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AN EXPERIMENTAL STUDY ON THE USE OF PLASTIC BOTTLE CAPS AS A REPLACEMENT MATERIAL IN FIBRE CONCRETE

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ABSTRACT

The aim of this study is to Using waste product like bottle caps and coir fibre to make ecofriendly concrete. Large quantities of waste can be generated from empty cans and bottle caps of juices and soft drinks. This study is aimed at addressing such issues by investigating the possibility of using waste bottle caps to partially substitute for coarse aggregate in concrete production. Hence an attempt has been made in present investigations to study the influence of addition of waste materials bottle caps dosage of 0%, 1%, 2%,3% , 4% & 5% of total weight of coarse aggregate .M20 grade of concrete was produced by replacing coarse aggregate by plastic bottle caps .Coir fibre is a natural fibre is a natural consist of cellulose , lignin ,pentosans and ash in varying percentage when dried . Also coir fibre is locally and economically available. Hence an attempt has been made in present investigations to study the influence of addition of coir fibre dosage of 2% of total weight of cement. Addition of coir fibre increases the crack resistance of concrete, produces the structural light weight material. Hence coir fibre can be used in construction and can reduce environmental waste by proper utilization. Also the use of coir fibre is cost effective and ecofriendly.

KEYWORDS: ***Bottle caps, compressive strength, split tensile and flexural strength test.***

1. INTRODUCTION

Concrete, it is the most widely used material for the construction. Concrete is weak in tension and strong in compression. Due to rapid industrialization & urbanization in the Country, lots of infrastructure developments are taking place. This process has in turn led questions to mankind to solve the problems generated by this growth. The problems decorated are acute shortage of constructional materials increased dumping of waste products. Hence in order to overcome the above said problems waste products should be employed as construction material. Looking forward the scenario of present life style a complete ban on the use of plastic cannot be put, although the waste plastic taking the face of devil for the present and future generation. We cannot ban use of plastic but we can reuse the plastic waste. Quantities of plastic wastes have increased rapidly throughout this decade due to its beneficial properties of low density, light weight and strength. Other important factors such as low cost and friendly design were the reason polymer product becomes an inseparable part of our lives.

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2. OBJECTIVE

- To manage industrial waste.
- To find the alternative of basic materials which are used in constructionfrom past many years?
- To compare the mechanical properties of polypropylene cap in concrete with control concrete.
- To design the mix ratio for M20 grade of concrete
- To test the specimens
- To determine the compressive, flexural and split tensile strength of concrete by adding waste bottle caps and coir fibres by varying percentages.
- To compare the strength behaviour with normal concrete.

3. MATERIALS USED

Cement:

43 Grade Ordinary Portland Cement (OPC) confirming to IS 8112-1989 is used in this project.

Fine aggregate:

Fine aggregate used in this project was locally available and confirming to zone II with specific gravity 2.62.

The testing of Fine aggregate was done as per Indian Standard Specification IS: 383-1970.

Coarse aggregate:

20 mm and down size and specific gravity 2.93 was used. Testing of coarse aggregate was done as per Indian Standard Specification IS: 383-1970.

Plastic bottle caps:

Plastics collected from the disposal area were sorted to get the superior one. Plastic is a non-biodegradable material and researchers found that the material can remain on earth for 4500 years without degradation. Several studies have proven the health hazard caused by improper disposalof plastic waste.

Coir fibre:

Coir fibre is a natural fibre is a natural consist of cellulose, lignin, pentosans and ash in varying percentage when dried . Also coir fibre is locally and economically available. Addition of coir fibre increases the crack resistance of concrete, produces the structural light weight material and the suitable alternative partial replacement for natural river sand in order to overcome the lack of that. Hence coir fibre can be used in construction and can reduce environmental waste by proper utilization.

4. METHODOLOGY

The methodology followed to carry out the project work. As the result of literature study, the properties of plastic bottle caps and coir fibre are obtained regarding mix design procedures. Using that information, the preliminary tests are done to obtain the data for mix design formulation. After achieving a complete mix design procedure, plastic bottle cabs and coir fibre of trial mixes are prepared to check the target Strength. Then possible replacements are studied and finalized.

Fig.4.1 Flow chart for methodology

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5. MIX PROPORTIONING

Mix	Water (Kg)	Cement (Kg)	Fine aggregate (Kg)	Coarse aggregate (Kg)	Plastic bottle caps	Coir fibre
M1	8.83	17.86	40.46	58.69	0.00	0.00
M2	5.22	9.5	19.6	32.3	0.323	0.095
M3	6.52	11.84	24.44	40.26	0.8052	0.2368
M4	6.52	11.84	24.44	40.26	1.2078	0.3552
M5	5.22	9.5	19.6	32.3	1.292	0.38
M6	5.22	9.5	19.6	32.3	1.292	0.38

Table 5.1 Mix Proportioning

6. CASTING OF SPECIMEN

S.No	Mix	No. of Specimen			Total
		Cube	cylinder	prism	
1	M1	6	6	6	18
2	M2	6	6	6	18
3	M3	6	6	6	18
4	M4	6	6	6	18
5	M5	6	6	6	18
6	M6	6	6	6	18

Table 6.1 Casting of Specimen

7. TEST RESULTS AND DISCUSSIONS

7.1 General

Cubes were casted with W/C ratio of 0.50 by considering the replacement of bottom ash in percentages. The casted cubes are texted for, 14days and 28days to study their strength performance with the conventional concrete.

7.1.2 Compressive strength test replacement concrete:

1. The conventional concrete 7&28 day's test was conducted. The average compression value was 535 kN.
2. Then replacement are made in concrete and placed into the compression testing machine, applied the half of the load value of the obtained conventional concrete strength. The crack was induced in the cube and then immersed into the water.

TABLE 1
COMPRESSIVE STRENGTH LOAD RESULTS

%	BOTTLE CAPS WITHOUT COIR FIBRE					
	FOR 7DAYS(KN)			FOR 28DAYS(KN)		
0	305	308	314	497	501	503
1	304	306	310	487	491	493
2	294	297	299	484	486	487
3	281	282	284	462	464	465
4	280	281	283	431	433	435
5	251	252	254	388	389	391
%	BOTTLE CAPS WITH 2% COIR FIBRE					
	FOR 7 DAYS(KN)			FOR 28 DAYS(KN)		
0	318	319	321	525	520	528
1	320	321	323	529	531	532
2	325	326	328	533	534	536
3	305	306	308	487	488	490
4	302	304	306	464	465	467
5	267	268	269	416	419	420

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TABLE 2
COMPRESSIVE STRENGTH TEST RESULTS

%	WITHOUT COIR FIBRE		2%WITH COIR FIBRE	
	DAY 7 (N/mm^2)	DAY 28 (N/mm^2)	DAY 7 (N/mm^2)	DAY28 (N/mm^2)
0	13.68	22.29	14.2	23.4
1	13.61	21.84	14.3	23.6
2	13.21	21.6	14.5	23.76
3	12.56	20.66	13.6	21.7
4	12.5	19.25	13.5	20.7
5	11.2	17.3	11.89	18.6

TABLE 3
SPLIT TENSILE STRENGTH TEST RESULTS

%	WITHOUT COIR FIBRE	2%WITH COIR FIBRE
	DAY28 (N/mm^2)	DAY28 (N/mm^2)
0	7	7.30
1	6.97	7.31
2	6.45	6.84
3	6.15	6.50
4	5.80	6.06
5	5.5	5.78

TABLE 4
FLEXURAL STRENGTH TEST RESULTS

%	WITHOUT COIR FIBRE	2%WITH COIR FIBRE
	DAY28 (N/mm^2)	DAY28 (N/mm^2)
0	2.61	2.67
1	2.51	2.71
2	2.46	2.63
3	2.06	2.4
4	2.0	2.3
5	1.78	2.0

7.1.3 Compressive Strength of Concrete In 7 Days Bottle Caps Without Coir Fibres

The compressive strength test was conducted by as per IS 516 (1959). As per IS code, 7th day test result was attained 90 % of the targeted compressive strength. Test results given below are compared with conventional concrete with and without coir fibre and waste plastic caps. From this comparison the conventional concrete strength was better than the conventional concrete with coir fibre and waste plastic caps replaced.

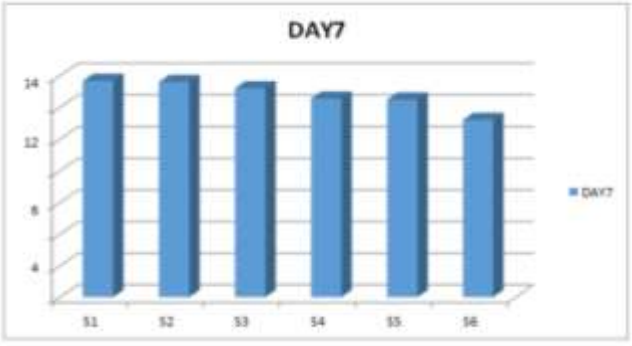

Figure 7.1.3 Compressive strength of concrete in 7days without coir fiber

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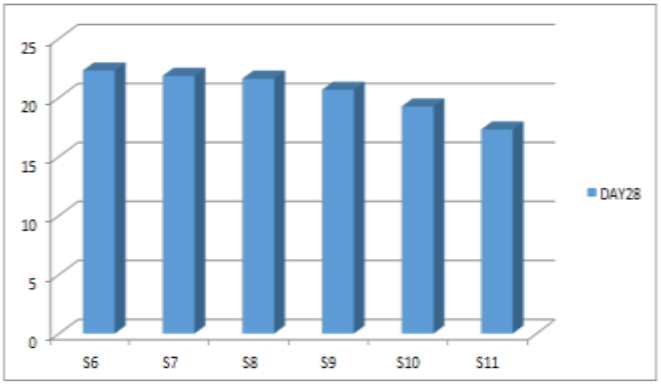
7.1.4 Compressive Strength Of Concrete In 28 Days Bottle Caps Without Coir Fibre

The compressive strength test was conducted by as per IS 516 (1959). As per IS code, 28th day test result was attained 99 % of the targeted compressive strength. Test results given below are compared with conventional concrete with and without coir fibre and waste plastic caps. From this comparison the coir fibre and waste plastic caps replaced is better than conventional concrete strength.



7.1.5 Compressive Strength Of Concrete In 7 Days Bottle Caps With 2% Coir Fibre

The compressive strength test was conducted by as per IS 516 (1959). As per IS code, 28th day test result was attained 99 % of the targeted compressive strength. Test results given below are compared with conventional concrete with and without coir fibre and waste plastic caps. From this comparison the coir fibre and waste plastic caps replaced is better than conventional concrete strength.

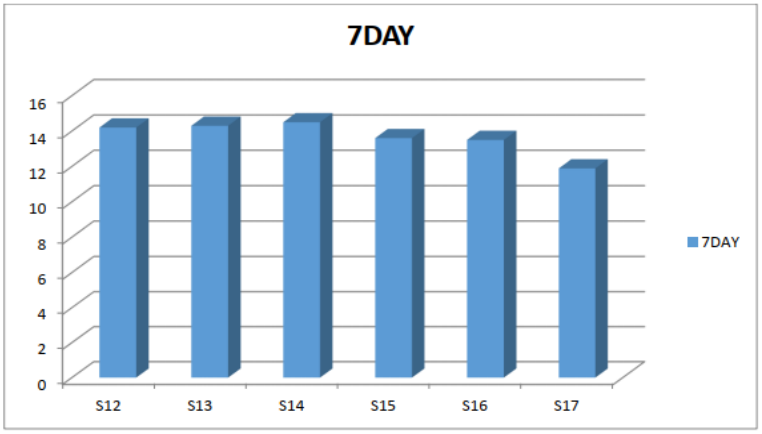


Figure 7.1.5 Compressive Strength of Concrete in 7 DaysWith 2% Coir Fibre

7

.1.6 Compressive Strength Of Concrete In 28 DaysBottle Caps With 2% Coir Fibre:

The compressive strength test was conducted by as per IS 516 (1959). As per IS code, 28th day test result was attained 99 % of the targeted compressive strength. Test results given below are compared with conventional concrete with and without coir fibre and waste plastic caps. From this comparison the coir fibre and waste plastic caps replaced is better than conventional concrete strength.

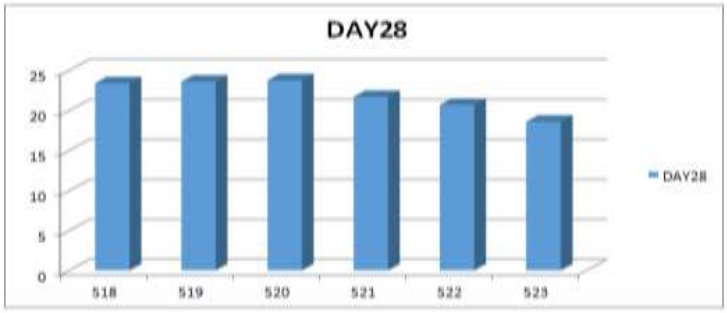


Figure 7.1.6 Compressive Strength Of Concrete In 28 Days With 2% Coir Fibre

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7.1.7 Split Tensile Strength Of Concrete In 28dayBottle Caps Without Coir Fibre:

The split tensile strength test was conducted As per IS code, 28th day test result was attained 99 % of the targeted compressive strength. Test results given below are compared with conventional concrete with and without coir fibre and waste plastic caps. From this comparison the coir fibre and waste plastic caps replaced is better than conventional concrete strength.

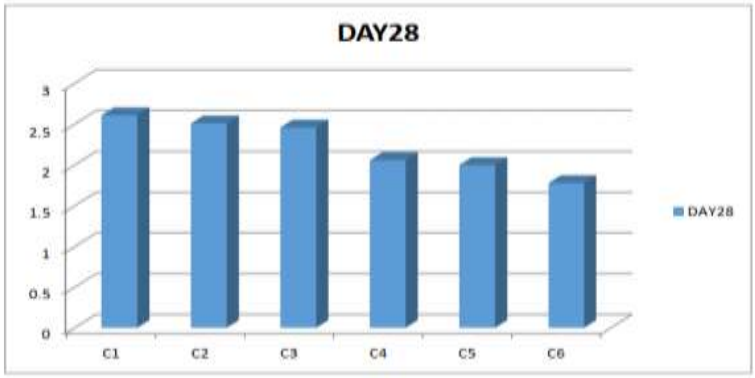

Figure 7.1.7 Split Tensile Strength@28day without CoirFibre

7.1.8 Split Tensile Strength at 28 Day Bottle Caps With 2% Coir Fibre

The split tensile strength test was conducted As per IS code, 28th day test result was attained 99 % of the targeted compressive strength. Test results given below are compared with conventional concrete with and without coir fibre and waste plastic caps. From this comparison the coir fibre and waste plastic caps replaced is better than conventional concrete strength.

Figure 7.1.8 Split Tensile Strength@28day With 2% CoirFibre

7.1.9 Flexural Strength at 28 Day Bottle Caps Without Coir Fibre

The flexural strength test was conducted As per IS code, 28th day test result was attained 99 % of the targeted compressive strength. Test results given below are compared with conventional concrete with and without coir fibre and waste plastic caps. From this comparison the coir fibre and waste plastic caps replaced is better than conventional concrete strength.

Figure: 7.1.9 Flexural Strength@28day without Coir Fibre

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7.2.0 Flexural Strength At 28 Day Bottle Caps With 2% Coir Fibre

The flexural strength test was conducted As per IS code, 28th day test result was attained 99 % of the targeted compressive strength. Test results given below are compared with conventional concrete with and without coir fibre and waste plastic caps. From this comparison the coir fibre and waste plastic caps replaced is better than conventional concrete strength.

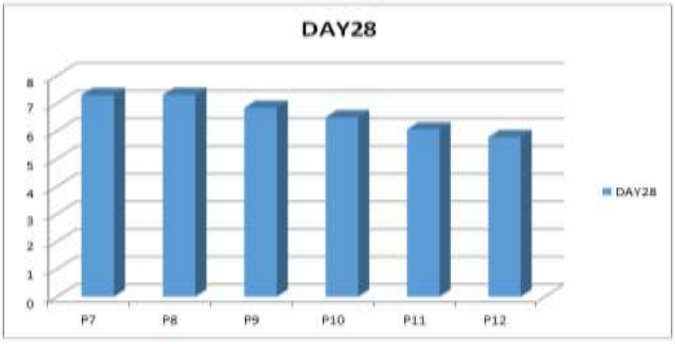

Figure 7.2.0 Flexural Strength@28day With 2% Coir Fibre

8. CONCLUSION

Based on the results obtained from this study, the following conclusions can be drawn:

1. Based on the results obtained from this study, the following conclusions can be drawn:
2. The maximum compressive strength is obtained at 2% replacement of bottle caps at 28 days without adding a coir fibre. While adding coir fibre the maximum compressive strength is obtained at 2%.
3. The maximum Split tensile strength is obtained at 1% replacement of bottle caps at 28 days by without adding the coir fibre. While adding coir fibre at 28days the maximum split tensile strength is obtained at1%.
4. The maximum Flexural strength is obtained at 1% replacement of bottle caps at 28 days by without adding the coir fibre. While adding coir fibre at 28days the maximum flexural strength is obtained at 1%.
5. The test results of this study indicate that there is great potential for utilization of bottle caps in concrete mixes up to 5%.
6. With the utilization of bottle caps in construction industry the waste disposal problems can be solved.

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