Strength and Workability Characteristics of Waste Plastic Fibre Reinforced Concrete Produced From Recycled Aggregates

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ABSTRACT

The fibre reinforced concrete (FRC) is relatively a new construction material developed through extensive research during the last two decades. It has already found a wide range of practical applications and has proved reliable in construction and is a material having superior performance characteristic. The addition of fibres into the concrete has been found to improve several of its properties like tensile strength, cracking resistance, impact, wear and tear, ductility, fatigue resistance etc. Many types of fibres like steel fibres, carbon fibres, GI fibres, glass fibres, asbestos fibres etc. can be used in fibre reinforced concrete.

Waste plastics can also be used as fibres. The disposing of waste plastic is causing environmental pollution. The plastic is a non-biodegradable material, neither decays nor degenerate it either in water or in soil. In turn it pollutes the water and soil. The plastic if burnt releases many toxic gases, which are very dangerous for the health. Such plastic, which is non-biodegradable material, can be used in concrete in the form of fibres to impact some additional desirable qualities to the concrete.

This paper presents the Strength and workability results of waste plastic fibre reinforced concrete (WPFRC) produced from recycled aggregates. The different percentages of waste plastic fibre reinforced concrete used in the experimentation are 0%, 0.5%, 1%, 1.5%, 2%, 2.5% and 3% (by volume fraction) with an aspect ratio of 50. The results are compared with the plastic fibre reinforced concrete produced from conventional aggregates.

Key words: Fibre Reinforced Concrete, Recycled Aggregates, Waste Plastic Fibres, Strength and Workability Characteristics

1.0 INTRODUCTION

Concrete is the most widely used construction material. Because of its specialty of being cast in any desirable shape, it has replaced stone and brick masonry.

Plain concrete is weak in tension and has limited ductility and little resistance to cracking. Micro cracks are present in concrete because of its poor tensile strength. The cracks propagate with the application of load, leading to brittle fracture of concrete.

Micro cracks in concrete are formed during its hardening stage. A discontinuous heterogeneous system exists even before the application of any external load. When the load is applied, micro cracks start developing along the planes, which may experience relatively low tensile strains, at about 25-30% of the ultimate strength in compression. Further application of the load leads to uncontrolled growth of micro cracks. The low resistance to tensile crack propagation in turn results in a low fracture toughness, and limited resistance to impact and explosive loading.

The low tensile strength of concrete is being compensated in several ways, and this has been achieved by the use of reinforcing bars and also by applying pre-stressing force. Though these methods provide tensile strength to concrete, they do not increase the inherent tensile strength of concrete itself.

These deficiencies have led researchers to investigate and develop a material, which could perform better in areas where conventional concrete has several limitations. One such development has been two phase composite materials i.e., fibre reinforced concrete, in which cement based matrix is reinforced with ordered or random distribution of fibres.

Fibres in the cement based matrix acts as cracks arrester, which restricts the growth of flaws in the matrix, preventing these from enlarging under load, into cracks, which eventually cause failure. Prevention of propagation of cracks originating from internal flaws can result in improvements in static and dynamic properties of the matrix.

The idea of mixing more than one material to obtain a composite is not new. The two -phase concepts in which two materials are combined to produce a composite has been known since ancient times. The use of straw to strengthen sun dried mud bricks and stabilize their dimensional stability pre-dates the use of Portland cement.

Mortar and concrete are themselves essentially two-phase composite systems in which relatively stiff aggregate particles are embedded in a soft brittle matrix imparting stiffness and stability to the composite. The behavior of mortar and concrete indicates the role of fibre reinforcement of the cement matrix.

The idea that concrete can be strengthened by the inclusion of fibres was first put forward by Porter in 1910, but little progress was made in the development of this material until 1963 when Romualdi and Batson published their classic paper on the subject. Since then there has been a wave of interest in fibre reinforced concrete and several kind of fibres such as steel, fibrillated polypropylene, nylon, asbestos, coir, jute sisal, kenaf, glass, carbon have been tried.

Even though plastic is making wonders in all the fields, it is endangering the environment. It is causing environmental pollution in different ways. The waste plastic is a health hazard, non-biodegradable/non-perishable material; it neither decays nor degenerates either in soil or in water. It cannot be burnt since it releases many toxic gases causing air pollution. When the waste plastic did not find any place in America and Europe they dumped million tones of waste plastics in Atlantic and pacific Oceans, resulting the death of many aquatic lives.

Thus, plastic is causing a tremendous environmental pollution. Many researchers are trying to use this plastic in a safe manner.

2.0 EXPERIMENTAL WORK

2.1 Materials used

Cement: Ordinary Portland Cement-43 grade was used having a specific gravity of 3.15 and it satisfies the requirements of IS: 8112-1989 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.

Recycled aggregates: Recycled aggregates were collected from demolished concrete slabs, beams and columns. The aggregates used in the experimentation were 10mm and down size aggregates and tested as per IS: 383 -1970 and 2386 (I, II and III) specifications and having fineness modulus of 1.75. Physical properties of tested recycled coarse aggregate are given in Table2.1 and 2.2 respectively

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 different volume fraction of fibres and suitable aspect ratio were selected and used in this investigation

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

Super plasticizer: To impart the additional desired properties, a super plasticizer (Conplast SP-430) was used. The dosage of super plasticizer adopted in the investigation was 1% (by weight of cement

2.2 Experimental procedure

Concrete was prepared by using design 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 percentages of waste plastic fibre like 0%, 0.5%, 1%, 1.5%, 2%, 2.5% and 3% (by volume fraction) were adopted in the programme. Waste plastic fibres having an aspect ratio 50 (thickness = 1mm, length = 30mm and breadth = 5mm) were added in the dry mix. All the specimens were cast and tested after 28 days of curing as per IS specifications. The results are compared with the WPFRC produced from conventional aggregates. The compressive strength specimens were of dimension 150*150*150 mm. The tensile strength specimens were of dimensions 150 mm and length 300mm. indirect tension test (Brazilian test) was conducted on these specimens. Flexural strength specimens were of dimensions 100*100*500mm.Two point loading was adopted during the testing of flexural specimens on a span of 400 mm. The impact strength test specimens were of dimensions 250*250*30 mm. A steel ball weighing 1.112 kg was dropped from a height of one meter on the impact specimens which were 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. The numbers of blows were converted into impact energy by the formula-

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

Where, m = mass of the ball
w = weight of the ball =1.112 kg = 11.12 N
g =Acceleration due to gravity
h =Height of the drop =1m
N =Average number of blows to cause the failure

Table 2.1: Sieve analysis of recycled coarse aggregate (IS: 383-1979)

IS sieve size	Weight retained in grams	Cumulative weight retained in grams	Cumulative % weight retained	Cumulative % passing	ISI permissible limit
12.5mm	0	0	0	100	100
10mm	310	310	15.5	84.5	85-100
4.75mm	1170	1480	74	7	0-20
2.36mm	230	1710	85.5	14.50	0-5
pan	290	2000	-	-	-
Total	2000	-	175	-	-

Fineness modulus = 175.00/100 = 1.75

Table 2.2: Properties of tested recycled coarse aggregate (IS: 2383-1963)

Properties	Results
Moisture content (%)	5.2
Water absorption (%)	7.2
Specific gravity (SSD)	2.52
Impact value (%)	32.3
Crushing value (%)	34.3

3.0 Experimental results-The following tables give the details of the experimental results

3.1 Compressive strength test results: The following Tables 3.1 and 3.2 give the compressive strength test results of waste plastic fibre reinforced concrete produced from using recycled aggregates and conventional aggregates with different percentage addition of waste plastic fibres.

Table 3.1: Compressive strength test results of waste plastic fibre reinforced concrete produced from using recycled aggregates

Percentage addition of fibres	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	23.7	23.67	890	39.55	35.99	---
	A	81.5	24.14		790	35.11		
	A	78.2	23.17		750	33.33		
0.5	B	81.8	24.23	24.11	790	35.11	36.44	+ 1
	B	83.3	24.68		840	37.33		
	B	79.1	23.43		830	36.89		
1	C	79.1	23.43	23.59	820	36.44	36.73	+ 2
	C	79	23.4		820	36.44		
	C	80.8	23.94		840	37.33		
1.5	D	79.6	23.58	23.4	770	34.22	33.63	- 7
	D	78.4	23.23		740	32.89		
	D	78.98	23.4		760	33.78		
2	E	76.3	22.6	23.23	690	30.66	33.18	- 8
	E	79.4	23.52		780	34.66		
	E	79.5	23.55		770	34.22		
2.5	F	79.3	23.49	23.53	470	20.88	22.95	- 36
	F	79.7	23.61		560	24.88		
	F	79.25	23.48		520	23.11		
3	G	78.4	23.23	23.02	520	23.11	22.52	- 37
	G	77.54	22.97		490	21.78		
	G	77.18	22.86		510	22.67		

Table 3.2: Compressive strength test results of waste plastic fibre reinforced concrete produced from using conventional aggregates

Percentage addition of fibres	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	86	25.48	25.74	832	36.97	37	---
	A1	86.5	25.63		833	37.03		
	A1	88.2	26.13		832.5	37		
0.5	B1	86.8	25.72	25.89	857	38.08	38.08	+ 3
	B1	86.3	25.57		858	38.13		
	B1	89.1	26.4		856	38.04		
1	C1	89.1	26.4	25.57	860	38.23	38.47	+ 4
	C1	89	26.37		870	38.67		
	C1	80.8	23.94		866	38.5		
1.5	D1	89.6	26.55	26.37	810	36	35.99	- 3
	D1	88.4	26.19		810	36		
	D1	88.98	26.36		809	35.95		
2	E1	81.3	24.09	24.61	778.5	34.6	34.2	- 8
	E1	84.4	25.01		765	34		
	E1	83.5	24.74		765	34		
2.5	F1	83.3	24.68	24.91	680	30.22	30	- 18
	F1	84.7	25.1		675	30		
	F1	84.25	24.96		670	29.78		
3	G1	83.4	24.71	24.5	652	29.98	29.37	- 20
	G1	82.54	24.46		653	29.02		
	G1	82.18	24.35		655	29.11		

The above results can be depicted in the form of graph as shown fig 3.1

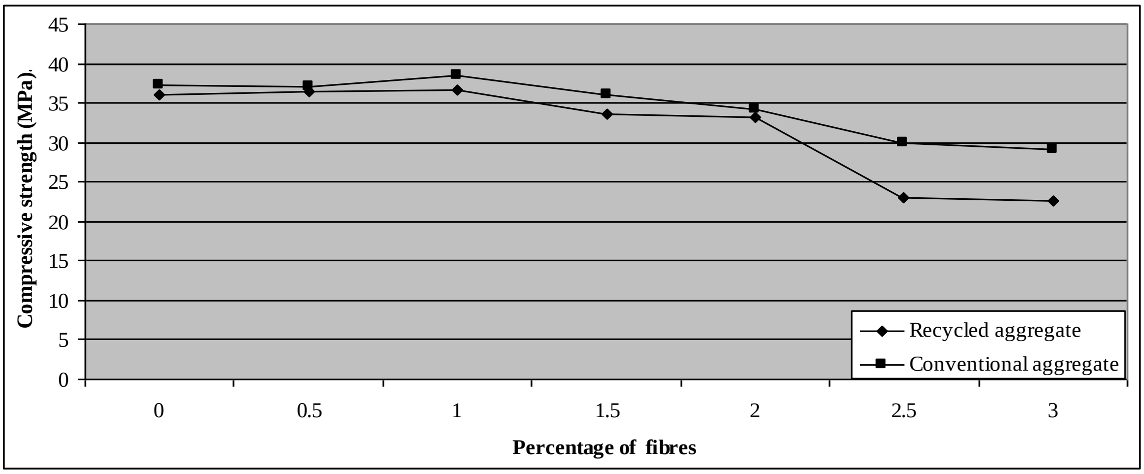

Fig 3.1: Variation of compressive strength of waste plastic fibre reinforced concrete produced from using recycled and conventional aggregates

3.2 Tensile strength test results: The following Tables 3.3 and 3.4 give the tensile strength test results of waste plastic fibre reinforced concrete produced from using recycled aggregates and conventional aggregates with different percentage addition of waste plastic fibres.

Table 3.3: Tensile strength test results of waste plastic fibre reinforced concrete produced from using recycled aggregates

Percentage addition of fibres	Specimen identification	Failure load (kN)	Tensile strength (MPa)	Average tensile strength (MPa)	Percentage increase or decrease of tensile strength w. r. t reference mix
s0 (Ref mix)	A	230	3.25	3.34	---
	A	250	3.53		
	A	230	3.25		
0.5	A	240	3.39	3.36	+ 1
	B	240	3.39		
	B	235	3.32		
1	B	270	3.81	3.6	+ 8
	C	255	3.6		
	C	240	3.39		
1.5	C	240	3.39	3.32	- 1
	D	245	3.46		
	D	220	3.11		
2	D	210	2.97	2.75	- 18
	E	195	2.75		
	E	180	2.54		
2.5	E	210	2.97	2.78	- 17
	F	200	2.82		
	F	180	2.54		
3	F	180	2.54	2.66	- 20
	G	200	2.82		
	G	185	2.61		

Table 3.4: Tensile strength test results of waste plastic fibre reinforced concrete produced from using conventional aggregates

Percentage addition of fibres	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	268	3.79	3.8	---
	A1	270	3.82		
	A1	268	3.79		
0.5	B1	273	3.86	3.95	+ 4
	B1	280	3.96		
	B1	285	4.04		
1	C1	297	4.2	4.2	+ 11
	C1	300	4.25		
	C1	294	4.16		
1.5	D1	270	3.82	3.85	+ 1
	D1	273	3.86		
	D1	274	3.88		
2	E1	260	3.68	3.7	- 3
	E1	266	3.76		
	E1	260	3.68		
2.5	F1	212	3	3	- 21
	F1	210	2.97		
	F1	214	3.03		
3	G1	211	2.99	2.98	- 22
	G1	210	2.97		
	G1	212	3		

The above results can be depicted in the form of graph as shown fig 3.2

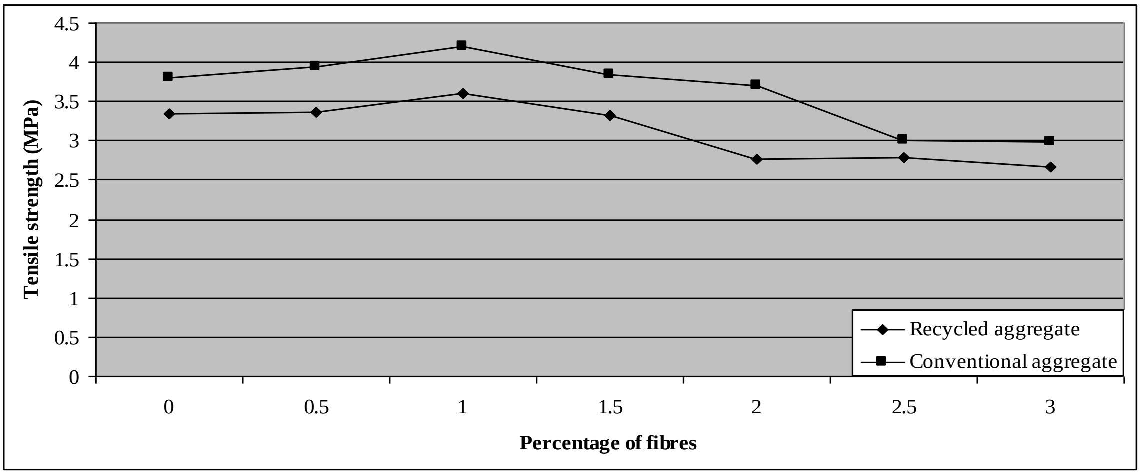

Fig 3.2: Variation of tensile strength of waste plastic fibre reinforced concrete produced from using recycled and conventional aggregates

3.3 Flexural strength test results: The following Tables 3.5 and 3.6 give the flexural strength test results of waste plastic fibre reinforced concrete produced from using recycled aggregates and conventional aggregates with different percentage addition of waste plastic fibres.

Table 3.5: Flexural strength test results of waste plastic fibre reinforced concrete produced from using recycled aggregates

Percentage addition of fibres	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	12.5	5	5.06	---
	A	12.8	5.12		
	A	12.6	5.04		
0.5	B	13.9	5.56	5.6	+ 11
	B	14	5.6		
	B	14.1	5.64		
1	C	15.5	6.2	6.2	+ 23
	C	15.3	6.12		
	C	15.7	6.28		
1.5	D	11.9	4.76	4.73	- 7
	D	11.8	4.72		
	D	11.7	4.68		
2	E	9.3	3.74	3.74	- 26
	E	9.3	3.74		
	E	9.4	3.76		
2.5	F	8.2	3.28	3.26	- 36
	F	7.9	3.16		
	F	8.4	3.36		
3	G	7.3	2.92	2.9	- 43
	G	7.0	2.8		
	A	7.5	3		

Table 3.6: Flexural strength test results of waste plastic fibre reinforced concrete produced from using conventional aggregates

Percentage addition of fibres	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	15	6	6.2	---
	A1	16	6.4		
	A1	15.5	6.2		
0.5	B1	17	6.8	6.8	+ 10
	B1	17.2	6.88		
	B1	16.8	6.72		
1	C1	18	7.2	7.2	+ 16
	C1	18.2	7.28		
	C1	17.8	7.12		
1.5	D1	17.2	6.88	6.88	+ 11
	D1	17.1	6.84		
	D1	17.3	6.92		
2	E1	15.5	6.2	6.2	0
	E1	15.4	6.16		
	E1	15.6	6.24		
2.5	F1	14.3	5.72	5.75	- 7
	F1	14.4	5.76		
	F1	14.4	5.76		
3	G1	12.5	5	5.2	-16
	G1	13	5.2		
	G1	13.5	5.4		

The above results can be depicted in the form of graph as shown fig 3.3

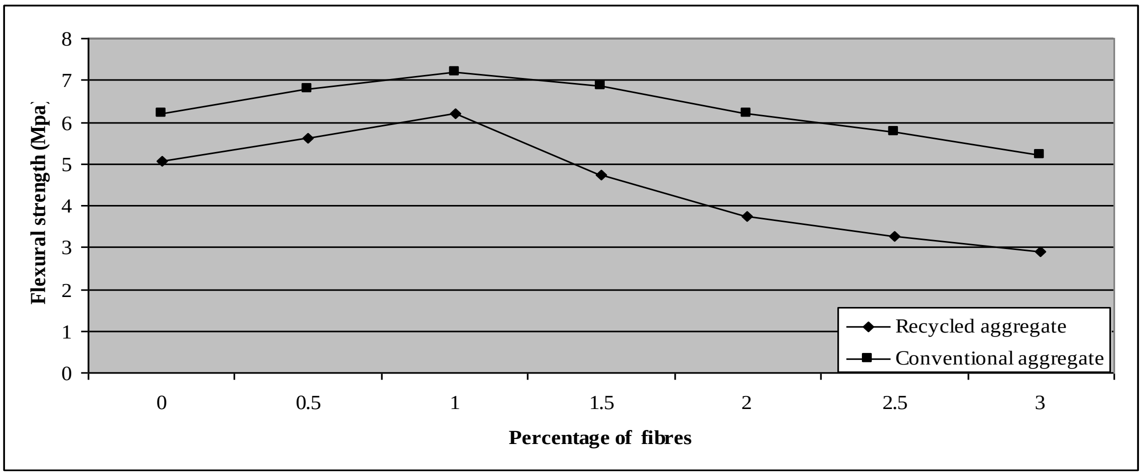

Fig 3.3: Variation of flexural strength of waste plastic fibre reinforced concrete produced from using recycled and conventional aggregates

3.4 Impact strength test results: The following Tables 3.7 and 3.8 give the impact strength test results of waste plastic fibre reinforced concrete produced from using recycled aggregates and conventional aggregates with different percentage addition of waste plastic fibres.

Table 3.7: Impact strength test results of waste plastic fibre reinforced concrete produced from using recycled aggregates

Percentage addition of fibres	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	3	6	3.34	6.34	40.61	77.09	---	---
	A	3	7						
	A	4	6						
0.5	B	5	9	4.34	9.34	52.77	113.57	+ 30	+ 47
	B	4	8						
	B	4	11						
1	C	6	16	6	15.34	73.96	186.53	+ 80	+ 142
	C	7	16						
	C	5	14						
1.5	D	4	14	4.34	15	52.77	182.4	+ 30	+137
	D	5	15						
	D	4	16						
2	E	4	15	4.34	14.66	52.77	178.26	+ 30	+ 131
	E	4	15						
	E	5	14						
2.5	F	5	14	4	14	48.64	170.24	+ 20	+ 121
	F	3	16						
	F	4	12						
3	G	4	8	3.34	10	40.61	121.6	0	+ 58
	G	3	9						
	G	3	13						

Table 3.8: Impact strength test results of waste plastic fibre reinforced concrete produced from using conventional aggregates

Percentage addition of fibres	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	3	7	4	7.34	48.64	89.25	---	---
	A1	4	7						
	A1	5	8						
0.5	B1	6	17	6.34	17	77.09	206.72	+ 59	+ 132
	B1	7	18						
	B1	6	16						
1	C1	7	17	7	18	85.12	218.88	+ 75	+ 145
	C1	6	18						
	C1	8	19						
1.5	D1	6	17	6.34	17.34	77.09	210.85	+ 59	+ 136
	D1	7	18						
	D1	6	17						
2	E1	5	17	5.67	17	68.94	206.72	+ 42	+ 132
	E1	7	18						
	E1	6	16						
2.5	F1	5	16	5.34	16.34	64.93	198.69	+ 34	+ 123
	F1	6	17						
	F1	5	16						
3	G1	5	15	4.67	14.34	56.78	174.37	+ 17	+ 95
	G1	5	15						
	G1	4	14						

The above results can be depicted in the form of graph as shown fig 3.4

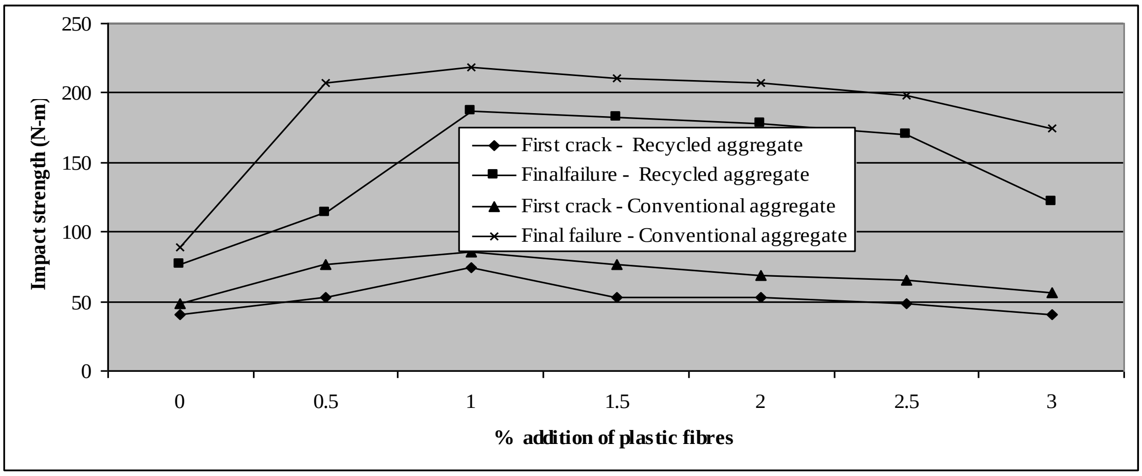

Fig 3.4: Variation of impact strength of waste plastic fibre reinforced concrete produced from using recycled and conventional aggregates

3.5 Workability test results: The following Table 3.9 give the overall results of workability of waste plastic fibre reinforced concrete produced from using recycled aggregates and conventional aggregates with different percentage addition of waste plastic fibres.

Table 3.9: Workability test results of waste plastic fibre reinforced concrete

Percentage addition of fibers	Using recycled aggregates			Using conventional aggregates		
	Slump (mm)	Compaction factor	Percentage flow	Slump (mm)	Compaction factor	Percentage flow
0 (Ref. mix)	0	0.91	31.2	0	0.94	38.8
0.5	0	0.94	33.6	0	0.96	40.9
1	0	0.98	59.5	0	0.99	60
1.5	0	0.90	59.2	0	0.95	59.2
2	0	0.90	47.6	0	0.94	52
2.5	0	0.94	43.2	0	0.94	49.2
3	0	0.90	40	0	0.93	45.6

The above results can be depicted in the form of graph as shown fig 3.5 to 3.7

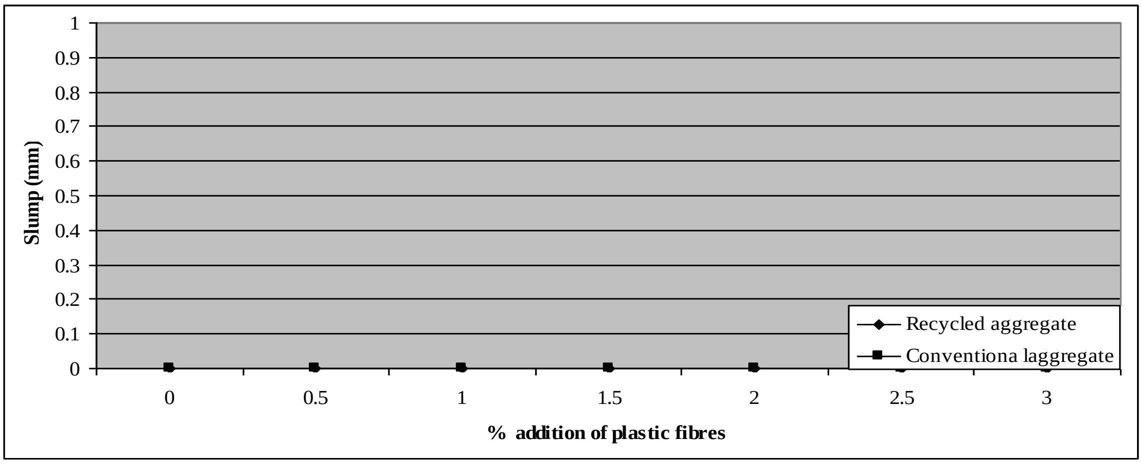

Fig 3.5: Variation of slump of waste plastic fibre reinforced concrete produced from using recycled and conventional aggregates

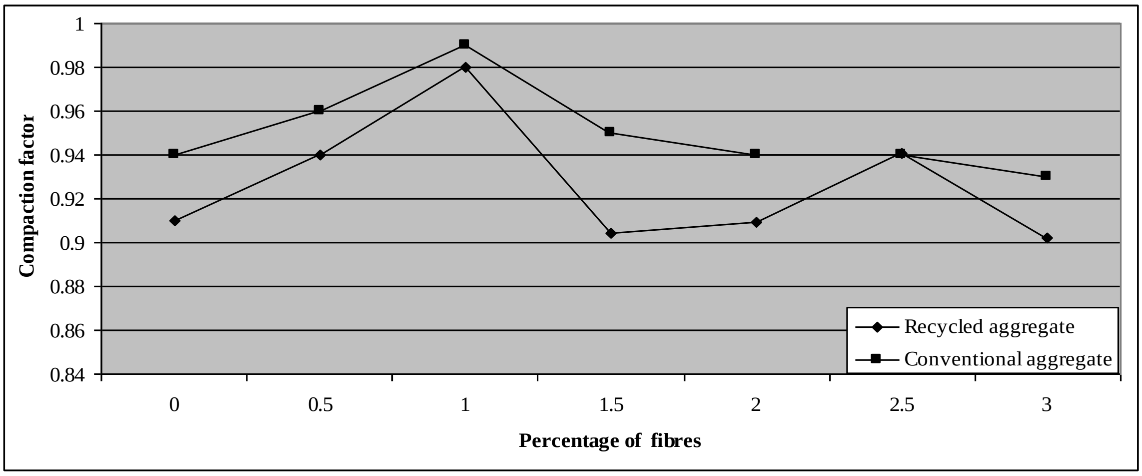

Fig 3.6: Variation of compaction factor of waste plastic fibre reinforced concrete produced from using recycled and conventional aggregates

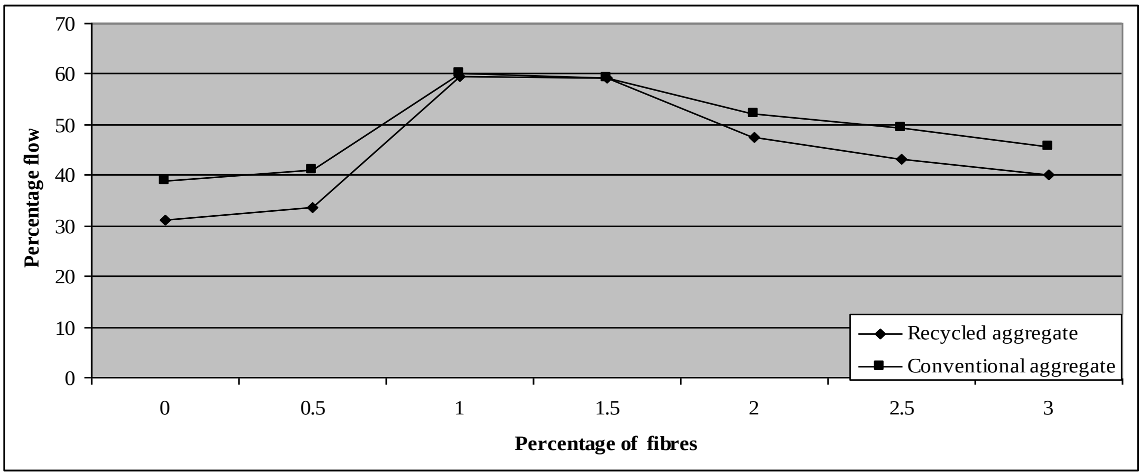

Fig 3.7: Variation of percentage flow of waste plastic fibre reinforced concrete produced from using recycled and conventional aggregates

4.0 OBSERVATIONS AND DISCUSSIONS

Based on the experimental results the following observation were made

1. It has been observed that the compressive strength of waste plastic fibre reinforced concrete using recycled aggregates goes on increasing until 1% addition of waste plastic fibres. After 1%, the compressive strength starts decreasing i.e. the maximum compressive strength of waste plastic fibre reinforced concrete can be obtained with 1% addition of waste plastic fibre. This is true for waste plastic fibre reinforced concrete produced from conventional aggregates also. Therefore, the higher compressive strength can be achieved with 1% addition of fibres and the percentage increase in the compressive strength is 2% and 4% respectively for waste plastic fibre reinforced concrete produced with recycled aggregates and conventional aggregates.

It has been observed that the tensile strength of waste plastic fibre reinforced concrete using recycled aggregates goes on increasing until 1% addition of waste plastic fibres. After 1%, the tensile strength starts decreasing i.e. the maximum tensile strength of waste plastic fibre reinforced concrete can be obtained with 1% addition of waste plastic fibre. This is true for waste plastic fibre reinforced concrete produced from conventional aggregates also. Therefore, the higher tensile strength can be achieved with 1% addition of fibres and the percentage increase in the tensile strength is 8% and 11% respectively for waste plastic fibre reinforced concrete produced with recycled aggregates and conventional aggregates.

It has been observed that the flexural strength of waste plastic fibre reinforced concrete using recycled aggregates goes on increasing until 1% addition of waste plastic fibres. After 1%, the flexural strength starts decreasing i.e. the maximum flexural strength of waste plastic fibre reinforced concrete can be obtained with 1% addition of waste plastic fibre. This is true for waste plastic fibre reinforced concrete produced from conventional aggregates also. Therefore, the higher flexural strength can be achieved with 1% addition of fibres and the percentage increase in the flexural strength is 23% and 16% respectively for waste plastic fibre reinforced concrete produced with recycled aggregates and conventional aggregates.

It has been observed that the impact strength of waste plastic fibre reinforced concrete using recycled aggregates goes on increasing until 1% addition of waste plastic fibres. After 1%, the impact strength starts decreasing i.e. the maximum impact strength of waste plastic fibre reinforced concrete can be obtained with 1% addition of waste plastic fibre. This is true for waste plastic fibre reinforced concrete produced from conventional aggregates also. Therefore, the higher impact strength can be achieved with 1% addition of fibres and the percentage increase in the impact strength for first crack are 80% and 75% and final failure are 142% and 145% respectively for waste plastic fibre reinforced concrete produced with recycled aggregates and conventional aggregates.

This may be due to the addition of waste plastic fibres may fit in and interlock the aggregates thereby increasing the strength characteristics.

Thus, it can be concluded that the higher strength characteristics of waste plastic fibre reinforced concrete using recycled aggregates and conventional aggregates can be obtained with 1% addition of fibres in it.

2. It has been observed that the compressive strength, tensile strength, flexural strength, and impact strength of waste plastic fibre reinforced concrete produced from conventional aggregates is higher than waste plastic fibre reinforced concrete produced from recycled aggregates. This is true for all percentage addition of waste plastic fibres.

The strength reduction of waste plastic fibre reinforced concrete with recycled aggregates may be due to the fact that the recycled aggregates show less mechanical strength properties than the conventional aggregates. This may be also due to the fact that recycled aggregates may develop microcracks inside their body when they were previously loaded. Attached mortar to recycled aggregates may also contribute in bringing down the strength properties.

Thus it can be concluded that the strength properties of waste plastic fibre reinforced concrete produced from recycled aggregates are slightly lower than waste plastic fibre reinforced concrete produced from conventional aggregates.

3. It has been observed that the workability of waste plastic fibre reinforced concrete using recycled aggregates as measured from slump, compaction factor and percentage flow is maximum when 1% fibres are used. Addition of more than 1% of waste plastic fibres will decrease the workability. This is true for waste plastic fibre reinforced concrete produced from conventional aggregates also. Therefore, the maximum workability is achieved with the addition of 1% waste plastic fibres.

This may be due to the fact that addition of more than 1% waste plastic fibres may obstruct the flow of concrete creating many interlocks with aggregates.

Thus it can be concluded that 1% addition of waste plastic fibres will yield good workability.

4. It has been observed that the workability of waste plastic fibre reinforced concrete using conventional aggregates as measured from slump, compaction factor and percentage flow is more as compared to waste plastic fibre reinforced concrete using recycled aggregates. This is true for all percentage addition of waste plastic fibres.

This is may due to the fact that the adhered cement particles to the recycled aggregates absorb more water from the system and reduce the flowing nature of concrete. One more reason may be that the adhered cement particles to the recycled aggregates make the surface of aggregate rough thereby reducing the flowing nature of concrete.

Thus it can be concluded that the workability of waste plastic fibre reinforced concrete using conventional aggregates is higher than that of recycled aggregates.

5.0 CONCLUSIONS

1. It can be concluded that higher strength and workability characteristics of waste plastic fibre reinforced concrete using recycled aggregates and conventional aggregates can be obtained with 1% addition of fibres into it.
2. It can be concluded that the strength properties of waste plastic fibre reinforced concrete produced from recycled aggregates are slightly lower than waste plastic fibre reinforced concrete produced from conventional aggregates.
3. It can be concluded that the workability of waste plastic fibre reinforced concrete produced from recycled aggregates is less than that of conventional aggregates.

6.0 ACKNOWLEDGEMENTS:
The authors indebted to Vice-Chancellor, Christ University and Fr.Benny, Director of Christ University Faculty of Engineering, Bangalore for their encouragement

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