

Experimental Investigation on Effect of Sisal Fiber by partial substitution of Fine Granite Waste in Concrete Composition

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ABSTRACT: Concrete is an artificial stone resulting from hardening of rationally chosen mixture of cement, fine aggregate, coarse aggregate and water. Sustainable development in the construction industry involves use of non-conventional innovative materials in order to compensate the lack of natural resources to find alternative ways for conserving the environment. In the present day, it deals with effect of fine granite waste based on sisal fiber concrete with results presented in this study from part of an investigation on the use of granite waste as partial replacement for natural sand as fine aggregate and sisal fiber is additionally added to the weight of cement in concrete. Hence, an attempt has made to study the compressive strength and the tensile strength of concrete using different proportions i.e., Granite waste at an interval of 10% up to 50% and Sisal fiber at 0.5% in concrete mixes to finalize the optimum % of mix which can yield better strength properties.

"In the present study, we are investigate on mechanical (compressive strength and split tensile test). Properties of concrete by adding fine granite waste as partially replacement of sand in various percentages i.e., 10%, 20%, 30%, 40% and 50% respectively and by adding sisal fiber additionally to the wt. of cement in 0.5%. Test results showed that there is increase in the strength properties up to 30% partial replacement of fine aggregate with fine granite waste & 0.5% addition of sisal fiber and also its observed that there is decrease in strength properties when more than 30% of fine granite waste is added."

KEYWORDS: Strength properties, compressive strength, tensile strength, granite waste, sisal fiber, performance.

I. INTRODUCTION

Concrete is a combination of cement, fine and coarse aggregates and water, which are mixed in a particular proportion to get a particular strength. The cement and water react together chemically to form a paste, which binds the aggregate particles together. Now-a-days, due to high global consumption of natural sand, sand deposit are being depleted and causing serious threat to environment as well as society. River sand is becoming a scarce commodity and hence an exploration alternative to it has become imminent. Manufactured sand is the good alternative to river sand and it is purposely made, fine crushed aggregate produced under controlled conditions from a suitable sand source rock. Concrete is most widely used construction material in world. It is manmade building material it can be mould into any shape. Concrete is composite material having properties of high compressive strength, low tensile strength, low post cracking capacity, brittleness and low impact strength. These properties can be improved by addition of fiber in the concrete. The fibers are dispersed and distributed randomly in the concrete during mixing and this improves certain properties like tensile strength, flexural strength etc. Fiber reinforced concrete can be defined as composite materials consist of cement based matrix containing an ordered or randomly distributed of fibres. The common fibers used in the concrete are steel, glass, asbestos, jute, coir, polypropylene, nylon, sisal. The uses of sisal fibers in the concrete are going to improve the mechanical properties of concrete.

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II. OBJECTIVE OF THE WORK

The present study is aimed at the study the material properties of concrete constituents. The objectives of the present study are: The primary objective of this is to study the workable properties of fine granite powder replaced with fine aggregate and on the effect of sisal fiber additionally added by the weight of cement. The natural fine aggregate is replaced by fine granite powder at an interval of 10% upto 50% and 0.5% of sisal fiber to finalize the optimum % at which % of replacement can yield better strength properties.

III. MATERIALS AND METHODOLOGY

Following are the materials which are used in the present study:

FINE GRANITE WASTE

Fine granite waste is one of the most used among such materials to replace river sand, which can be used as an alternative to fine aggregate in concrete. Fine granite waste is a fine aggregate that is produced by crushing stone, gravel or slag. Used for aggregate material less than 4.75 mm that is processed from crushed rock or gravel and intended for construction use. Fine granite waste is a material of high quality, in contradiction to non-refined surplus from coarse aggregate production. Fine granite waste is widely used all around the world and technicians of major projects around the world insist on the compulsory use of fine granite waste because of its consistent gradation and zero impurity.

Chemical Composition of Fine Granite Waste:

S.No	Constituents	% present in Granite powder
1	Alumina(Al_2O_3)	14.72
2	Magnesium oxide(MgO)	0.71
3	Calicum oixide(CaO)	1.82
4	K_2O	4.12
5	Na_2O	3.69
6	Silica(SiO_2)	72.04
7	Fe_2O_3	1.22

SISAL FIBER

Sisal Fiber is one of the most widely used natural fiber and is very easily cultivated. It is obtain from sisal plant. The plant, known formally as *Agave sisalina*. These plants produce rosettes of sword-shaped leaves which start out toothed, and gradually lose their teeth with maturity. Each leaf contains a number of long, straight fibers which can be removed in a process known as decortications. During decortications, the leaves are beaten to remove the pulp and plant material, leaving the tough fibers behind. The fibers can be spun into thread for twine and textile production, or pulped to make paper products.

Sisal fiber is fully biodegradable, green composites were fabricated with soy protein resin modified with gelatin. Sisal fiber, modified soy protein resins, and composites were characterized for their mechanical and thermal properties. It is highly renewable resource of energy. Sisal fiber is exceptionally durable and a low maintenance with minimal wear and tear. Its fiber is too tough for textiles and fabrics. It is not suitable for a smooth wall finish and also not recommended for wet areas.

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Chemical Composition of Sisal Fiber:

Constitute	Content
Cellulose	65%
Hemicelluloses	12%
Lignin	9.9%
Waxes	2%
Total	100%

IV. PREPARATION OF SAMPLES

The concrete cubes and cylinders were prepared to test the compressive strength and split tensile strength of concrete. For the preparation of cubes and cylinders, metal moulds steel or cast iron is used. These moulds should be of sufficient thick to prevent distortion. These moulds are made in such a manner to facilitate the removal of moulded specimen without damage. Each mould is provided with a base plate having a plane surface. The base plate is of such a dimensions to support the mould during the filling without leakage and it is preferably attached to the mould by screws. The interior surface of the mould is thinly coated with oil to prevent adhesion of concrete. After all these preparations, the concrete ingredients namely cement, fine aggregate, coarse aggregate and water in required proportions are thoroughly mixed in dry condition until uniform color is achieved. Then the water is added in required proportions and again mixed thoroughly. Then the concrete is placed in the mould.

CONVENTIONAL CUBES AND CYLINDERS:

Number of cubes casted= 6 (3 for 7 days & 3 for 28 days)
Number of cylinders casted = 6 (3 for 7 days & 3 for 28 days)

V. RESULTS AND DISCUSSION

Based on the experimental investigations, the results of cubes & cylinders are presented below:
The below table represents that the values of compressive strength and split tensile strength of various percentages i.e., 0%, 10%, 20%, 30%, 40%, 50% of granite waste fines with 0.5% of sisal fiber.

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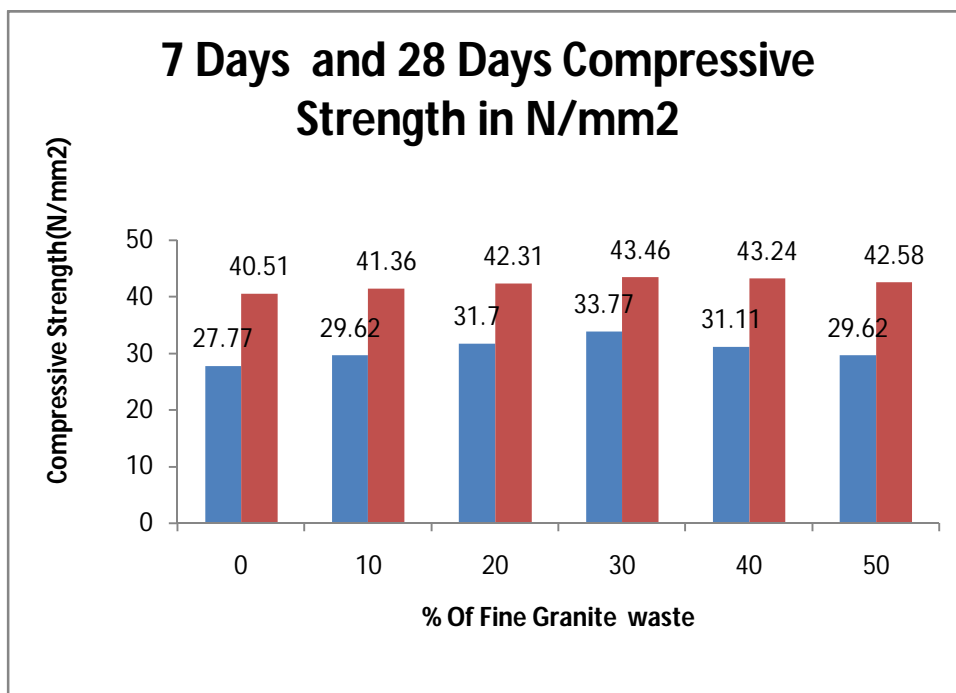
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No. Of days	PERCENTAGE(%)	Avg. Compressive Strength(N/Mm ²)	Avg. Split Tensile Strength(N/mm ²)
7 days	0%	27.77	1.64
	10%	29.62	1.73
	20%	31.7	2.49
	30%	33.77	2.82
	40%	31.11	2.72
	50%	29.62	1.59
28 days	0%	40.51	1.98
	10%	41.36	2.21
	20%	42.31	2.90
	30%	43.46	3
	40%	43.24	2.97
	50%	42.58	2.26

COMPARISION OF 7 DAYS AND 28 DAYS COMPRESSIVE STRENGTH



The above graph represents that the Comparison of 7-days and 28 days compressive strength with different % replacement of granite fines as fine aggregate with 0.5% of sisal fiber.

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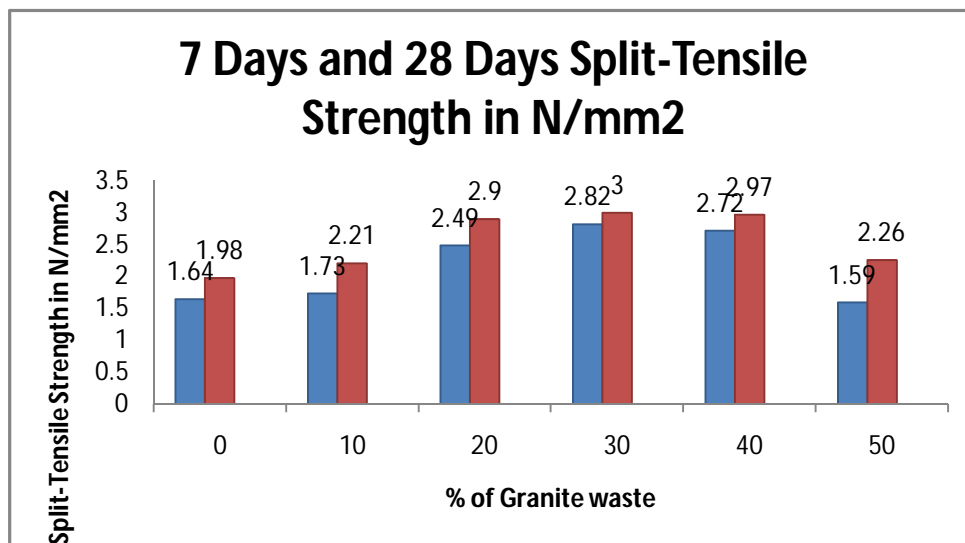
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COMPARISION OF 7 DAYS AND 28 DAYS SPLIT-TENSILE STRENGTH

The above graph represents that the Comparision of 7-days and 28 days Split Tensile strength with different % replacement of granite fines as fine aggregate



VI. CONCLUSIONS

- The strength and durability characteristics of concrete mixtures have been computed in the present work by replacing 0%, 10%, 20%,30%,40% and 50% sand with the Fine Granite Powder. On the basis of present study, following conclusions are drawn.
- The cost of concrete is less than conventional concrete. The concrete becomes environment friendly, due to use of waste industrial material.
- Concrete produced using Fine Granite waste as partial replacement of fine aggregate has influence on the properties of the concrete.
- The Normal Concrete average Compressive Strength for 7-days is 27.77 N/mm² and for 28-days is 40.51 N/mm²
- The maximum compressive strength when fine aggregate is replaced with fine granite waste in concrete cubes gives 33.77 N/mm² for 7-days and 43.46 N/mm² for 28-days at 30% replacement.
- The Normal Concrete average split tensile Strength for 7-days is 1.64 N/mm² and for 28-days is 1.98 N/mm².
- The maximum split tensile strength when fine aggregate is replaced with fine granite waste in concrete cubes gives 2.82 N/mm² for 7-days and 3 N/mm² for 28-days at 30% replacement.
- There is an increase of 17% compressive strength for 30% replacement of fine aggregate compare with normal concrete for 7-days and 8.74% increase in strength for 28-days.
- The split tensile strength also follows the similar pattern compare with the compressive strength that is at 30% replacement of fine aggregate with waste granite fines it shows the maximum split tensile strength.
- Hence, we can conclude from the above results that the maximum compressive and split tensile strength is obtained at 30% replacement of fine aggregate with waste granite fines.

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