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Effect of Flyash on the Strength Characteristics of Waste Plastic Fibre Reinforced Concrete - an Experimental Investigation

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Abstract

In this paper an attempt has been made to study the effect of addition of flyash and replacement cement by flyash in different percentages on the properties of workability and strength characteristics of waste plastic fibre reinforced concrete. The strength characteristics viz., compressive strength, tensile strength, flexural strength, impact strength and workability characteristics are found for waste plastic fibre reinforced concrete, when flyash was added in different percentages viz, 0%, 5%, 10%, 15%, 20%, 25% and replaced in different percentages viz, 0%, 5%, 10%, 15%, 20%, 25%, 30%, 35% and 40% respectively by weight of cement. Waste plastic fibres having an aspect ratio 50 (thickness = 1mm, length = 50mm and breadth = 5mm) were added at the rate of 0.5% (by volume fraction). The results show that upto 10% of flyash can be added and 25% of cement can be replaced by flyash by weight of cement into waste plastic fibre reinforced concrete, without adversely affecting the compressive strength and with advantage in other strength properties.

Keywords: Waste Fibre reinforced concrete, Flyash, Compressive strength, Tensile strength, Flexural strength, Impact strength and Workability characteristics.

Introduction

The ductility of the concrete increases with the addition of fibres, such a composite material is called fibre reinforced concrete. The fibre reinforced concrete, which is also defined as a composite material consisting of a material of cement mortar or concrete and discontinues discrete, uniformly distributed fibres, has gained a wide popularity in the construction industry. The introduction of fibres into the concrete induces many desirable properties to the concrete and such concrete has wide varieties of applications in the field of civil engineering. Many types of fibres like steel, carbon, GI, glass, asbestos fibres can be used for the production of fibre reinforced concrete [1, 4]

It has been found that the addition of small closely spaced and uniformly distributed fibres to concrete would act as crack arrestors and substantially improve the tensile strength, cracking resistance, impact strength, wear and tear and fatigue resistance. The fibre reinforced concrete is very much attracting the attention of researchers and builders as it has several applications in the civil engineering field. It is used for the production of pre-casting elements like pipes, hulls of ships, railway

sleepers, beams, stairways, wall panels, roof panels, roof and floor tiles, manhole covers etc. in its advanced applications FRC can be used in highway payments, airport runway, deck slab construction, water retaining structures, marine structures, blast resistance structures, refractory structures etc [2].

Many types of fibres can be used in the production of FRC. The plastic is becoming a real headache for the environmentalists. The plastic is non biodegradable material. Soil cannot decay it. Water cannot dissolve or disintegrate it. But heat can burn it. But the moment the plastic is burnt, many toxic gases are produced and cause the air pollution. The inhalation of such toxic gases is very dangerous to health. Sustainable/safe methods of plastic destruction are not yet invented. The plastic is causing an environmental pollution. The plastic is a non-biodegradable material. It does not undergo decay. To destroy this plastic, if it is burnt, it adds to air pollution by releasing many toxic gases. Thus, for environmentalists, the plastic has become a big headache [6, 7].

Flyash is another industrial waste which is causing environmental pollution. The water in which

flyash falls becomes unfit for drinking. The land on which it falls becomes infertile. The air becomes polluted since it spreads into atmosphere and causes lung problems [3, 5].

In this paper an attempts has been made to study the properties of fibre reinforced concrete produced from waste plastic fibres and flyash which are the two environmental pollutions. The strength characteristics of waste plastic fibre reinforced concrete like compressive strength, tensile strength, flexural strength and impact strength are found when the flyash is added and replaced the cement by flyash in different percentages. Also the workability characteristic of waste plastic fibre reinforced concrete with flyash was studied.

Experimental Work

Materials used

Cement: Ordinary Portland Cement-53 grade was used having a specific gravity of 3.15 and it satisfies the requirements of IS: 12269-1987 specifications.

Fine aggregates: Locally available sand collected from the bed of river Bhadra was used as fine aggregate. The sand used was having fineness modulus 2.96 and conformed to grading zone-III as per IS: 383-1970 specification.

Coarse aggregates: The crushed stone aggregate were collected from the local quarry. The coarse aggregates used in the experimentation were

10mm and down size aggregate and tested as per IS: 383-1970 and 2386-1963 (I, II and III) specifications. The aggregates used were having fineness modulus 1.9.

Water: Ordinary potable water free from organic content, turbidity and salts was used for mixing and for curing throughout the investigation.

Plasticizer: To impart the additional desired properties, a plasticizer (Conplast P-211) was used. The dosage of plasticizer adopted in the investigation was 0.5% (by weight of cement).

Flyash: The flyash used in the experimentation was obtained from "Harihara polyfibres plant" Harihara (Kumarpatnam). It satisfies the requirements of IS: 3812-1981 specification. Physical and chemical properties of flyash are given in Table No. 2.1.1

Fibres: The waste plastic fibres were obtained by cutting waste plastic pots, buckets, cans, drums and utensils. The waste plastic fibres obtained were all recycled plastics. The fibres were cut from steel wire cutter and it is labour oriented. The thickness of waste plastic fibres was 1mm and its breadth was kept 5mm and these fibres were straight. The particular volume fraction of fibres and suitable aspect ratio were selected and used in this investigation. Physical properties of these fibres are given in Table No. 2.1.2.

Table 2.1.1: Physical and chemical properties of fly ash (IS: 3812-1981)

Properties	Results	Permissible limit as per IS: 3812-1981
A. Physical properties		
Fineness-specific surface in m ² /kg by Blaine permeability method	410	320 (Minimum)
Compressive strength at 28 days in MN/mm ²	83.33% to 137.28% of the corresponding plain cement mortar cubes	Not less than 80% of the strength of corresponding plain cement mortar cubes
B. Chemical Properties		
1. Silica dioxide (SiO ₂)	60.1%	SiO ₂ = 35% (Minimum)
2. Aluminum oxide (Al ₂ O ₃)	14.77%	SiO ₂ + Al ₂ O ₃ + Fe ₂ O ₃ = 70% (Minimum)
3. Iron or Ferrous oxide (Fe ₂ O ₃)	2.84%	5% (Maximum)
4. Magnesium oxide (MgO)	0.6%	-
5. Calcium oxide (CaO)	1.2%	2.75% (Maximum)
6. Sulphur trioxide (SO ₃)	0.58%	1.5% (Maximum)
7. Sodium oxide (Na ₂ O)	1.45%	-
8. Soluble salt	0.54%	-
9. Loss of ignition	11.34%	12% (Maximum)

* Data taken from the production centre

Table 2.1.2: Physical properties of waste plastic fibres

Size of specimen (l x b x t) in mm	Percentage of elongation	Tensile strength (MPa)	Modulus elasticity (MPa)	Water absorption	Specific gravity
150 x 25 x 1	15.56	15.52	113.90	Nil	1.28

Experimental Procedure

Concrete was prepared by a mix proportion of 1: 1.374: 2.42 with a W/C ratio of 0.46 which correspond to M30 grade of concrete. The different percentage, addition of flyash and replacement of cement by flyash adopted in the experimental programme are 0%, 5%, 10%, 15%, 20% , 25% and 0%, 5%, 10%, 15%, 20%, 25%, 30%, 35%, 40% respectively. Waste plastic fibres having an aspect ratio 30 (thickness = 1mm, length = 30mm and breadth = 5mm) were added in the dry mix at the rate of 0.5% (by volume fraction). All the specimens were cast and tested after 28 days of curing as per IS specifications.

The different strength parameters of waste plastic fibre reinforced concrete like compressive strength, tensile strength, flexural strength and impact strength were found for different percentage addition/replacement of cement by flyash as the case may be. The compressive strength tests were conducted as per IS: 516-1959 on specimens of size 150 x 150 x 150 mm. The tensile strength tests were conducted as per IS: 5816-1999 on specimens of diameter 150 mm and length 300mm. Indirect tension test (Brazilian test) was conducted on tensile strength test specimens. Flexural strength tests were conducted as per IS: 516-1959 on specimens of size 100 x 100 x 500mm. Two point loading was adopted on a span of 400 mm, while conducting the flexural strength test. The impact strength tests were conducted as per ACI committee-544 on the panels

of size 250 x 250 x 30 mm. A mild steel ball weighing 1.216 kg was dropped from a height of one meter on the impact specimen, which was kept on the floor. The care was taken to see that the ball was dropped at the center point of specimen every time. The number of blows required to cause first crack and final failure were noted. From these numbers of blows, the impact energy was calculated as follows.

$$\begin{aligned} \text{Impact energy} &= mghN \\ &= w/g \times g \times h \times N \\ &= whN \text{ (N-m)} \end{aligned}$$

Where, m = mass of the ball
w = weight of the ball =1.216 kg
g = acceleration due to gravity
h = height of the drop =1m
N = average number of blows to cause the failure

Experimental Results

The following tables give the details of the experimental results of waste plastic fibre reinforced concrete with different percentage addition of flyash and different percentage replacement of flyash.

Compressive strength test results - The following Table No. 4.1.1 and Table No. 4.1.2 gives the compressive strength test results of waste plastic fibre reinforced concrete with different percentage addition of flyash and different percentage replacement of flyash.

Table 4.1.1: Compressive strength test results of waste plastic fibre reinforced concrete with different percentage addition of flyash

Percentage addition of flyash	Specimen identification	Weight of specimen (N)	Density (kN/m ³)	Average density (kN/m ³)	Failure load (kN)	Compressive strength (MPa)	Average compressive strength (MPa)	Percentage increase or decrease of compressive strength w. r. t reference mix
0 (Ref. mix)	A	80.15	23.74	23.99	680	30.22	30.07	---
	A	81.13	24.03		660	29.33		
	A	81.67	24.19		690	30.66		
5	B	81.25	24.07	23.94	780	34.66	33.7	+ 12
	B	81	24		700	31.11		
	B	80.2	23.76		795	35.33		
10	C	81	24	23.95	765	34	33.99	+ 13
	C	81.23	24.06		750	33.33		
	C	80.32	23.79		780	34.66		

15	D	79.2	23.46	23.63	705	31.33	32.51	+ 8
	D	79.8	23.64		730	32.44		
	D	80.32	23.79		760	33.77		
20	E	79.37	23.51	23.53	630	28	30.51	+ 1
	E	79.47	23.54		680	30.22		
	E	79.48	23.54		750	33.33		
25	F	78.32	23.2	23.32	655	29.11	28.88	- 4
	F	79.08	23.43		660	29.33		
	F	78.72	23.32		635	28.22		

Table 4.1.2: Compressive strength test results of waste plastic fibre reinforced concrete with different percentage replacement of cement by flyash

Percentage replacement of cement by flyash	Specimen identification	Weight of specimen (N)	Density (kN/m ³)	Average density (kN/m ³)	Failure load (kN)	Compressive strength (MPa)	Average compressive strength (MPa)	Percentage increase or decrease of compressive strength w. r. t reference mix
0 (Ref. mix)	A1	80.25	23.77	23.92	685	30.44	30.14	---
	A1	81	24		670	29.77		
	A1	81.15	24		680	30.22		
5	B1	80.6	23.88	23.99	705	31.34	31.04	+ 3
	B1	81	24		690	30.66		
	B1	81.4	24.11		700	31.12		
10	C1	81.6	24.17	24.03	710	31.55	31.92	+ 6
	C1	81.2	24.07		725	32.22		
	C1	80.5	23.85		720	32		
15	D1	82	24.3	24.24	735	32.66	32.36	+ 7
	D1	81.5	24.14		720	32		
	D1	82	24.3		730	32.44		
20	E1	82	24.3	24.14	750	33.34	32.96	+ 9
	E1	81	23.24		740	32.88		
	E1	81.5	24.14		735	32.66		
25	F1	81.5	24.14	24.16	755	33.55	33.62	+ 12
	F1	81.5	24.14		760	33.77		
	F1	81.75	24.22		755	33.55		
30	G1	80.6	23.88	23.99	740	32.88	32.36	+ 7
	G1	80.9	23.97		735	32.66		
	G1	81.5	24.14		710	31.55		
35	H1	81.75	24.22	24.21	700	31.12	31.78	+ 5
	H1	81.8	24.23		725	32.22		
	H1	81.65	24.19		720	32		
40	I1	80.9	23.97	24.1	700	31.12	30.67	+ 2
	I1	81.8	24.23		690	30.66		
	I1	81.4	24.11		680	30.22		

Tensile strength test results - The following Table No. 4.2.1 and Table No. 4.2.2 gives the tensile strength test results of waste plastic fibre reinforced concrete with different percentage addition of flyash and different percentage replacement of flyash

Table 4.2.1: Tensile strength test results of waste plastic fibre reinforced concrete with different percentage addition of flyash

Percentage addition of fly ash	Specimen identification	Failure load (kN)	Tensile strength (MPa)	Average tensile strength (MPa)	Percentage increase or decrease of tensile strength w. r. t reference mix
0 (Ref. mix)	A	210	2.97	3.2	---
	A	240	3.39		
	A	230	3.25		
5	B	230	3.25	3.25	+ 2
	B	220	3.11		
	B	240	3.39		
10	C	250	3.53	3.29	+ 3
	C	230	3.25		
	C	220	3.11		
15	D	220	3.11	3.2	0
	D	250	3.53		
	D	210	2.97		
20	E	230	3.25	3.18	- 1
	E	225	3.18		
	E	220	3.11		
25	F	220	3.11	3.08	- 4
	F	205	2.9		
	F	230	3.25		

Table 4.2.2: Tensile strength test results of waste plastic fibre reinforced concrete with different percentage replacement of cement by flyash

Percentage replacement of cement by flyash	Specimen identification	Failure load (kN)	Tensile strength (MPa)	Average tensile strength (MPa)	Percentage increase or decrease of tensile strength w. r. t reference mix
0 (Ref. mix)	A1	215	3.04	3.18	---
	A1	230	3.25		
	A1	230	3.25		
5	B1	240	3.34	3.32	+ 4
	B1	230	3.25		
	B1	235	3.32		
10	C1	245	3.46	3.41	+ 7
	C1	235	3.32		
	C1	245	3.46		
15	D1	250	3.53	3.57	+ 12
	D1	250	3.53		
	D1	260	3.67		
20	E1	255	3.6	3.72	+ 17
	E1	275	3.9		
	E1	260	3.67		
25	F1	270	3.82	3.86	+ 21
	F1	280	3.96		
	F1	270	3.82		
30	G1	250	3.53	3.65	+ 15
	G1	265	3.74		
	G1	260	3.67		
35	H1	250	3.53	3.5	+ 11
	H1	240	3.4		

	H1	255	3.6		
40	I1	240	3.4	3.2	+ 1
	I1	230	3.25		
	I1	210	2.97		

Flexural strength test results - The following Table No 4.3.1 and Table No. 4.3.2 gives the flexural strength test results of waste plastic fibre reinforced concrete with different percentage addition of flyash and different percentage replacement of flyash

Table 4.3.1: Flexural strength test results of waste plastic fibre reinforced concrete with different percentage addition of flyash

Percentage addition of fly ash	Specimen identification	Failure load (kN)	Flexural strength (MPa)	Average flexural strength (MPa)	Percentage increase or decrease of flexural strength w. r. t reference mix
0 (Ref. mix)	A	12.2	4.88	4.98	---
	A	12.4	4.96		
	A	12.8	5.12		
5	B	13	5.2	5.2	+ 4
	B	12	4.8		
	B	14	5.6		
10	C	14.8	5.92	5.76	+ 16
	C	14	5.6		
	C	14.4	5.76		
15	D	13.6	5.44	5.46	+ 10
	D	15	6		
	D	12.4	4.96		
20	E	14.2	5.68	5.09	+ 2
	E	11.6	4.64		
	E	12.4	4.96		
25	F	10.8	4.32	4.4	- 12
	F	10.2	4.08		
	F	12	4.8		

Table 4.3.2: Flexural strength test results of waste plastic fibre reinforced concrete with different percentage replacement of cement by flyash

Percentage replacement of cement by flyash	Specimen identification	Failure load (kN)	Flexural strength (MPa)	Average flexural strength (MPa)	Percentage increase or decrease of flexural strength w. r. t reference mix
0 (Ref. mix)	A1	13	5.2	5.17	---
	A1	12.8	5.12		
	A1	13	5.2		
5	B1	13.2	5.28	5.36	+ 4
	B1	13.6	5.44		
	B1	13.4	5.36		
10	C1	13.6	5.44	5.52	+ 7
	C1	13.8	5.52		
	C1	14	5.6		
15	D1	14.2	5.68	5.7	+ 10
	D1	14.2	5.68		
	D1	14.4	5.76		
20	E1	14.6	5.84	5.86	+ 13
	E1	14.6	5.84		

25	E1	14.8	5.92	6.1	+ 18
	F1	15.2	6.08		
	F1	15.2	6.08		
	F1	15.4	6.16		
30	G1	15.2	6.08	6.02	+ 16
	G1	15	6		
	G1	15	6		
35	H1	14.8	5.92	5.8	+ 12
	H1	14.8	5.92		
	H1	14	5.6		
40	I1	14.5	5.8	5.7	+ 10
	I1	14.2	5.68		
	I1	14.1	5.64		

Impact strength test results -The following Table No 4.4.1 and Table No. 4.4.2 gives the impact strength test results of waste plastic fibre reinforced concrete with different percentage addition of flyash and different percentage replacement of flyash.

Table 4.4.1: Impact strength test results of waste plastic reinforced concrete with different percentage addition of fly ash

Percentage addition of fly ash	Specimen identification	Number of blows required to cause		Average number of blows required to cause		Impact strength (N-m) required to cause		Percentage increase or decrease of impact strength w. r. t reference mix	
		first crack	final failure	first crack	final failure	first crack	final failure	first crack	final failure
0 (Ref. mix)	A	5	17	5.33	14.33	53.72	144.44	---	---
	A	6	14						
	A	5	12						
5	B	4	17	5.66	17.33	57.05	174.68	+ 6	+ 21
	B	6	18						
	B	7	17						
10	C	8	22	6.67	22.66	67.23	228.41	+ 25	+ 58
	C	5	24						
	C	7	22						
15	D	6	22	4.33	21.66	43.64	218.33	+ 19	+ 51
	D	3	21						
	D	4	22						
20	E	2	14	4	15	40.32	151.2	+ 25	+ 5
	E	4	11						
	E	6	20						
25	F	2	10	3.66	10.66	36.89	107.45	+ 31	- 26
	F	4	10						
	F	5	12						

Table 4.4.2: Impact strength test of waste plastic fibre reinforced concrete with different percentage replacement of cement by flyash

Percentage replacement of cement by flyash	Specimen identification	Number of blows required to cause		Average number of blows required to cause		Impact strength (N-m) required to cause		Percentage increase or decrease of impact strength w. r. t reference mix	
		first crack	final failure	first crack	final failure	first crack	final failure	first crack	final failure

0 (Ref. mix)	A1	6	16	5.67	14.34	57.15	144.54	---	---
	A1	6	14						
	A1	5	13						
5	B1	6	17	6.67	16.34	67.23	164.7	+ 18	+ 14
	B1	7	16						
	B1	7	16						
10	C1	7	16	7.67	17.67	77.31	178.11	+ 35	+ 23
	C1	8	18						
	C1	8	19						
15	D1	8	18	8.34	18.34	84.06	184.86	+ 47	+ 28
	D1	8	19						
	D1	9	18						
20	E1	9	19	10	19.34	100.8	194.94	+ 76	+ 35
	E1	11	20						
	E1	10	19						
25	F1	12	21	12.34	21	124.38	211.68	+ 118	+ 46
	F1	13	20						
	F1	12	22						
30	G1	9	17	9.34	17.34	94.14	174.78	+ 65	+ 21
	G1	10	17						
	G1	9	18						
35	H1	6	16	6.34	15.67	63.9	157.95	+ 12	+ 9
	H1	6	16						
	H1	7	15						
40	I1	5	14	5.34	14.34	53.82	144.54	- 6	0
	I1	5	14						
	I1	6	15						

Workability test results - The following Table No 4.5.1 and Table No. 4.5.2 gives the overall results of workability of waste plastic fibre reinforced concrete with different percentage addition of flyash and different percentage replacement of flyash.

Table 4.5.1: Workability test results of waste plastic reinforced concrete with different percentage addition of flyash

Percentage addition of fly ash	Workability through		
	Slump (mm)	Compaction factor	Percentage flow
0 (Ref. mix)	0	0.87	12.38
5	0	0.83	12.53
10	0	0.89	11.02
15	0	0.86	11.67
20	0	0.83	10.91
25	0	0.84	10.05

Table 4.5.2: Workability test results of waste plastic fibre reinforced concrete with different percentage replacement of cement by flyash

Percentage replacement of cement by flyash	Workability through		
	Slump (mm)	Compaction factor	Percentage flow
0 (Ref. mix)	0	0.87	12.4
5	0	0.9	12.6
10	0	0.91	12.9
15	0	0.92	13.3
20	0	0.94	13.8
25	0	0.96	14.1
30	0	0.93	14
35	0	0.91	13.75
40	0	0.89	13.5

Observations and Discussions

Based on the experimental results the following observations were made

1. It has been observed that the waste plastic fibre reinforced concrete show an increasing trend in the compressive strength upto 10% addition of fly ash into it. After 10% addition of fly ash the compressive strength starts decreasing. Thus, the waste plastic fibre reinforced concrete shows a higher compressive strength when 10% fly ash is added and the percentage increase in the compressive strength is 13%

It has been observed that the waste plastic fibre reinforced concrete show an increasing trend in the tensile strength upto 10% addition of fly ash into it. After 10% addition of flyash the tensile strength starts decreasing. Thus, the waste plastic fibre reinforced concrete shows a higher tensile strength when 10% fly ash is added and the percentage increase in the tensile strength is 3%

It has been observed that the waste plastic fibre reinforced concrete show an increasing trend in the flexural strength upto 10% addition of flyash into it. After 10% addition of fly ash the flexural strength starts decreasing. Thus, the waste plastic fibre reinforced concrete shows a higher flexural strength when 10% fly ash is added and the percentage increase in the flexural strength is 16%

It has been observed that the waste plastic fibre reinforced concrete show an increasing trend in the impact strength upto 10% addition of flyash into it. After 10% addition of fly ash the impact strength starts

decreasing. Thus, the waste plastic fibre reinforced concrete shows higher impact strength when 10% flyash is added and the percentage increase in the impact strength for first crack is 25% and final failure is 58% respectively.

This may be due to the fact that 10% addition of fly ash may induce maximum workability through which a thorough compaction can be achieved which aids in higher strengths. Also it may be due to the fact that 10% addition fly ash may fill all the cavities and induce right pozzolonic reaction.

Thus it can be concluded that 10% flyash addition will induce higher strength properties to waste plastic fibre reinforced concrete.

2. It has been observed that the maximum workability is achieved when 10% of flyash is added. After 10% addition of flyash the workability decreases. The concrete becomes stiff as the percentage of flyash increases beyond 10%.

This may be due to the fact that 10% addition of flyash may act as ball bearings thus reducing the friction and enhancing the workability.

Thus it can be concluded that 10% addition of flyash yield good workability in waste plastic fibre reinforced concrete.

3. It has been observed that the waste plastic fibre reinforced concrete show an increasing trend in the compressive strength upto 25% replacement of cement by fly ash into it. After 25% replacement of fly ash the compressive strength starts decreasing. Thus, the waste plastic fibre reinforced

concrete shows a higher compressive strength when 25% fly ash is replaced and the percentage increase in the compressive strength is 12%

It has been observed that the waste plastic fibre reinforced concrete show an increasing trend in the tensile strength upto 25% replacement of cement by flyash into it. After 25% replacement of fly ash the tensile strength starts decreasing. Thus, the waste plastic fibre reinforced concrete shows a higher tensile strength when 25% fly ash is replaced and the percentage increase in the tensile strength is 21%

It has been observed that the waste plastic fibre reinforced concrete show an increasing trend in the flexural strength upto 25% replacement of cement by flyash into it. After 25% replacement of flyash the flexural strength starts decreasing. Thus, the waste plastic fibre reinforced concrete shows a higher flexural strength when 25% fly ash is replaced and the percentage increase in the flexural is 18%

It has been observed that the waste plastic fibre reinforced concrete show an increasing trend in the Impact strength upto 25% replacement of cement by fly ash into it. After 25% replacement of fly ash the impact strength starts decreasing. Thus, the waste plastic fibre reinforced concrete shows higher impact strength when 25% flyash is replaced and the percentage increase in the impact strength for first crack are 118% and final failures are 46% respectively.

This may be due to the fact that 25% replacement of cement by flyash may induce maximum workability through which a thorough compaction can be achieved which aids in higher strengths. Also it may be due to the fact that 25% replacement cement by flyash may fill all the cavities and induce right pozzolanic reaction.

Thus it can be concluded that 25% replacement of cement by flyash can induce higher strength properties to waste plastic fibre reinforced concrete.

4. It has been observed that the maximum workability is achieved when 25% of cement is replaced by flyash. The concrete becomes very stiff as the percentage of flyash increases beyond 25%. This may be due to the fact 25% replacement of cement by flyash may act as

ball bearings thus reducing the friction and enhancing the workability.

Thus it can be concluded that 25% replacement of cement by flyash yield good workability in waste plastic fibre reinforced concrete. This saves the cost of concrete.

5. It is observed from the literature (Sheshagiri Rao., et al.) that the steel fibre reinforced concrete with 30% replacement of cement by flyash results in slight increase in compressive strength but decrease in the tensile strength and flexural strength. As against this waste plastic fibre reinforced concrete produced with 30% replacement of cement by flyash shows promising results (7%, 15% and 16% increase in compressive strength, tensile strength and flexural strength)

Conclusions

The following overall conclusions can be drawn from the experimental investigations carried out

1. It can be concluded that 10% addition of flyash will induce higher strength properties and good workability properties to waste plastic fibre reinforced concrete.
2. It can be concluded that 25% replacement of cement by flyash can induce higher strength properties and good workability properties to waste plastic fibre reinforced concrete.
3. Thus flyash can be used in the production of waste plastic fibre reinforced concrete.

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