IJREAT International Journal of Research in Engineering & Advanced Technology, Volume 3, Issue 3, June-July, 2015
ISSN: 2320 – 8791 (Impact Factor: 2.317)
www.ijreat.org

Experimental Study On M30 Grade Fiber Reinforced Concrete Using Quarry Dust And Recycled Aggregates

Shreyas Y S[1], Sharath N[2], Rajeeva S J[3], Manjunath K A[4]

[1,2]U G Student, Department of Civil Engineering, S J C Institute of Technology, Chickaballapura, Karnataka, India

[3,4]Assistant Professor, Department of Civil Engineering, S J C Institute of Technology, Chickaballapura, Karnataka, India

Abstract: Fiber Reinforced Concrete (FRC) is being used broadly nowadays on account of improvement of urbanization. Due to development being utilized of conventional material like conduit sand and crushed stone aggregate has extended the cost of era moreover has negative effect on environment due to over the top mining. In the present work, a trial study was made by absolutely supplanting quarry dust and recycled aggregate instead of conduit sand and crushed stone aggregate independently. Mix plot for M30 assessment was done utilizing 0.2% and 0.4% of polypropylene and polyester as fibers. Strength tests were crushed 7, 14 and 28 days. Exploratory study demonstrated appealing results when differentiated and conventional concrete.***Keywords:****Quarry dust,Recycled aggregate, polypropylene, polyester.*

1. Introduction

Concrete is most generally utilized as development material as a part of the world. In view of its capacity to get cast in any shapes, It is practically decreased old development materials like bricks and stone masonry.The strength and toughness of concrete can be changed by rolling out fitting improvements in its ingredients.Concrete is appropriate for extensive variety of utilizations yet as the interest for materials is calm high in creating nations, the worldwide utilization of materials as additionally turn out to be extremely high.Therefore it is important to supplant the materials in concrete by option materials. Fiber Reinforced Concrete comprises of Portland cement, coarse and fine aggregates alongside fibers like polypropylene and polyester. River sand is favoured for concrete however exorbitant mining of river sand has brought about ecological debasement. In this way, scan for different option for river sand has as of now started. Quarry dust a by-product got amid by the process of quarrying. Because of the over utilization of coarse aggregates utilized as a part of development works, that outcomes in the exhaustion of rough mountains which influences the aesthetic magnificence of nature. Because of that, illicit mining, natural impacts and so on, may bring about a few issues. Consequently it is important to supplant the coarse aggregates by recycled aggregates. Test investigations of past specialists have demonstrated that expansion of polypropylene and polyester improves strength properties of concrete and lessens the cracks in the concrete.

2. Problem Context and Definition

Concrete as a development material has a vast potential everywhere throughout the world and next just to the utilization of water. Aggregates contributing around 60-70% of concrete mass, henceforth there exists an unlimited interest for aggregates. The quick and boundless infrastructural improvements in India request enormous amount of river sand for concrete, as fine aggregate. Waning sand assets in river beds posture ecological issue and thus government has forced limitation on the utilization of sand. The tremendous request because of quick improvement in framework, shortage of river sand in river overnight boardinghouse because of government limitation on quarrying of sand, have has prompted the increment in the expense of river sand. This not just has expanded the expense of the development additionally defers the development in few spots because of the non-accessibility of river sand. The crude material utilized for the assembling of concrete has exhausting step by step. This rouses inquires about for option material to supplant the river sand. Substitution of crude materials constituents with choices is a vital eco productivity driver and is need of great importance. It lessens utilization of common assets and counterbalance customary materials accordingly

moderating non-renewable characteristic assets adding to reasonable development and taking into account the recuperation of both vitality and material from chose waste.In this exploratory examination, strength parts of fiber reinforced concrete is to be contemplated with quarry dust as replacement to river sand and recycled aggregate as replacement to crushed stone aggregate with varying percentage of 0%, 0.2% & 0.4% of polypropylene and polyester by weight of cementitious materials. The tests are directed with a specific end goal to study strengths, for example, cube compressive strength, split tensile strength and flexural strength. The outcomes got will be looked at between Conventional concrete and Fiber reinforced concrete.

3. Previous Works

Experimental study on steel fiber reinforced concrete shows that the investigations conducted for compression test on fiber reinforced concrete specimens. In this project the use of recycled aggregates as coarse aggregate is possible in normal concrete mixes. This is useful in reducing the environmental problems created by dumping these waste materials. The density of polypropylene fibers is lower than water, so they normally show of uniform distribution during the mixing process and thereby in concrete bulk. The presence of fibers in concrete alerts the failure mode of material. It is found that the failure mode of plain concrete is mainly due to spalling, while the failure mode of fiber reinforced concrete is bulging in transverse directions. Use of fiber in recycled aggregate concrete increases strength characteristics mainly flexural &split tensile strengths of concrete. Recycled aggregates can be replaced up to 50% in concrete for natural aggregates by using fibers, thus saving the natural resources[1].This paper presents a review of the aluminium salt slag chemical and mineralogical characteristics, as well as various processes for metal recovery, recycling of sodium and potassium chlorides content back to the smelting process and preparation of value added products from the final non-metallic residue[2].Very few literatures are available regard to the use of aluminium slag. Presently no literatures are available on using of aluminium as fine aggregate and recycled aggregate as coarse aggregate. The present study examines the possibility of using aluminium slag and recycled aggregates as full replacement of fine aggregate and coarse aggregate respectively.

4. Materials Used

4.1 Cement

The cement used was ordinary Portland cement of 53 grade with specific gravity of 3.06, fineness 4% and normal consistency 36%. The initial and final setting time of cement was 35 minutes and 431 minutes respectively.

4.2 Fine Aggregate

In this study, Quarry dust is used as replacement of river sand by constant 100% for all variations and is collected from the local Quarry situated in chickballapura, Karnataka. But for conventional concrete we have used river sand.

Table 1: Properties of fine aggregate

Particular	River sand	Quarry dust
Specific gravity	2.61	2.25
Sieve analysis	Zone II	Zone II
Absorption	1.75%	1.96%

4.3 Coarse Aggregate

In this study, recycled aggregate is used as replacement of crushed stone aggregate by constant 100% for all variations. But for conventional concrete we have used crushed stone aggregate. The aggregate of 20mm and below size were used.

Table 2: Properties of Coarse aggregate

Particular	Crushed stone Aggregate	Recycled Aggregate
Shape	Angular	Angular
Crushing Test	27.59%	35%
Impact Test	15%	16%
Specific Gravity	2.60	2.51
Water absorption	0.1%	0.73%

4.4 Fibers Used

In the present work, commercially available Recron 3S Polypropylene fibers and Polyester fibers supplied by Reliance industries limited are used.

Table 3: Properties of fibers

Particulars	Polypropylene	Polyester
Color	White	White
Length	12mm	18mm
Specific gravity	0.91	1.34-1.39
Cross - section	Triangular	Triangular

4.5 Water

Ordinary potable water was used for mixing and curing purpose.

4.6 Super Plasticizer

Rheo-build 1125 is used for the work. The percentage of super-plasticizer is 0.8% and 0.8% of total cementitious quantity for Conventional concrete and Fiber Reinforced concrete is used respectively.

5. Methodology

Design mix concrete is preferred to nominal mix. Mix is designed following the stipulations laid down in IS 456:2000 with respect to minimum cement content, maximum water to cement ratio and minimum grade of concrete for various exposure conditions and guidelines. Mix is designed as per IS 10262:2009 - BIS method of Mix design.

Mix design for Conventional concrete:

Mix Ratio = C: FA: CA: w/c

Mix ratio **= 1: 2.14: 3.48**: 0.42 (0.8% of Super plasticizer)

Mix design for Fiber Reinforced concrete:

Mix Ratio = C: FA: CA: w/c

Mix ratio = **1: 1.84: 3.36**: 0.42 (0.8% of Super plasticizer)

6. Results and Discussions

6.1 Slump Test

Slump test was done for Conventional Concrete (CC) and Fiber Reinforced Concrete (FRC) as a full replacement for Quarry dust in place of River sand and Recycled aggregate in place of Crushed stone aggregate for all variations of Fibers.

Table 4: Slump Value for Concrete Mixes

Mix	Slump in mm	% of SP
CC	70	0.80
FRC	68	0.80

6.1.1 Observation and Discussion on Workability

For the Conventional Concrete the slump was found to be 70 mm then when fibers were mixed with concrete, the slump reduced. Workability of Conventional Concrete was found to be more when appeared differently in relation to Fiber Reinforced Concrete. The obliged slump worth is proficient by changing the rate of super plasticizer. The diminishment in slump with the utilization of Quarry dust is a direct result of the water maintenance by Quarry dust, since it has more water ingestion limit than river sand, which hinders the hydration of cement in view of nonappearance of water substance.

6.2 Compressive Strength

Compressive strength of concrete mixes with cube specimen of size 150x150x150 mm for Conventional Concrete and Fiber Reinforced Concrete with a varying percentages of 0% fiber, 0.2% &0.4% of polypropylene respectivelyand 0.2% & 0.4% of polyester respectively made with Quarry dust as fine aggregate and recycled aggregate as coarse aggregate by volume fraction of concrete was determined at 7, 14 and 28days.

Table 5: Compressive Strength Results in N/mm^2

Curing Period	CC	0% FIBER	POLYPROPYLENE		POLYESTER	
			0.2%	0.4%	0.2%	0.4%
7 DAYS	25.90	30.60	36.95	37.20	35.82	36.10
14 DAYS	31.43	32.70	39.86	40.01	38.54	38.14
28 DAYS	37.40	38.68	41.40	42.62	40.15	41.60

CC = CONVENTIONAL CONCRETE(ALL VALUES ARE IN N/ mm^2)

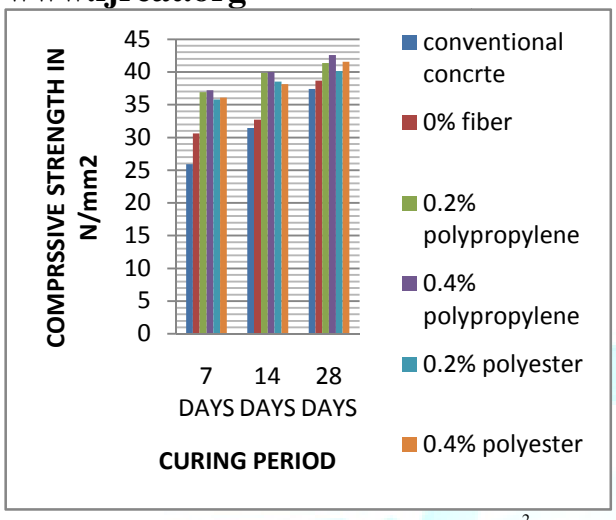

Fig. 1 Compressive strength test results in N/mm^2

6.2.1 Observation and Discussion on Compressive Strength

The compressive strength for conventional concrete at 28 days was found to be 37.40 N/mm^2 and the most significant compressive strength was obtained for 0.4% polypropylene which was 42.62 N/mm^2. There is augmentation in compressive strength by the development of polypropylene and polyester fibers. The compressive strength barely increases with development of unmistakable extents of fibers. By development of 0.4% polypropylene fiber we achieved more strength stood out from whatever other assortment of fibers. The strength obtained by fiber reinforced concrete is 8% more than the conventional concrete.

6.3 Split Tensile Strength

Split strength of concrete mixes with cylinder specimen of size 150mm diameter and 300mm in height, for Conventional Concrete and Fiber Reinforced Concrete with a varying percentages of 0%fiber, 0.2% &0.4% of polypropylene respectivelyand 0.2% & 0.4% of polyester respectively made with Quarry dust as fine aggregate and recycled aggregate as coarse aggregate by volume fraction of concrete was determined at 7, 14 and 28days

Table 6: Split Tensile Strength Results in N/mm^2

Curing Period	CC	0% FIBER	POLYPROPYLENE		POLYESTER	
			0.2%	0.4%	0.2%	0.4%
7 DAYS	2.15	2.32	2.60	2.93	2.72	2.95
14 DAYS	3.24	3.52	3.86	4.07	3.65	3.79
28 DAYS	4.00	3.65	4.30	4.50	3.86	4.28

CC = CONVENTIONAL CONCRETE(ALL VALUES ARE IN N/ mm^2)

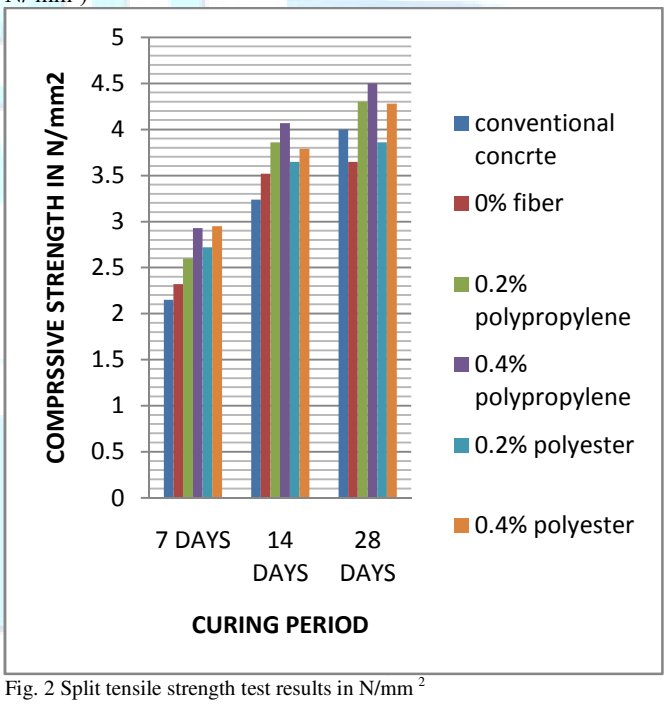

Fig. 2 Split tensile strength test results in N/mm ^{2}

6.3.1 Observation and Discussion on Split Tensile Strength

The split tensile strength for CC was gotten as 4.00 N/mm2 at 28 days. For fiber reinforced concrete, strength extended by 3% for 0.2% polypropylene moreover for 0.4% polyester and 5% for 0.4% polypropylene. 0.4% polypropylene as yielded more strength when stood out from distinctive mixtures of fibers. Concrete is weak in tension in this way by the extension of fibers we could achieve more strength than conventional concrete.

6.4 Flexural Strength

Flexural strength of concrete mixes with beam mould of size 700x150x150 mm, for Conventional Concrete and Fiber Reinforced Concrete with a varying percentages of 0%fiber , 0.2% &0.4% of polypropylene respectively and 0.2% & 0.4% of polyester respectively made with Quarry dust as fine aggregate and recycled aggregate as coarse aggregate by volume fraction of concrete was determined at 7, 14 and 28days.

Table 7: Flexural Strength Results in N/mm^2

Curing Period	CC	0% FIBER	POLYPROPYLENE		POLYESTER	
			0.2%	0.4%	0.2%	0.4%
14 DAYS	4.04	3.65	3.90	4.24	3.95	4.10
28 DAYS	5.34	4.95	5.25	6.18	5.10	5.65

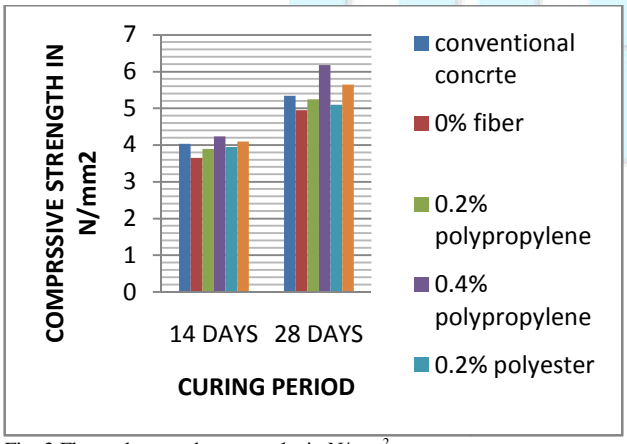

Fig. 3 Flexural strength test results in N/mm^2

6.4.1 Observation and Discussion on Flexural Strength

The flexural strength for CC was acquired as 5.34 N/mm2 at 28 days. For fiber reinforced concrete, the strength expanded by 14% for 0.4% polypropylene and 5% for 0.4% polyester. The ideal replacement level for quarry dust is up to 100%. The increment in flexural strength is a direct result of the expansion of polypropylene and polyester fibers alongside quarry dust.

7. Conclusions

The test results obtained can be concluded as:

- The physical and chemical properties of quarry dust fulfill the prerequisites of code procurement in properties studies. Characteristic river sand if supplanted by 100% quarry dust from quarries, might now and then give equivalent or preferred execution over the conventional concrete made with river sand, as far as compressive strength and flexural strength studies.

- The expansion of polypropylene fiber 1.5% by volume of concrete of M30 the flexural strength is discovered significantly more than M30 of conventional concrete.

- The expansion of polypropylene fiber 0.4% by weight of M30 concrete is discovered a great deal more than M30 conventional concrete

- The expansion polyester fibers additionally expand the compressive strength and flexural strength of concrete; however polypropylene fibers turn out to be more productive for the same amount of fibers utilized.

- Conventional concrete has preferred strength over 0% fiber concrete however fiber reinforced concrete has preferable strength over conventional concrete.

References

[1] Journal of Civil Engineering Technology and Research Volume 2 Number 1 (2014) pp. 259-266 : Study on Strength Characteristics of Recycled Aggregate Concrete using Polypropylene Fiber

[2] B Balapgol, S A Kulkarni and K M Bajoria, "Strength and durability of concrete with crushed sand", 27th Conference on Our World in Concrete & Structures, 2002, pp. 179-184.

[3] International Refereed Journal of Engineering and Science (IRJES) ISSN (Online) 2319-183X (Print) 2319-1821

Volume 1 Issue 2 (October 2012) PP.37-40: Behaviour of Polypropylene Fiber Reinforced Concrete with Artificial Sand.

[4] V Vytlacilova, Czech Technical University in Prague, Czech Republic: Fiber Concrete With Recycled Aggregate – Masonry And Concrete.