF USING THESE MATERIALS

- **Economic advantages**

Reduces need for lower energy consumption

Reduces cost of construction as these are waste materials

- **Environmental advantages**

Will reduce CO2 emissions

Heat of hydration will get decreased

Will provide long term mechanical strength

2. LITERATURE REVIEW

Sagar W. Dhengare1, Dr. Ajay L. Dandge2, Harshal R. Nikhade3, Monali Wagh (Nikhade) 4, Anshul R. Nikhade (2017) - Economical concrete by utilizing SCBA and ceramic waste - There has been an increase in Compressive, Split Tensile and Flexural strength after partial replacement of cement and coarse aggregate by Sugarcane Bagasse Ash and Ceramic Waste. 2. The 7 days strength of the 15% partial replacement mix showed higher strength in compression and Split tensile strength. 3. The 28 days Strength of the Concrete mix with 10% partial replacement showed highest Compressive, Split Tensile and Flexural strength. 4. The water requirement to produce the workable mix was slightly higher since ceramic tiles absorbs water. 5. The cost of producing Concrete mix with inclusion of SCBA and Ceramic waste as partial replacement can be decreased by 20-25%. 6. Since the high flexural is achieved this method can be adopted for pavement and road construction.

G.SAI CHAND , "partial replacement of aggregate with ceramic tile in concrete" (2017) - Crushed waste ceramic tiles, crushed waste ceramic tile powder and Granite powder are used as a replacement to the coarse aggregates and fine aggregate. The ceramic waste crushed tiles were partially replaced in place of coarse aggregates by 10%, 20%, 30%, 40% and 50%. Granite powder and ceramic tile powder were replaced in place of fine aggregate by 10% along with the ceramic coarse tile. M25 grade of concrete was designed and tested. The mix design for different types of mixes were prepared by replacing the coarse aggregates and fine aggregate at different percentages of crushed tiles and granite powder. Experimental investigations like workability, Compressive strength test, Split tensile strength test, Flexural strength test for different concrete mixes with different percentages of waste crushed and granite powder after 7, 14 and 28 days curing period has done. It has been observed that the workability increases with increase in the percentage of replacement of granite powder and crushed tiles increases. The strength of concrete also increases with the ceramic coarse tile aggregate up to 30% percentage.

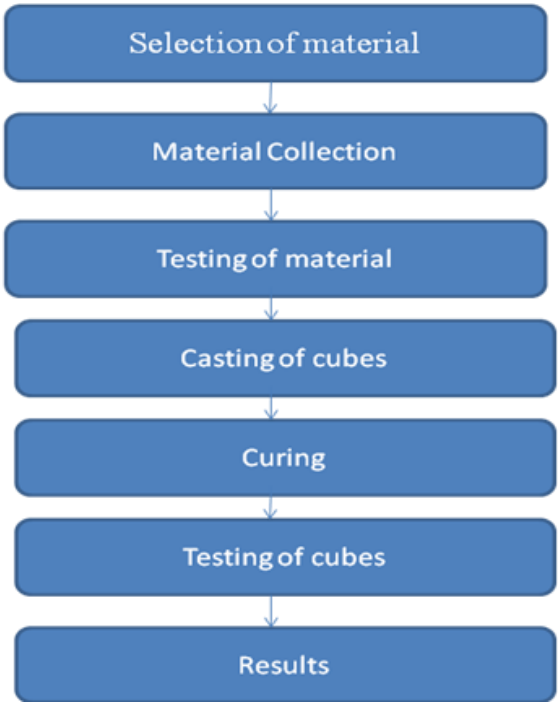
Ajamu Solomon olarere , Impact of Replacement of coarse aggregates with ceramic tile waste on the strength characteristics of concrete (2018) - From the research carried out, the following conclusions were made: (i) Aggregate impact value of the granite used for this study is lower compared with that of Ceramic Tiles Waste which implies it was tougher than CTW. (ii) The slump test showed that the concrete becomes less workable as the CTW percentage increases beyond 20%. (iii) Compacting factor increases with increase in the percentage of CTW up to 20% above which the value began to fall. (iv) The compressive strength of concrete reduced with the increase in percentage of CTW replacement. However the reduction rates were significantly low for all the ages and percentage replacement. Using up to 100% ceramic tile waste did not produce a weak concrete. (v) Use of CWT to replace granite as coarse aggregates up to 30% in the production of concrete is established

3. METHODOLOGY/PLANNING OF RESEARCH WORK

- Procurement of SCBA and CW from sellers and converting them into required finness.
- Lab testing of characteristics of SCBA and CW such as specific gravity, physical state, odour etc.
- Preparation of design mix of M20 grade using relevant code.
- Preparation of different concrete mix using SCBA and CW as partial replacement of cement by 10% for all the mixes and coarse aggregates by 10%, 20%, 30%, 40%, 50%.
- Comparative study of compressive, flexural, split tensile strength of concrete mix.

EXISTING WORK:

Fresh ceramic waste coarse aggregate and sugarcane bagasse with cement more less cohesive and workable than than conventional concrete.



4. RESULTS / PERFORMANCE EVALUTION

The objectives of this study were to examine the hardened properties of concrete beams with different reinforcement type. Properties which were examined are:

1. Workability
2. Compressive strength
3. Flexural strength

The detailed analysis and discussion of the results obtained from the experimental program is presented in the following section.

WORKABILITY OF CONCRETE MIXES

Workability is considered to be the property of plastic concrete that indicates its ability to be mixed, handled, transported and placed with a minimum loss of Homogeneity as almost important property.

Table 4.1: Slump results

GRADE OF CONCRETE	ADDITION OF CWA + SCBA (%)	Slump(mm)
M20	M1(10% CWA+10%SCBA)	52
	M2(20%CWA+10%SCBA)	58
	M3(30%CWA+10%SCBA)	63
	M4(40%CWA+10%SCBA)	68
	M5(50%CWA+10%SCBA)	70

Compressive strength test of concrete mix

The results of the compressive strength tests conducted on concrete specimens of mix M20 cured at different ages presented and discussed in this section. These tests were carried out in accordance with IS: 516-1959 on Compression Testing Machine. The compressive strength test of the M20 grade of concrete at different curing ages are shown in the table.

Table No. 4.2: Results of compressive strength test of concrete mix

% of replacement of CWA and SCBA	7Days	14days	28days
M0	18.83	22.23	25.82
M1	18.53	22.54	26.28
M2	20.21	23.42	26.43
M3	20.54	24.53	27.53
M4	17.93	21.08	24.24
M5	17.23	19.82	22.63

Split Tensile Strength Test on Cylinders

It is an indirect method of finding the tensile strength of concrete. The test specimen was placed in the centring jack with packing strip and loading pieces carefully positioned along diametrically vertical planes at the top and bottom of the specimen. The test result of split tensile strength of all the mixes are given in table

Table No. 4.3: Results of split tensile strength test on cylinders

% of replacement of CWA and SCBA	7Days	14days	28days
M0	3.44	3.92	4.39
M1	3.97	4.12	4.42
M2	3.85	4.15	4.44
M3	3.82	4.24	4.61
M4	3.74	4.20	4.67
M5	3.65	4.18	4.72

Flexural strength test on beam **:**Two-point load method was adopted to measure the flexural strength . As per guidelines, beams of (150x150x150) mm size were adopted. The load was applied without shock and was increased until the specimen failed, and the maximum load applied to the specimen during the test was recorded.

Table No. 4.4: Results of Flexural Strength Test on Beam

% of replacement of CWT and SCBA	28 Days(MPa)
M0	2.089
M3	2.756
M4	2.563
M5	2.355

5. CONCLUSIONS

1. The water necessity to produce the workable was to some extent higher since ceramic tiles absorbs water.

2. The cost of producing Concrete mix with addition of SCBA and Ceramic waste as partial replacement can be decreased by 30%.

3. The properties of concrete improved linearly with the increase in ceramic aggregate up to 30% substitution later it is decreased linearly.

4. The workability of concrete increases with the increase in tile aggregate replacement. The workability is further increased with the addition ofsugarcane bagasse ash which acts as admixture due to its chemical properties.

5. Increases the workability of concrete.

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