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AN EXPERIMENTAL ATTEMPT ON PLAIN CEMENT CONCRETE USING MARBLE DUST

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Abstract

Demand for cement continues to grow, and also increase in the cost of conventional building materials; for this objective, the use of industrial waste products and agricultural by products are very constructive. These industrial and agricultural by products such as Fly Ash, Rice Husk Ash, Silica Fume, Marble Dust and Slag etc can be used as cementing materials because of their pozzolanic behavior, and natural fibers like jute fiber, Coconut fiber can be used to increase the tensile strength of concrete, which otherwise require large tracts of lands for dumping, thus the concrete industry offers an ideal method to integrate and utilize a number of waste materials, which are easily available, and economically within the buying powers of an ordinary man. Presence of such materials in cement concrete not only reduces the carbon dioxide emission, but also imparts significant improvement in Tensile strength, and Compressive strength. The present study is carried out for evaluating the influence of Marble Dust and Coconut fibers in M25 & M30 grade concrete. This study presents the results of workability, compression test and split tensile test on concrete which were casted with various percentage of Coconut fibers ranging from0.75% to 1.25% at a regular interval of .25% and Marble Dust ranging from 7.5% to 12.5% at regular interval of 2.5%.

Keywords- *Marble dust, coconut fiber split tensile strength, compressive strength, standard concrete.*

I. INTRODUCTION

Concrete is one of the widely accepted construction material
in the development of infrastructure. It perfectly matches with several requirements like strength, durability, impermeability, and fire-resistance and abrasion resistance with this advantages it has some shortcomings like shrinkage and cracking low tensile and flexural strength poor toughness, high brittleness, low shock resistance that restricts its application. To overcome these deficiencies additional material called fibers are used to improve the performance of concrete. Fiber reinforced concrete is cement based composite material. It has been used in construction to improve tensile and flexural strength of concrete. India produces around 960 million tons of solid wastes which pose a major environment and ecological problem. The environmental impact can be reduced by making more sustainable use of this waste. On the other hand, recycling waste without properly based scientific research and development can result in environmental problems greater than the waste itself. As building maintenance continues to be deferred on academic campuses, building conditions continuallydecline more and more each year. For educational buildings, resources and assets must be well kept, in working conditionand more importantly safe. By deferring maintenance perpetually these buildings may fall beyond the chance of renovation and into building failure.[8] One of the logical means for reduction of this waste is utilizing them in building industry itself. Emission of co_2 can also decrease by replacing cement by appropriate material from this waste.

Materials

Marble Dust

Marble is type of metamorphic rock that forms from limestone, dolomite, or older marble under certain conditions. These conditions are heat and pressure over a period of time inside the earth's crust. The application of heat and pressure force the limestone to change. In a process called recrystallization, the limestone is altered to form coarse grained calcite. The composition of the resulting marble will be affected by the different impurities that may be present in the limestone before recrystallization takes place. India produces around 960 million tons of solid wastes which pose a major environment and ecological problem. In this regard one of the major industrial wastes is the marble sludge produced by marble processing industries. In this regard one of the major industrial wastes is the marble sludge produced by marble processing industries. In India, marble processing industry generates around 7 million tons of wastes mainly in the form of powder during sawing and polishing processes. These are dumped in the open which pollute and damage the environment. The pollution issue is a serious cause of concern in the state of Rajasthan since there are around 4000 marble mines and about 1100 marble cutters in medium sector spread over 16 districts of Rajasthan. Generally, the marble wastes are being dumped in any nearby pit or vacant space near the marble processing industries, although notified areas have been marked for dumping the same. This leads to increased environmental risks as dust pollution spreads alongside for a large area. In the dry season, the dust dries up, floats in the air, flies and deposits on crops and vegetation. In addition, the deposition of such generated huge amount of fine wastes certainly creates necrotic ecological conditions for flora and fauna changing landscapes and habitats. The accumulated waste also contaminates the surface and underground water

reserves One of the logical means for reduction of the waste marble masses is utilizing them in building industry itself. The aim is to reduce, reuse, or recycle waste, the latter being the preferred option of waste disposal.

Fig 1.1: Physical View of Marble Powder

Coconut fiber

Coconut fiber is extracted from the outer shell of a coconut.. Coir fibers are found between the hard, internal shell and the outer coat of a coconut. The individual Fibre cells are narrow and hollow, with thick walls made of cellulose. They are pale when immature, but later become hardened and yellowed as a layer of lignin is deposited on their walls. Each cell is about 1 mm (0.04 in) long and 10 to 20 µm (0.0004 to 0.0008 in) in diameter. Fibers are typically 10 to 30 centimeters (4 to 12 in) long. There are two types of coconut fibers, brown fiber extracted from matured coconuts and white fibers extracted from immature coconuts. Brown fibers are thick, strong and have high abrasion resistance. White fibers are smoother and finer, but also weaker. There are many general advantages of coconut fibers e.g. they are moth-proof, resistant to fungi and rot, provide excellent insulation against temperature and sound, not easily combustible, flame-retardant, unaffected by moisture and dampness, tough and durable, resilient, springs back to shape even after constant use, totally static free and easy to clean. Coconut fibers are commercial available in three forms, namely bristle (long fibers), mattress (relatively short) and decorticated (mixed fibers). These different types of fibers have different uses depending upon the requirement. In engineering, brown fibers are mostly used.

Fig 1.2: Physical View of coconut fiber

II. EXPERIMENTAL PROGRAMME

The coconut fibers were used for the purpose of this dissertation work. The length of the individual fiber is 2mm. Fibre of 0.75%, 1% and 1.25% by the weight of the cement were suggested in this study. The binder consists of ordinary Portland cement. The coarse aggregate used was 20mm maximum size. Naturally available fine aggregate were used for the study wok. The coir fiber was randomly layered in the mix.

For fresh concrete, the standard slump cone test was conducted according to the IS: 1199-1959 for all mixes immediately after the mix was completed. Cubic samples 150 x150 x 150 mm were used for compressive strength. The concrete cube specimen were

taken out from the tank, their surfaces were dried of excess water, cleaned and kept in the laboratory for a few minutes to obtain saturated dry surfaces specimens. Then their weight and dimensions were measured and noted.

The specimens were tested at various ages i.e. 7 days and 28 days (3 cubes at each age) for compressive strength. Control mix details are listed in the table 1 below

Table-1 Mix details

Contents				
Grade	Cement kg/m^3	Water kg/m^3	FA kg/m^3	CA kg/m^3
M25	372	197	811	1094
M30	425	197	791	1067

III. RESULTS AND DISCUSSIONS

3.1. Slump of the fresh concrete

Table-2 Slump in mm

Grade	Coir Fiber percentage (%)		
	0.75%	1%	1.25%
M25	50	45	40
M30	45	40	35
Grade	Marble Dust percentage (%)		
	7.5%	10%	12.5%
M25	40	35	30
M30	45	35	30

Increasing the percentage of coir fiber as an addition by weight of cement and replacement of marble dust by weight with cement leads to a decrease in slump. This is mainly due to the fact that both materials absorbs the water from fresh concrete and results in a decrease in workability.

Strength of the concrete

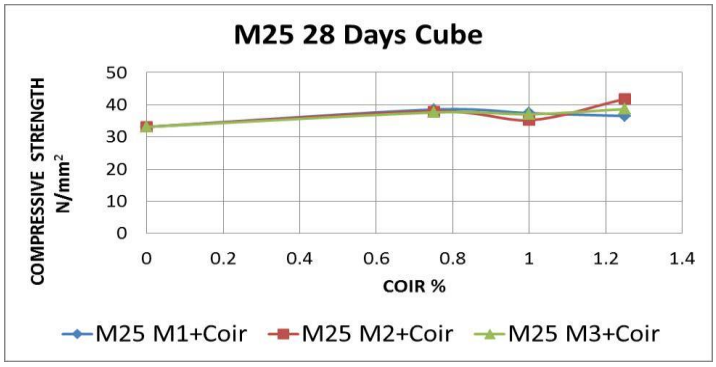
Compressive strength

Table-3 Compressive Strength for M25 grade at age of 7 days and 28 days

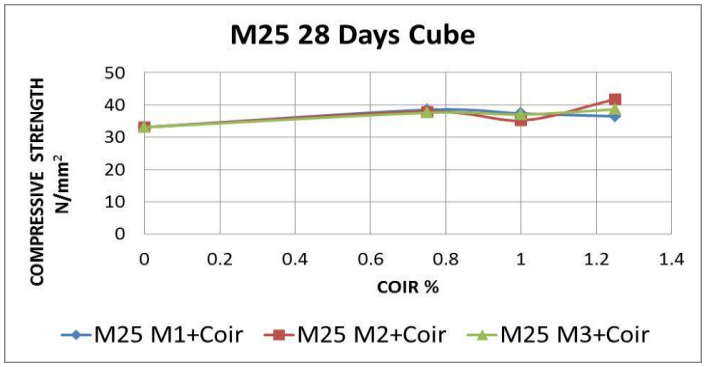
NO.	MIX	COMPRESSIVE STRENGTH	
		(7 Days) N/mm^2	(28Days) N/mm^2
1	NC	21.73002	33.11
2	7.5%M	24.7893	32.02
3	10%M	18.28696	29.85
4	12.5%M	23.82828	36.75
5	0.75%C	24.00211	35.55
6	1.0%C	25.80427	37.47
7	1.25%C	23.51023	34.89

8	7.5%M +0.75%C	28.54201	38.49
9	7.5%M +1.0%C	26.04857	37.38
10	7.5%M +1.25%C	26.84458	36.50
11	10%M +0.75%C	20.43352	37.96
12	10%M +1.0%C	27.84966	35.19
13	10%M +1.25%C	24.91956	41.78
14	12.5%M+0.75%C	28.1457	37.59
15	12.5%M +1.0%C	27.28316	37.04
16	12.5%M+1.25%C	27.37074	38.65

Results of 7 days and 28 days indicate the increase in the compressive strength at various coir fiber and marble dust percentages added for M25 and M 30 grades of concrete.



Graph-1 Compressive strength of M25 Grade at the age of 28 days



Graph-2 Compressive strength of M30 Grade at the age of 28 days

IV. CONCLUSION

- Fresh properties results showed that with increase in amount of Marble Dust (MD) and Coir Fibre (CF) workability decreased for all grade of concrete.

For M25 grade,

- The compressive strength of concrete with 10% of MD replacement and 1.25% of CF addition with cement increase about 20% in comparison with normal concrete.

- The split tensile strength of concrete with 10% of MD replacement and 1% of CF addition with cement increase about 9.28% in comparison with normal concrete.

For M30 grade

- The compressive strength of concrete with 10% of MD replacement and 1% of CF addition with cement increase about 12% in comparison with normal concrete.

- The split tensile strength of concrete with 10% of MD replacement and 0.75% of CF addition with cement increase about 10.6% in comparison with normal concrete.

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