INTERNATIONAL JOURNAL OF RESEARCH IN MECHANICAL, MECHATRONICS AND AUTOMOBILE ENGINEERING (IJRMMAE)
ISSN: 2454-1435 (Print) | 2454-1443 (online)
Volume 4 Issue 3, October – Dec. 2018 - www.ijrmmae.in – Pages 97-106

EXPERIMENTAL BEHAVIOR OF FIBER REINFORCED CONCRETE USING RECYCLED AGGREGATE WITH AGRO-WASTE REPLACEMENT

R.Saranraj, B.Anandhakumar, Pavithra, S.Sugunya
Assistant Professor
Department Of civil Engineering, A.R Engineering College,Villupuram
Email:veensann@gmail.com

ABSTRACT:

Utilization of industrial waste materials in concrete compensates the lack of natural resources, solving the disposal problem of waste and to find alternative technique to safeguard the nature. There are a number of agro wastes used as fully or partial replacement of coarse aggregates or fine aggregates. This review carries out a assessment about agro waste substances, which can be adequately utilized in concrete as fine aggregate substitution. This paper reviewed some of these materials like fiber reinforced concrete, recycled aggregates, groundnut shell, super plasticizers are the replacement in concrete. Different physical and mechanical properties of recycled fine aggregates and recycled coarse aggregates as well as agro waste materials has been substituted and it has been reviewed and comparisons are made between them. Deflection and leaching study review are carried out additionally and compared. It can observed that the concrete where river sand is replaced by M – sand and natural aggregates is replaced aggregates which exhibits improved strength and durability properties, but it's slump increases as the rate of replacement increase in the case of superplasticizers and the slump decreases in the case of superplasticizers. There is a less research work reported on agro waste ad groundnut shell, so it is felt that further detailed investigation are required. ready mix concrete each year. It is used in highways, big apartments, bridges, dams, and numerous other applications. Sand is used as fine aggregate in mortars and concrete. Natural river sand is the most preferred choice as the fine aggregate materials.

River sand is a product of natural weathering of rocks over a period of millions of years. It is mined from the river beds and sand mining has disastrous environmental consequences. River sand is becoming a scarce commodity and hence exploring alternatives to it has become imminent. Fiber Reinforced Concrete, Groundnut shell powder, Recycled Coarse aggregates are the alternative materials is used.

INTERNATIONAL JOURNAL OF RESEARCH IN MECHANICAL, MECHATRONICS AND AUTOMOBILE ENGINEERING (IJRMMAE)
ISSN: 2454-1435 (Print) | 2454-1443 (online)
Volume 4 Issue 3, October – Dec. 2018 - www.ijrmmae.in – Pages 97-106

Concrete is a mixture comprised of cement (10-15 percent), coarse and fine aggregates (60-75 percent) and water (15-20 percent) by volume. Fiber Reinforced Concrete, Groundnut shell powder and Recycled Coarse aggregates can be used as a partial replacement in PCC concrete. Fine aggregates are generally 3/8 inch or smaller, while coarse aggregates are 3/8 to 2 inches in diameter. Natural Coarse aggregates and Recycled Coarse aggregates, are the two critical requirements for concrete aggregates: it is uniformly graded, and is strong, hard, and durable. In this report fiber reinforced concrete, and groundnut shell powder are used as partial replacing material.

Keywords: Recycled aggregates, groundnut shell powder, super plasticizers.

1.INTRODUCTION

Concrete is the most widely used construction material because of its high compressive strength, relatively low cost, *etc*. One adverse property of concrete is its sensitivity to crack formation as a consequence of its limited tensile strength. Normally concrete is a mixture of three essential ingredients. They are fine aggregate, coarse aggregate and water. Strength of concrete is based on the choice of size, shape and properties of the fine and coarse aggregate, quality of water etc. After that admixtures are introduces to improve the properties of concrete. Finally special concretes are manufactured for avoiding failures in strength, elasticity, creep, shrinkage and durability of conventional concrete. Because of incomparable strength of concrete, it is used for all industrial and big constructions. India uses about 7.3 million cubic meters of ready mix concrete each year. It is used in highways, big apartments, bridges, dams, and numerous other applications. Sand is used as fine aggregate in mortars and concrete. Natural river sand is the most preferred choice as the fine aggregate materials.

River sand is a product of natural weathering of rocks over a period of millions of years. It is mined from the river beds and sand mining has disastrous environmental consequences. River sand is becoming a scarce commodity and hence exploring alternatives to it has become imminent. Fiber Reinforced Concrete, Groundnut shell powder, Recycled Coarse aggregates are the alternative materials is used.

Concrete is a mixture comprised of cement (10-15 percent), coarse and fine aggregates (60-75 percent) and water (15-20 percent) by volume. Fiber Reinforced Concrete, Groundnut shell powder and Recycled Coarse aggregates can be used as a partial replacement in PCC concrete. Fine aggregates are generally 3/8 inch or smaller, while coarse aggregates are 3/8 to 2 inches in diameter. Natural Coarse aggregates and Recycled Coarse aggregates, are the two critical requirements for concrete aggregates: it is uniformly graded, and is strong, hard, and durable. In this report fiber reinforced concrete, and groundnut shell powder are used as partial replacing material.

INTERNATIONAL JOURNAL OF RESEARCH IN MECHANICAL, MECHATRONICS AND AUTOMOBILE ENGINEERING (IJRMMAE)
ISSN: 2454-1435 (Print) | 2454-1443 (online)
Volume 4 Issue 3, October – Dec. 2018 - www.ijrmmae.in – Pages 97-106

2. MATERIALS AND METHODS

A. ***Cement***

The Portland Pozzolana cement is a kind of blended cement which produced by either integrating of OPC clinker along with gypsum and pozzolonic materials separately or throughly blending them in a certain proportions. Pozzolana is a natural or artificial material containing silica in a reactive form. It may be further discussed as siliceous and aluminous material which is itself possesses little or no cementatious properties, but is chemically react with calcium hydroxide at ordinary temperature to form compounds possessing cementatious properties. Portland pozzolona cement produces less heat of hydration and offers greater resistance to attack of aggressive water.

B. ***Fine aggregate***

The sand from river due to natural process tends to possess smoother surface texture and better shape. It also carries moisture that is trapped in between the particles. These characters make concrete workability better. Fine aggregates are added to concrete to help workability and to get consistency blend. ordinary stream sand conforming IS 383-1970 was utilized in this project.

C. ***Coarse aggregate***

Graded crushed hard blue jelly are used. Aggregate shall comply the requirement of IS 383.As far as possible preference shall be given to natural aggregates. The nominal size of coarse aggregate should be large as possible within the limits specified but in no case greater than one fourth of the minimum thickness of the member. However for most of the work 20 mm and 12mm sizes in the combination of 70%, 30% respectively were selected as coarse aggregate because this particular combination had minimum voids. The properties of coarse aggregate used

D. ***Super plasticizer***

Super plasticizer is an essential component for high strength concrete. Conplast SP430 was used. Conplast SP430 has been specially formulated to give high water reductions upto 25% without loss of workability or to produce high quality concrete of reduced permeability. Conplast SP430 is the chloride free, super plasticizer based on sulphonated naphthalene polymers and Specific gravity is 1.20 to 1.21 at 300^{o} C..

E. ***Agro- waste***

Agro – waste is defined as waste which is produced from various agriculture activities. These agro-wastes include manures, bedding, plant stalks, hulls, leaves, and vegetables matter. Agro-waste is usually produced through farming activities.

INTERNATIONAL JOURNAL OF RESEARCH IN MECHANICAL, MECHATRONICS AND AUTOMOBILE ENGINEERING(IJRMMAE)
ISSN: 2454-1435 (Print) | 2454-1443 (online)
Volume 4 Issue 3, October – Dec. 2018 - www.ijrmmae.in – Pages 97-106

3. EXPERIMENTAL INVESTIGATION

The test conducted in harden concrete are cube compressive strength test, cylinder compressive strength test with recycled aggregates by using groundnut shell powder.

F. Cube compressive strength test

For cube compression tests on concrete, cube of size 150 mm were employed. All the cubes were tested in saturated condition after wiping out the surface moisture from the specimen. For this present investigation, cubes were tested by NDT (using Rebound Hammer) and HEICO compression testing machine as per IS: 516-1959 at an age of 7 days and 28 days. The tests were carried out at a uniform stress after the specimen has been placed in the testing machine. Loading was continued till the dial gauge needle just reverses its direction of motion. The reversal in the direction of motion of needle indicates that the specimen has failed. The dial gauge reading at that instant was noted which is the ultimate load. The ultimate load divided by the cross sectional area of the specimen is equal to the ultimate cube compressive strength.

Compressive strength = (load/Area) N/mm^2=26.26N/mm^2

Fig 1. Compressive strength

G. Split tensile strength of concrete

Fig 2. split tensile strength of concrete

INTERNATIONAL JOURNAL OF RESEARCH IN MECHANICAL, MECHATRONICS AND AUTOMOBILE ENGINEERING(IJRMMAE)
ISSN: 2454-1435 (Print) | 2454-1443 (online)
Volume 4 Issue 3, October – Dec. 2018 - www.ijrmmae.in – Pages 97-106

H. Sieve analysis for river sand

Sieve size	Weight Retained(g)	%Retained	Cumulative %Retained
4.75mm	0.046	4.6	4.6
2.36mm	0.030	7.6	7.6
1.18mm	0.166	24.2	24.2
600Microns	0.210	45.2	45.2
300Microns	0.406	85.8	85.8
150Microns	0.118	97.6	97.6
PAN	0.024	10.0	100

Fineness modulus of sand=3.65

I. Sieve analysis for M-sand

Sieve size	Weight Retained(g)	%Retained	Cumulative %Retained
4.75mm	0.016	1.6	0.6

INTERNATIONAL JOURNAL OF RESEARCH IN MECHANICAL, MECHATRONICS AND AUTOMOBILE ENGINEERING(IJRMMAE)
ISSN: 2454-1435 (Print) | 2454-1443 (online)
Volume 4 Issue 3, October – Dec. 2018 - www.ijrmmae.in – Pages 97-106

2.36mm	0.017	1.3	1.3
1.18mm	0.104	11.7	11.7
600Microns	0.152	26.9	26.9
300Microns	0.425	69.4	69.4
150Microns	0.192	88.6	88.6
PAN	0.114	10.0	100

Fineness modulus of M- sand=2.98

J. Sieve anlaysis for coarse Aggregate

Sieve Size	**Weight Retained (g)**	**Cumulative Retained (g)**	**Cumulative (%) Retained (g)**
40mm	0	0	0
25mm	382	382	7.64
20mm	3392	3774	75.48
16mm	1048	4822	96.44
12.5mm	144	4966	99.32
10mm	24	4990	99.8
6.3mm	4	4994	99.88
4.75mm	0	4994	99.88
Pan	6	5000	100

Coarse Aggregate = 678.44

K. Compaction factor test

W/C	**Partially**	**Fully**	**Cumulative**

INTERNATIONAL JOURNAL OF RESEARCH IN MECHANICAL, MECHATRONICS AND AUTOMOBILE ENGINEERING(IJRMMAE)
ISSN: 2454-1435 (Print) | 2454-1443 (online)
Volume 4 Issue 3, October – Dec. 2018 - www.ijrmmae.in – Pages 97-106

Ratio	compacted (Kg)	Compacted (Kg)	Frequency value
0.4	15.58	18.18	0.7707
0.45	16.10	18.98	0.7627
0.5	17.8	19.4	0.8726
0.55	19.01	19.62	0.9522
0.6	19.49	19.72	0.9821

Average Compaction Factor = 0.86806.

4. RESULTS AND DISCUSSION

The compressive strength test for cubes and cylinders are done. Their results are shown.

L. Compressive strength results

Type	Compressive strength At 28 days(N/mm^2)	
	Cube	Cylinder
SPECIFIC GRAVITY	36.44	34.52
RCA	32.145	25.14
GSP	31.68	21.32
NCA	41.52	36.52

M. Split tensile strength

The split tensile strength of concrete can be determined by using cylinder results are shown.

Type	Split tensile strength(N/mm^2)

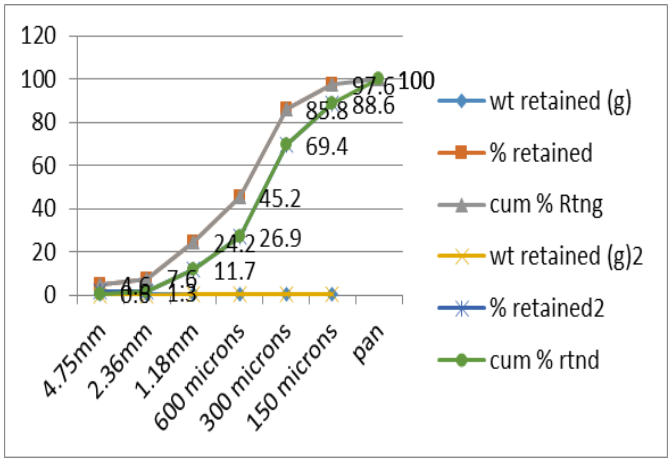
INTERNATIONAL JOURNAL OF RESEARCH IN MECHANICAL, MECHATRONICS AND AUTOMOBILE ENGINEERING(IJRMMAE)
ISSN: 2454-1435 (Print) | 2454-1443 (online)
Volume 4 Issue 3, October – Dec. 2018 - www.ijrmmae.in – Pages 97-106

SPECIFIC GRAVITY	3.57
RCA	3.12
GSP	2.27
NCA	4.18

Comparison of strength properties results

Cube compressive strength

The compressive strength of hardened concrete is often used as an index of the overall quality of concrete because it is considered one of the most important concrete properties. The compressive strength of cube and cylinder was replaces with RCA and GSP for both coarse aggregates and fine aggregates. It is little better than control concrete as it observed from test results.



Comparison of River sand and M-sand

5. CONCLUSION

An experimental study was carried out for strength and durability properties of concrete. Based on the extensive studies, the following conclusions have been drawn. They are summarized below.

From this experimental study the following conclusions were arrived

1. The replaced concrete is less workable than the control concrete.

2. Compressive strength for cube and cylinder composed of groundnut shell powder and recycled coarse aggregates are replaced is better than the control concrete.
3. The split tensile strength of the cylinder, of the concrete is replaced is better than the of the control concrete.
4. The hardened of the concrete is more or less same to that the control the concrete. Groundnut shell powder is mixed with cement of concrete hard.
5. Therefore it can be concluded that the replaced concrete can be reasonably used instead of the control concrete since their 28 days strength id well attained.
6. Therefore, the experimental results showed that the use of GSP in concrete improved strength characteristics, as well as the results is well attained to be used reasonably.
7. Hence we recommend using these replacement materials and preserve environment from agro- wastes.

6. References

1. M. karthikeyan and B. Asha (2017), "Feasibility study on using low cost adsorbents for the removal of cd(II) from textile wastewater". International Journal for Science and Advance Research in Technology, 3(9), 437-441. ISSN:2395-1052.

2. M. karthikeyan and Dr.B.Asha (2016), "Adsorption of Toxic Metals from Fabric Dye Effluent by Utiize Azadirachta Indica Foliages. "International Journal of Printing, Packaging & Allied Sciences,4(1), 257-267. ISSN: 2320-267. ISSN: 2320-4387. (Anna University-Annexure 1).

3. M. karthikeyan, Dr.B. Asha and U. Abirami (2016) "Cement Concrete behavior with replaced fo sewer water", Indian Journal of Environmental Protection, 36(9), 721-724. ISSN0253-7141. (Scopus Indexed).

4. M. karthikeyan and N. Prakash (2016), "Relative Analyze of Flexural Behavior of FRC using Recycled Aggregates with Quarry Dust Replacement", International Journal of Earth Sciences and Engineering, 9(3), 912-917. ISSN: 0974-5904. (scopus Indexed).

5. M. karthikeyan, A. Nandhini, R. Vinodha (2015), "Application on Partial Substitue of Cement by Bentonite in Concrete", International Journal of ChemTech Research, 8(11), 384-388. ISSN 0974-4290. (Scopus Indexed).

6. M. karthikeyan, Dr. B. Asha, P. Swaminathan, B. Sekar & N. Naga Arjuna (2015), "Reuse of Sago Treated Wastewaster Partially substitute in concrete", International Journal of Applied Engoneering Research, 10(2), 2050-2512 ISSN 0973-4562. (Scopus Indexed).

7. M. karthikeyan, Dr. B. Asha, and P. Raja Ramachandran (2014), "Application of Fine Aggregate by Replacement of Tannery Dry Sludge in Concrete" in International Journal of Applied Environmental Sciences, 9(6), 2805-2815. ISSN 0973-6077. (Scopus Indexed).

ISSN: 2454-1435 (Print) | 2454-1443 (online)
Volume 4 Issue 3, October – Dec. 2018 - www.ijrmmae.in – Pages 97-106

1. M. karthikeyan and Dr.B. Asha(2014), "Experimental Analysis of Regenerate the Treated Wastewater in Concrete. "Interational Journal of World Research, 1(IV), 32-37. Research (ISSN: 2347-937X).

2. Aggarwal, Y., Siddique, R.,2014, Microstructure and properties of concrete using bottom ash and waste foundry sand as partial replacement of fine aggregates. Constr, Build mater.54,210-223.

3. Ahmmad, R.,Jumaat, M.Z.,Bahri,S.,Islam. A.B.M.S., 2014. Ductility performance of lightweight concrete element containing massive palm shell clinker. Constr, Build. Mater,63,234-241.

4. Alnuaimi, A.S., 2012. Effects of copper slag as a replacement for fine aggregate on the behavior and ultimate strength of reinforced concrete slender columns. TJER 9 (2), 90-102.

.