International Journal of ChemTech Research
CODEN (USA): IJCRGG, ISSN: 0974-4290, ISSN(Online):2455-9555
Vol.10 No.8, pp 772-777, 2017

Experimental Investigation on Concrete Block by Partially Replacing Fine Aggregate with Paddy Husk and Quarry Dust

David Anandaraj.S.L*, Prasanth.R , Vinod.M, Niwetheni Sre.L and Priya.PL

Department of Civil Engineering, SNS College of Engineering, Coimbatore-641107, Tamil Nadu, India

Abstract : Sand is naturally defined by size, being finer than gravel and coarser than silt and non renewable resource over human timescale, and sand suitable for concrete is in high demand[2,4]. The reduction in the source of sand and the need to reduce the cost of construction projects has resulted in the invention of alternative construction materials as fine aggregate. It has been studied that, the quarry dust and Paddy husk are suitable to be used as an fine aggregate[1,5]. Hence an attempt has been made to study the characteristic properties of concrete block with partial replacement of fine aggregate by quarry dust and Paddy husk with replacement percentage of 10%, 20%, 30%, 40% and 50%. Mix design has been developed for M20 grade concrete design approach using IS for both conventional concrete and concrete with partial replacement. Tests were conducted on concrete blocks to study the strengths and the results were compared with the strength of conventional concrete. The compressive and flexural strength of the concrete blocks were higher than that of the conventional concrete.
Keywords : Quarry dust, Paddy husk, M20 grade, Characteristic Strength.

1.0 Introduction

Concrete is the widely used material in construction industry and sand is an constituent of concrete[7]. The growth of population and of cities and the consequent construction activities, thereis a huge demand for sand and Natural Sands are running low. This results in the increase of cost of resources. In the backdrop of such a bleak atmosphere, there is a large demand for alternative sources from industrial and agricultural wastes[3].

2.0 Need for the Replacement of Quarry Dust and Paddy Husk

A. Quarry Dust

The Quarry dust obtained from local resource Vigneshwara Granites, Coimbatore was used in concrete to cast test cubes and cylinders. The physical and chemical properties of Quarry dust obtained by testing the samples as per Indian Standards are as follows:

Table: 1 Properties of Quarry Dust

Properties	Quarry dust	Natural Sand
Specific gravity	2.820	2.50
Relative density (kg/m^3)	1970	1820
Sieve analysis	2.303	4.473

Table: 2 Sieve analysis for Quarry Dust

S. No	Sieve Size (mm)	Weight of Quarry Dust	Percentage of Weight Retained	Cumulative Percentage of Weight Retained	Percent of FinerY=(100 -x)
1.	4.75	0.065	3.25	3.25	96.75
2.	2.30	0.060	3.00	6.25	93.75
3.	1.18	0.085	4.25	10.50	89.50
4.	0.6	0.065	3.25	13.75	86.25
5.	0.425	0.005	0.25	14	86
6.	0.3	0.010	0.50	14.50	85.50
7.	0.15	1.210	60.50	75	25
8.	0.075	0.360	18.00	93	07
9.	Pan				

The specific gravity and fineness modulus of Quarry dust is 2.82 and 2.303.

B. Paddy Husk

The Paddy husk obtained from local resources SS Rice mill, Saravanampatti, was used in concrete to cast test cubes and cylinders. The physical and chemical properties of Paddy husk obtained by testing the samples as per Indian Standards are as follows:

Table: 3 Properties of Quarry Dust

Properties	Paddy husk	Natural Sand
Specific gravity	1.235	2.50
Relative density (kg/m^3)	190	1820
Sieve analysis	7.082	4.473

Table: 4 Sieve analysis for Paddy husk

S. No	Sieve Size (mm)	Weightof Paddy Husk	Percentage of Weight Retained	Cumulative Percentage of Weight Retained	Percent of Finer Y= (100-x)
1.	4.75	0	0	0	100
2.	2.36	0.445	44.50	44.50	55.50
3.	1.18	0.350	36	80.50	19.50
4.	0.6	0.100	10	90.50	9.50
5.	0.425	0.060	6	96.50	3.50
6.	0.3	0.005	1.50	98	2
7.	0.15	0.010	1	99	1
8.	0.075	0.005	0.50	99.50	0.50
9.	Pan	0.002	0.20	99.70	0.30

The specific gravity and fineness modulus of Paddy husk is 1.235 and 7.082.

3.0 Test Specimens Preparation

The 150mm size concrete cubes and cylinders of 150mm diameter and 300mm height were used as test specimens to determine the Compressive Strength and Split tensile strength respectively. The specimens were casted for grade M20 and the size of coarse aggregate used was 20mm. The slump value gives the workability

of the fresh concrete. The ingredients were thoroughly mixed till uniform consistency was achieved. The cubes and cylinders were compacted by hand using rod.

Mix Design for M20 Grade Concrete

Grade Designation

Type of cement	: OPC 53 Grade
Maximum size of aggregate	: 20mm
Minimum cement content	: 425.78 kg/m^3
Maximum water- cement ratio	: 0.45
Workability	: Slump cone
Type of exposure	: Normal
Degree of quality control	: Good
Type of aggregate	: Crushed
Cement Used	:Ultra Tech OPC 53 Grade
Maximum cement content	:540 kg/m^3
Specific gravity of coarse aggregate	: 5.56
Specific gravity of fine aggregate	: 4.473
Specific gravity of Quarry dust	: 2.303
Specific gravity of Paddy husk	: 7.082
Water Absorption Fine Aggregate	: 0.5%
Water absorption Coarse Aggregate	: 1.0%

The above mix designare used for casting concrete specimen. The water cement ratio changes for different percentage of Quarry dust and Paddy husk replacement with fine aggregate.

Table: 5 The water cement ratio for different percentage

Grade	Percentage of Quarry Dust	Percentage of Paddy Husk	Actual W/C Ratio	W/C Content (ml)
M20	5	5	0.45	1916
M20	10	10	0.45	1916
M20	15	15	0.45	1916
M20	20	20	0.45	1916
M20	25	25	0.45	1916

4.0 Preparation of Testing Specimen

4.1 Casting of The Specimen

The experimental work includes casting and testing of specimens to know the Compressive Strength and Split tensile strength of cubes and cylinders.

The specimens are casted for the following:

1. M20 concrete with OPC+ Natural Sand
2. M20 concrete with OPC+ 90% Natural Sand+ 5% Quarry Dust+ 5% Paddy Husk
3. M20 concrete with OPC+ 80% Natural Sand+ 10% Quarry Dust+ 10% Paddy Husk
4. M20 concrete with OPC+ 70% Natural Sand+ 15% Quarry Dust+ 15% Paddy Husk
5. M20 concrete with OPC+ 60% Natural Sand+ 20% Quarry Dust+ 20% Paddy Husk
6. M20 concrete with OPC+50% Natural Sand+ 25% Quarry Dust+ 25% Paddy Husk

4.2 Compaction of Concrete

Compaction of concrete is process of consolidating the plastic concrete after placing it. In this process efforts are made to reduce the voids manually or mechanically from the plastic concrete and obtain a homogeneous concrete. The removal of air entrapped helps in preventing the loss of strength. When compaction is done manually, it is called as Hand compaction and when done mechanically it is called as Machine compaction.

5.0 Results

In order to study the strength behaviour of the concrete made with replacement of sand with Quarry dust and Paddy husk, the tests are conducted. Results so obtained for the tests conducted on cubes and cylinders for M20 grade of concrete at 7days and 28 days were tabulated. The results were compared for concretes with Natural Sand to that of Quarry dust and Paddy husk as fine aggregate.

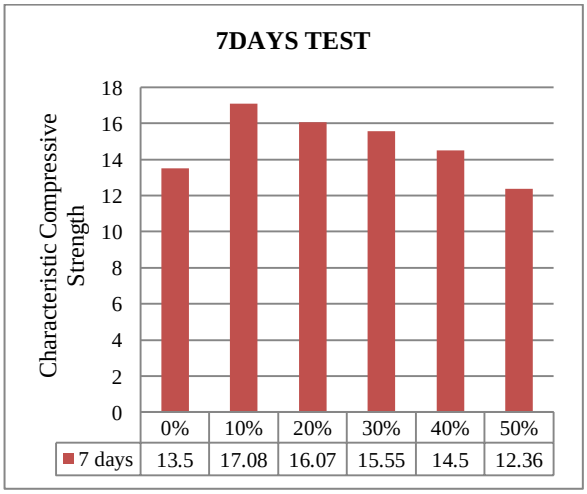
5.1 Compressive Strength (M20 Grade)

The Compressive Strength of M20 grade concrete cubes made with Natural Sand and those made with Quarry dust and Paddy husk as fine aggregate are tested under compression testing machine and results are tabulated below:

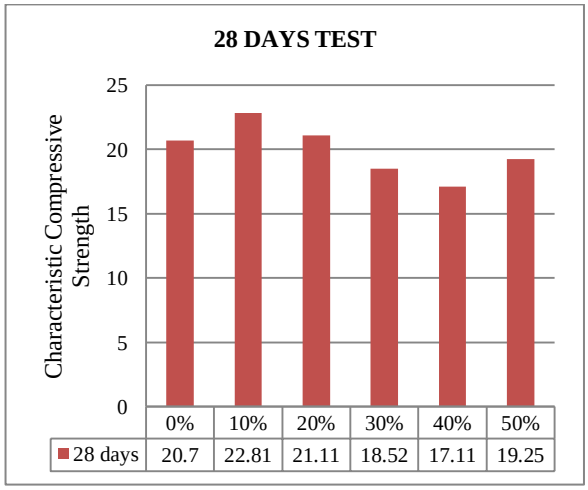
Table: 6 Compressive Strength comparisons for M20 Grade cubes

S. No	% of Quarry Dust and Paddy Husk replaced	OPC + Sand		OPC + Sand+ Quarry Dust+ Paddy Husk	
		7days	28days	7days	28days
1.	10	13.56	20.7	17.08	22.81
2.	20			16.07	21.11
3.	30			15.55	18.52
4.	40			14.50	17.11
5.	50			12.36	19.25

It is observed that both the concretes are achieving the target Compressive Strength at the age of 28 days. The Compressive Strength of sample A concrete is slightly higher.



Graph: 1 Characteristic Compressive Strength ofConcrete at 7 days



Graph: 2 Characteristic Compressive Strength of Concrete at 28 days

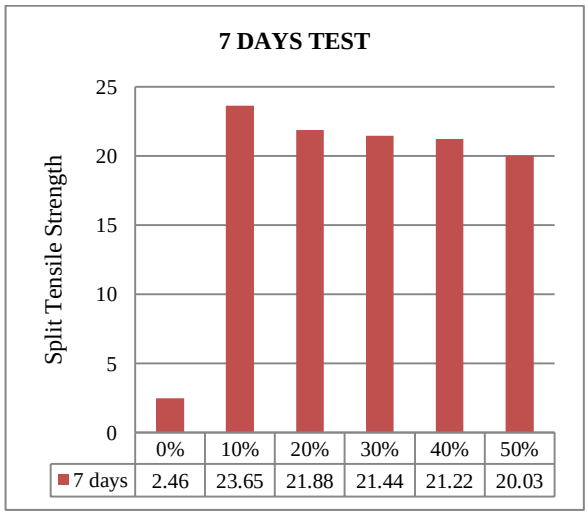
5.2 Split Tensile Strength of Concrete

The Split tensile strength of M20 grade concrete cylinders are tested under UTM machine. The results are tabulated as follows:

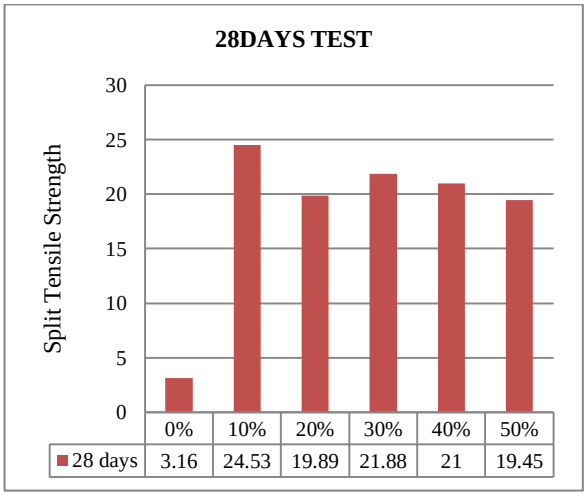
Table: 7 Split tensile Strength of concrete comparison for M20 cylinders

S. No	% of Quarry Dust and Paddy Husk replaced	OPC + Sand		OPC + Sand+ Quarry Dust+ Paddy Husk	
		7days	28days	7days	28days
1.	10	2.46	3.16	23.65	24.53
2.	20			21.88	19.89
3.	30			21.44	21.88
4.	40			21.22	21.00
5.	50			20.03	19.45

It is observed that the Split tensile strength of samples achieve the target strength. The Split tensile strength sample A is higher at the age of 28 days.



Graph: 3 Split Tensile Strength of Concrete at 7 days



Graph: 4 Split Tensile Strength of Concrete at 28 days

6.0 Conclusion

From the results tabulated in earlier chapter the following statement can be derived:

- The characteristic compressive strength obtained for concrete blocks using quarry dust and paddy husk acquires the required strength even at the partial replacement of about 10% fine aggregates.
- The split tensile strength obtained is also satisfies the target mean strength.
- The result shows that quarry dust and paddy husk can be successfully partially replaced for the construction of curtain walls and load bearing concrete blocks.
- The about concrete blocks may be used even with 60% (replacement of fine aggregate with quarry dust and paddy husk) for masonry works as cement block for the replacement of bricks, fly ash brick, hollow blocks and light weight concrete. Since is compressive strength is at 30% higher than the first class bricks.

7.0 References

1. ChandanaSukesh, KatakamBala Krishna, P.Sri Lakshmi SaiTeja, S.KanakambaraRao "Partial Replacement of Sand with Quarry Dust in Concrete", International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-2, Issue-6, May 2013 254.
2. Sumit L. Chauhan, RajuA.Bondre, "Partial Replacement of Sand by Quarry Dust in Concrete", International Journal of Scientific and Research Publications, Volume 5, Issue 7, July 2015 01, ISSN 2250-3153.
3. ChandanaSukesh, KatakamBala Krishna, P.Sri Lakshmi SaiTeja, S.KanakambaraRao, "Partial Replacement of Sand with Quarry Dust in Concrete", International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-2, Issue-6, May 2013 254.
4. IS:10262-2009 "Indian Standard code for concrete Mix proportioning guidelines", (First Revision), Bureau of Indian Standards , New Delhi
5. IS: 456-2000, "Indian Standard code for Plain & Reinforcement concrete", (Fourth Revision), Bureau of Indian Standards, New Delhi
6. IS:383-1970 "Indian Standard code for specification for fine and coarse aggregate", Bureau of Indian Standards , New Delhi
7. Advanced concrete Technology by M.S Shetty

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