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Experimental Investigations on concrete by using replacement of granite sludge powder

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ABSTRACT
The most commonly used fine aggregate is rive sand. Now-a-days river sand availability is very low so an alternative is made. Granite sludge powder (GSP) it is a byproduct obtained from the granite industries while cutting the granite rocks. Then the granite sludge waste are transported and disposal on the land. The disposal of granite sludge powder cause environmental problem so it is used as an replacement of fine aggregate in the concrete mix. The use of waste product helps in reducing disposal problems and economical. The % of adding granite sludge powder are 40%, 60%, 80% and 100% in M25 grade concrete. The tests conducted on concrete are compressive test, split tensile strength, flexural strength of concrete at 7,14 and 28 days is determined and compared the strength improvement with conventional concrete.

1. INTRODUCTION

Concrete is the most popular material in the world. The concrete is an pourable mix used are cement, sand, aggregate and water. Fine aggregate is an essential components of concrete. The most commonly used fine aggregate in natural river sand. River sand is mainly used for production of concreteand production of sand mortar. It is obtained by digging from river bed. It improves the workability of concrete and mortar compared with other alternatives such as fly ash, silica fume, fume etc so it is used as a fine aggregate.The non availability of sufficient quantity of ordinary river sand for making cement concrete is affecting the growth of construction industries. Tamil Nadu government has imposed restrictions on sand removal from the river beds due to its undesirable impact on the environment. The construction industries in developing countries are identifying alternative materials to reduce the demand of river sand.

Granite sludge powder is an waste material from granite industry. It is an by product obtained from the granite industry while cutting the granite rocks. It is in the form of slurry, a mud made of powder and waste. The percentage of adding granite sludge powder are 40%, 60%, 80% and 100% in M25 grade concrete. The test conducted on concrete are compressive strength, split tensile strength and flexural strength of concrete at 7^{th} , 14^{th} and 28^{th} days are determined and compared the strength improvement with conventional concrete.

Figure.1 Granite sludge powder

1.1 OBJECTIVE

1) To Determine the degree of strength improvement in concrete obtained with the addition of granite sludge powder
2) To compare the strength characteristics and economy with conventional concrete and concrete made of using granite sludge waste and to determine the physical properties and characteristics of concrete made of granite sludge powder

1.2 SCOPE

1) River sand is now demand so we are using granite sludge waste
2) The possibility of maximum replacement level of sand with granite sludge waste will helps to improve concrete quality
3) Disposal of granite sludge waste creates environment issues and landfill problem. It is good alternative during construction process

2. MATERIAL USED

2.1 Cement

Portland pozzolano cement (grade 53) available in local market. The cement used as been tested for various proportion as per IS :4031-1998

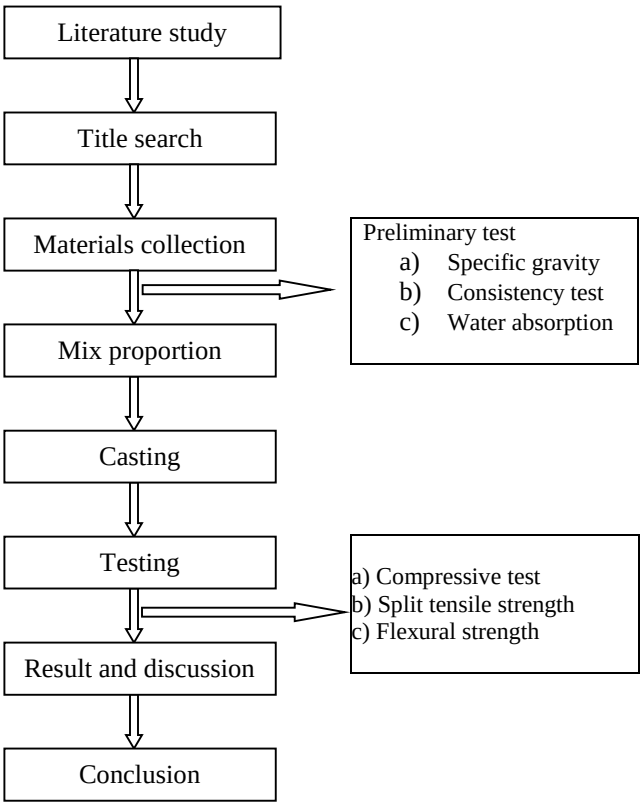
2.2 Aggregate

Aggregate are the important constituent in the concrete reduces shrinkage and economy. These are the chemically inert material which form the bulk of the cement concrete. These aggregate are bound together by means of cement. These aggregates are classified into two categories as coarse aggregate and fine aggregate. The M-sand is used as fine aggregate conforming to the requirement of IS :383-1970.

2.3 Water

Water fit for drinking is suitable for concrete mix. Impurities in the water may affects the seeting time and strength of the concrete. Normal available drinking water is used in the project.

3. METHODOLOGY



4. MATERIAL PROPERTIES

4.1 Property of cement

The Cement used in this project work exhibits the following property,

Table 1. Physical Properties of Cement

Name of the tests	Tested value
Standard consistency test	30%
Initial setting time	30 min
Final settimg time	2 hours
Standard consistency	30%

4.2 Sand

The sand was tested as per IS:2386 (Part III) -1963. The sand used in this project exhibits the following property,

Table 2. Test results of M-sand

Name of the tests	Tested value
Specific gravity	2.55
Water absorption	1.5%
Fineness modulus	3.95%

4.3 Coarse Aggregate

The coarse aggregate used in the project work exhibits the following property,

Table 3. Test results of coarse aggregate

Name of the tests	Tested value
Specific gravity	2.68
Water absorption	0.65%
Fineness modulus	6.19%

5. TEST ON FRESH CONCRETE

Using the slump cone test the workability of fresh concrete of the different mixes 40%, 60%, 80% and 100% are tabulated below,

Table 4. Slump cone test

S.NO	Mix proportion	Slump value (mm)
1	CC	73
2	40%	50
3	60%	60
4	80%	65
5	100%	50

6. EXPERIMENTAL INVESTIGATION ON CONCRETE

6.1 Compressive strength

The compressive strength is determined by dividing the maximum of failure load of the specimen during the test by the cross section area of the specimen. The test done for 7^{th} , 14^{th} and 28^{th} days are determined

Table 5. Compressive strength

S.NO	MIX %	Compressive strength (N/mm^2)		
		7 DAYS	14 DAYS	28 DAYS
1	CC	17.61	18.8	24.5
2	40%	16.3	17.5	20.5
3	60%	15.4	16.2	22.6
4	80%	13.4	18.1	23.7
5	100%	14.5	17.3	16.4

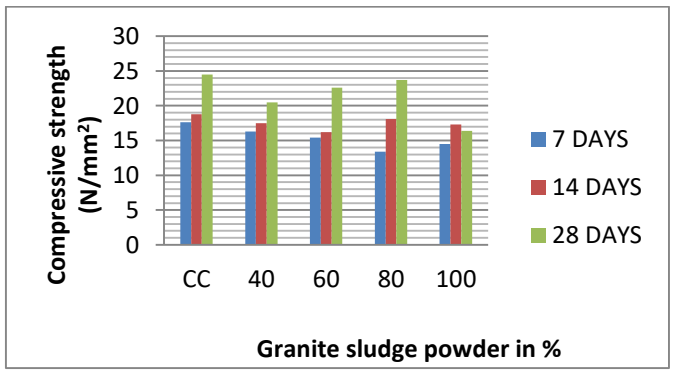


Figure.2 Compressive strength of cube

Figure.3 Testing of compressive strength

Figure.5 Testing of split tensile strength

6.2 Split tensile strength

Cylinder of size 150 mm X 300 mm were used to determine the split tensile strength. The test done for 7 , 14 and 28 days are determined.

Table 6. Split tensile strength

S.NO	MIX %	Split tensile strength (N/mm^2)		
		At 7th day	At 14th day	28th day
1	CC	2.3	2.4	2.43
2	40%	2.27	2.28	2.54
3	60%	1.7	2.15	2.40
4	80%	1.59	2.55	2.63
5	100%	1.66	2.44	2.25

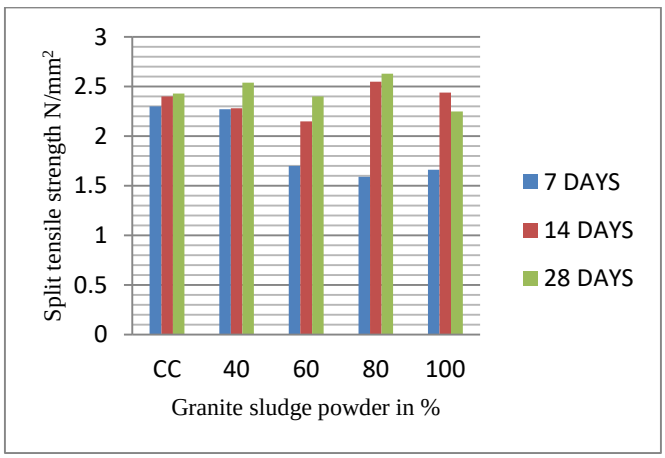


Figure.4 Split tensile strength

6.3 Flexural strength

Flexural strength is to determine the load at were the concrete member may crack. The specimen sizes 500 mm X 100mm X 100mm were used to determine the strength. The test done for 7 , 14 and 28 days are determined.

Table 7. Flexural strength

S.NO	MIX %	Flexural strength (N/mm^2)		
		At 7th day	At 14th day	At 28th day
1	CC	2.27	2.43	3.47
2	40%	2.11	2.57	2.67
3	60%	2.62	2.40	2.57
4	80%	2.85	2.68	2.9
5	100%	2.72	2.25	2.2

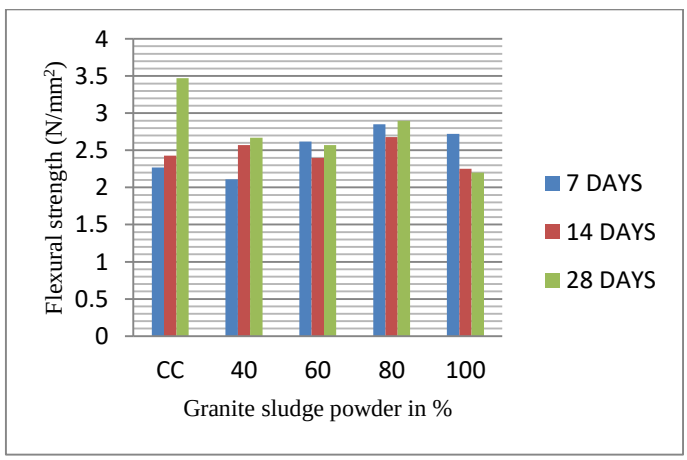


Figure.6 Flexural strength

Figure.7 Flexural strength

6. CONCLUSION

Compressive strength test, split tensile strength and flexural strength was tested for 7 ,14 and 28 days. From the above above results, the use of granite sludge powder up to 80% replacement with the fine aggregate is recommendable. 19% increment in compressive strength is observed. The replacement of fine aggregate is found that beyond 80% the strength is decreased.

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