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EXPERIMENTAL STUDY ON THE BEHAVIOR OFCONCRETE BY REPLACEMENT OF FINE AGGREGATE WITH GRANITE POWDER AND CEMENT WITH ALCCOFINE 1203

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ABSTRACT:-*Environmental concerns caused by the extraction of raw materials and CO_2 emissions in the production of Portland cement led to pressures to reduce the consumption of this constituent of concrete, combined with the need to increase its durability. The cement is the most costly and energy intensive component of concrete. The unit cost of concrete can be reduced as much as possible by partial replacement of cement with other waste pozzolanic materials. Certain materials of mineral origin are also added to concrete to enhance their strength and durability properties of concrete materials such as Granite Powder needles and other by product like Alccofine-1203. Granite powder and alccofine can be used in a combination as supplementary cementitious material as partial replacement of cement and Fine aggregate. 15% alccofine with 15% Granite powder (K3) gives 32% increase in compressive strength which is 31.65N/mm² of this newly modified concrete in comparison with conventional concrete of M35 grade which is optimum amongst other combinations within 7 Days. 15% alccofine with 15% Granite powder (K3) gives 34% increase in compressive strength which is 38.45 N/mm² of this newly modified concrete in comparison with conventional concrete of M35 grade which is optimum amongst other combinations within 14 Days. 15% alccofine with 15% Granite powder (K3) gives 42% increase in compressive strength which is 48.07 N/mm² of this newly modified concrete in comparison with conventional concrete of M35 grade which is optimum amongst other combinations within 28 Days. 15% alccofine with 15% Granite powder (K3) gives increase in Tensile strength which is 2.76N/mm², 3.23N/mm² and 3.89N/mm² within 7 Days, 14 Days and 28 Days alternatively. 15% alccofine with 15% Granite powder (K3) gives increase in Flexural strength which is 8.6N/mm², 9.1N/mm² and 10.5N/mm² within 7 Days, 14 Days and 28 Days alternatively. Percentage increase in Granite Powder results in decrease of strength parameters i.e. combination having 20%, 25%, 30% of Granite Powder gives less increase in results for this mix proportion.*

Index Terms: — *Granite Powder, Alccofine-1203, Compressive strength, Tensile Strength, Flexural Strength, Specific gravity, Concrete, Cement.*

1. INTRODUCTION

Concrete is the most widely used man made construction material in the world. It is obtained by mixing cement materials, water and aggregates, and sometimes admixtures in required proportions. The mixture when placed in forms and allowed to cure hardens into a rock – like mass known as concrete. The hardening is caused by chemical reaction between water and cement and continues for a long time, and consequently the concrete grows stronger with age.Concrete is generally classified as a normal strength concrete, high strength concrete and ultra-high strength concrete etc. As per Indian standard a recommended method of mix design denotes the boundary of 35Mpa between Normal strength concrete and high strength concrete. But as per international forum, the high strength concrete label was applied to concrete having strength above 40MPa. Now it have been rose to 55MPa as per IS 456-2000. The strength, durability and other characteristics of a concrete depend upon the properties of its ingredients, on the proportion of mix, the method of compaction and other controls during placing, compaction and curing. The key to producing a strong, durable and uniform concrete i.e. high performance concrete lies in careful control of its basic and process components i.e. cement, aggregate, water, chemical admixtures and other supplementary cementing materials. Certain materials of mineral origin are also added to concrete to enhance their strength and durability properties of concrete materials such as Granite powder and other byproduct like Alcofine and silica fumes

which are generally very fine, may be finer than cement, when added to concrete in right proportion can improve the strength and durability of concrete drastically and high strength and high performance concrete is obtained in this manner. So modern concrete can have more ingredients mentioned earlier and like many other composites, property of concrete can be suitably tailored for specific construction related performance. Cement production is the most energy intensive material produced after steel and aluminum. More than 7 per cent of world's carbon dioxide emissions are attributed to Portland cement.In addition to CO_2 emissions, the burning of Portland cement at high temperature (1450^0C) is costly in terms of fossil fuel usage. Moreover by some estimate concrete industry is the largest consumer of natural resources such as water, sand, gravel and crushed rock. Thus for sustainable development it is recognized that considerable improvements are necessary in productivity, energy efficiency and environmental performance.

MATERIAL USED

Following Material are used for studying the mechanical properties for his study used agriculture waste, eco-friendly material. Materials to be used are as follows:

1) GRANITE POWDER

2) ALCCOFINE

METHODOLOGY

The steps to be followed for the execution of work will be as:-

- M25 grade concrete mix design as proposed for controlled concrete based on "Indian standard concrete mix proportioning (IS 10262: 2009)" shall be designed using available natural aggregates.
- Material selection and testing of cement, coarse aggregates, and fine aggregates.
- The varying percentage of Coconut Shell Ash and Sugarcane Fibre added to develop thefibre reinforced concrete.
- Testing of rheological properties of concrete with slump test.
- Preparation of test samples to govern hardened properties Fibre reinforced concrete.
- 100×100×100mm cubes (set of 3 for control mix as well as for various additions of fibers) for compressive strength determination are casted. So total no. of 126 cubes were casted fortested
- 100×200mm cylinders (set of 3 for each) are casted for testing split tensile strength. So total no. of 126 cylinders were casted for tested.
- Pond Curing of all samples is done after 24 hours of cast and testing of all samples is done at 28 days.
- Testing of specimen's for compressive strength, flexural strength as per Indian standard guidelines.
- Analysis and conclusion of results shown by various experiments.

RESULTS

Specific Gravity

Specific gravity may be defined as a ratio of density of a substance to the density of a reference substance. The reference substance is nearly always water but sometimes we use other substance like kerosene. Kerosene is used as a reference substance for determining the specific gravity of cement and water is used as a reference substance for determining the specific gravity of sand and coarse aggregates.

Table No. 3 Specific Gravity

S. No.	Materials	Specific Gravity
1	Granite Powder	2.73
2	Cement	3.15
3	Sand	2.6
4	Coarse aggregate	2.74

Sieve Analysis of Fine Aggregates

Here sand is allowed to pass through the different sieves size varying from 4.75mm to 75µmm and their particle size distribution is determined. The sand used confirms to table 4 of IS 383 and it belongs to zone 1.

Table no. 4 Sieve Size Analysis of Fine Aggregates

IS sieve size	Weight retained	% Weight retained	Cumulative % weight retained	Cumulative % Passing
4.75mm	8.7	0.87	0.87	99
2.36mm	35	3.5	4.37	95
1.18mm	275	27.50	31.87	68
300µm	235	23.50	95.57	4.43
150µm	40	4	99.57	0.43
75µm	0.5	0.05	99.62	0.38
Pan	3.8	0.38	99.65	0.35

Fineness Modulus = 295/100 = 2.95

Effect on Workability

The consistency of concrete for each mix group has been determined using the slump test in accordance to **IS: 1199-1959**. The test results for workability of fibre mix at addition percentage of 5%, 10%, 15%, 20% and 25% of Alccofine-1203 and 5% to 25% of Granite Powder.

Table 5 Slump Values of Concrete Mix

Mix Group	**Replacement of Cement with Alccofine-1203 (%)**	**Replacement of fineaggregate with Granite Powder (%)**	**Slump (mm)**
R	0	0	75
K_1	5	5	63
K2	10	10	61
K_3	15	15	60
K_4	20	20	56
K_5	25	25	53

Compressive Strength

The compressive strength of 7 days, 14days and 28 days increased by 31.6N/mm², 39.6N/mm² and 49.08N/mm² respectively than that of control mix M35. The compressive strength of replacement of Alccofine with cement and Granite powder with replacement of fine aggregate for 28 days is 49.08N/mm².

Table 6 Compressive Strength

Mix groups	7 Days	14 Days	28 Days
R	31.65	38.45	48.07
K_1	30.7	38.97	44.97
K_2	31.1	39.1	46.1
K_3	31.6	39.6	49.08
K_4	30.2	37.2	47.2
K_5	29.1	35.1	43.1

Tensile Strength

The Tenslie strength of 7 days, 14days and 28 days increased by 2.76N/mm², 3.23N/mm² and 389N/mm² respectively than that of control mix M35. The Tensile strength of replacement of Alccofine with cement and Granite powder with replacement of fine aggregate for 28 days is 3.89N/mm².

Table 7 Tensile Strength

Mix groups	7 Days	14 Days	28 Days
R	2.08	2.58	3.10
K_1	2.19	2.89	3.32
K_2	2.12	3.10	3.61
K_3	2.76	3.23	3.89
K_4	2.42	3.02	3.42
K_5	2.26	2.86	2.93

Flexural Strength

The Flexural strength of 7 days, 14days and 28 days increased by 2.76N/mm², 3.23N/mm² and 389N/mm² respectively than that of control mix M35. The Flexural strength of replacement of Alccofine with cement and Granite powder with replacement of fine aggregate for 28 days is 3.89N/mm².

Table 8 Flexural Strength

Mix groups	7 Days	14 Days	28 Days
R	7.4	7.6	8.0
K_1	8.1	8.2	8.2
K_2	8.3	8.4	9.9
K_3	8.6	9.1	10.5
K_4	8.2	8.3	9.2
K_5	7.6	7.7	8.2

CONCLUSIONS

- Granite powder and alccofine can be used in a combination as supplementary cementitious material as partial replacement of cement and Fine aggregate
- 15% alccofine with 15% Granite powder (K3) gives 32% increase in compressive strength which is 31.6N/mm^2 of this newly modified concrete in comparison with conventional concrete of M35 grade which is optimum amongst other combinations within 7 Days.
- 15% alccofine with 15% Granite powder (K3) gives 34% increase in compressive strength which is 39.6 N/mm^2 of this newly modified concrete in comparison with conventional concrete of M35 grade which is optimum amongst other combinations within 14 Days.
- 15% alccofine with 15% Granite powder (K3) gives 42% increase in compressive strength which is 49.08 N/mm^2 of this newly modified concrete in comparison with conventional concrete of M35 grade which is optimum amongst other combinations within 28 Days.
- 15% alccofine with 15% Granite powder (K3) gives increase in Tensile strength which is 2.76N/mm^2, 3.23N/mm^2 and 3.89N/mm^2 within 7 Days, 14 Days and 28 Days alternatively.
- 15% alccofine with 15% Granite powder (K3) gives increase in Flexural strength which is 8.6N/mm^2, 9.1N/mm^2 and 10.5N/mm^2 within 7 Days, 14 Days and 28 Days alternatively.
- Percentage increase in Granite Powder results in decrease of strength parameters i.e. combination having 20%, 25%, 30% of Granite Powder gives less increase in results for this mix proportion.

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