International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 07 | July 2020 www.irjet.net p-ISSN: 2395-0072

Experimental Study on M20 Grade of Concrete with Acid Soaked Recycled Aggregate in Concrete

G.Sripavithra[1], Dr.R.Malathy[2]

[1]PG Student, Department of Civil Engineering, Sona College of Technology, Salem-636005, Tamil Nadu, India
[2]Professor,HOD/Dean – R&D, Department of Civil Engineering, Sona College of Technology,Salem-636005, Tamil Nadu, India

---

Abstract *India is a developing country. In India the construction and demolition waste is increased. The current quantity of waste estimates to be around 48 million to per annum out of which the waste generated from the construction industry is found to be around 12 to 14.7 million tons. The resultant concrete which is referred to as Recycled Aggregate Concrete would create a sustainable end for concrete waste, and reduce the demand for NA, by using an RA dumping of construction and demolition waste can be reduced and this process leads to be an ecofriendly in nature. By adopting this process it helps to increase the strength, durability and reduce the water absorption various treatment process has been carried out during the test procedure. The various treatment process are fly ash slurry coating, cement slurry coating, and acid soaking method are used in the process of a recycled aggregate. While checking with the quality Recycled aggregate is low when compared with the natural aggregate. This is due to cement mortar which is sticking on its surface.*

Key Words: **Recycled Aggregate, Recycled Coarse Aggregate, Cement Slurry Treatment, Fly Ash Slurry Treatment, Chemical Treatment.**

1. INTRODUCTION

Past few decades, the construction activities are increased in India. The naturally available construction material are reduced in construction field. The aggregate are one of the most important material in construction the aggregate are manufactured naturally from available rocks. The natural rocks has led to its scarcity. The eco-balance in environment which was decreased by the use of load on these natural material. The way to reduce this load is to use the various alternative material. To replace these natural aggregates the reuse of demolition waste is used in the construction.

From the construction and demolition waste the coarse aggregate can be recycled with natural aggregates by improving its different properties. But now there are four method are adopted to improve the properties of recycle of coarse aggregates. For fresh and hardened properties of concrete, the treated aggregates are tested and compared with natural aggregates.

2. MATERIAL AND METHODS

This part describes about the materials that are used in the experimental set up and the procedure carried out for processing the recycled aggregate and how the recycled concrete aggregates were obtained. The recycled aggregate has been treated with various treatment process.

2.1 Materials Used

(1) Cement: Ordinary Portland cement of grade 53 according to the specification of IS 269:2015 is used. The specific gravity of cement was found to be 3.15.

(2) M-sand: M-sand passes through 4.75mm sieve is used as fine aggregate .The specific gravity of 2.69

(3) Recycled Aggregate: The crushed concrete specimen waste was taken from the nearby institute. This laboratory test cube and cylinder were part of the waste that has been generated from the lab

Table -1: Properties of NA and RA Obtained After Different Treatment Methods

Properties	Natural aggregate	Recycled aggregate	Fly ash coated	Cement slurry	Acid soaking
Specific gravity	2.79	2.67	2.50	2.91	2.42
Water absorption	2%	4%	3.10%	3.27%	2.7%
Impact value	7.3%	9.5%	16%	18%	6%
Crushing value	9.25%	16.52 %	15.20 %	16.26 %	7.53%
Density (kg/m^3)	1673.8	1392.5	1352.5	1251.2	1497.7

2.2 Methods to Improve Properties of Recycled Coarse Aggregate

During the process of recycled aggregate concrete mortar particle which has been sticking in those aggregate is found. In order to remove the particle various which present in aggregate treatment process have been carried out and the result will show the increased quality of the recycled aggregate.

2.2.1. Cement Slurry Coating of RA

This cement slurry method is used to bonding of aggregate improved the surface properties of recycled aggregate in concrete mix. In cement and water cement ratio is 0.5 mixed. The coating is done on the RA and is kept dried for 24 hours. Then the treated aggregate is used in the concrete mix process.

2.2.2 Fly Ash Slurry Coating of RA

This is method is similar to the previous method for coating but for preparing the fly ash slurry. 10% of cement is replaced by adding fly ash. In fly ash and water ratio is 0.5 mixed. The coating is done on the RA and is kept dried for 24 hours. Then the treated aggregate is used in the concrete mix process.

2.2.3 Acid Soaking Method of RA

In this method 5M H_2SO_4 solution was prepared in distilled water. The RA is soaked in Acid for 24 hours. After the completing of 24 hours the aggregate is washed with water and is dried in sunlight. Then the treated aggregate is used in the concrete mix process.

2.3 Concrete Mix Proportion

The recycled concrete is prepared for M_{20} grade of concrete as per IS 10262-2009. The ordinary Portland cement of 53 grade is used with M-Sand. The water cement ratio is 0.5 adopted without adding super plasticizer. The mixing is done by hand mix and the concrete is mixed uniformly.

3. RESULTS AND DISCUSSION

3.1 Workability Measurement by Slump Test

Slump test is the most commonly used method of measuring consistency of concrete. Slump test as per IS: 1199-1959 is followed. The apparatus used for doing slump test are slump cone and tamping rod. Bottom diameter of the slump cone is 200mm, top diameter of slump is 100mm and height of slump cone is 300mm. the concrete is filled by three layers; each layer is tamped 25 times using the tamping rod. After the top layer has been rodded mould is removed from the concrete immediately raised slowly and carefully in vertical direction. This allows concrete to subside and this subsidence referred as slump of concrete. If concrete slide evenly it is called true slump, if one half of cone slide down it is called shear slump, in collapse slump concrete collapse complete.

Table-2: Workability of Mixes

Mix	Slump value in mm
Natural aggregate	50
Recycled aggregate	40
Cement slurry coating of RA	75
Fly ash slurry coating of RA	80
Acid soaking method of RA	90

3.2 Compressive Strength Test

Test is carried out to determine 7,14 and 28 days strength of concrete on cube specimen of size 150mm x 150mm x 150mm according to IS: 516- 1956. Compression test is the most common test conducted on hardened concrete property and because it is an easy test to perform, and partly because most of the desirable. Characteristic properties of concrete are qualitatively related to its compressive strength.

3.3 Split Tensile Strength Test

Test is carried out to determine 7,14 and 28 days strength of concrete on cylindrical specimen of size 150mm diameter and 300mm height is used, test is carried out according to IS: 5816-1970 standards. Load is applied without shock and increased continuously until the resistance of the specimen tone the increasing load brake down and no grater load can be sustained. The maximum load applied was then recorded and any unusual type of failure was noted.

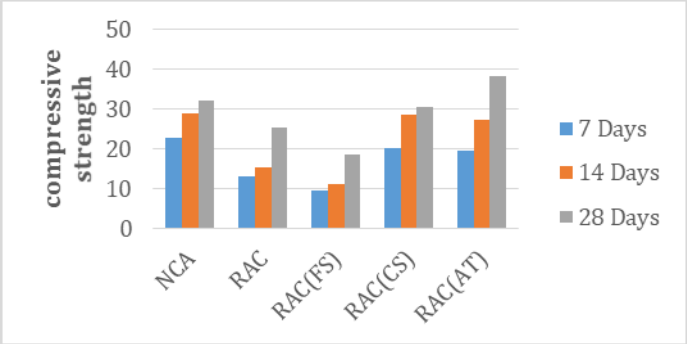

Chart -1: Compressive Strength

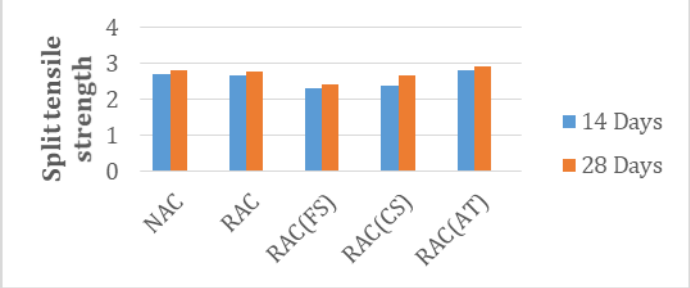

Chart -2: Split Tensile Strength

4. CONCLUSIONS

Based on the experimental investigation following conclusions are draw

1. While checking with the quality Recycled aggregate is low when compared with the natural aggregate. This is due to cement mortar which is sticking on its surface.
2. To increase the quality and to remove the old cement mortar various treatment is being carried out. They are Fly ash slurry coating, cement slurry coating and acid soaking.
3. With the result of physical and chemical properties of RCA such as Specific gravity, water absorption, density, impact value and crushing value.
4. While comparing with the above mentioned treatment acid soaking generates better quality of aggregate.
5. All the treatment method lead to an improvement in slump values of concrete mixes.
6. By removing the surface modification technique compressive strength is increased in RCA
7. Compressive strength of RAC (30.7MPa) is lower than the natural aggregate concrete. Hence compressive strength of RAC treated by various methods shows better results than the natural aggregate.

REFERENCES

[1] Yu-chang Liang and Yunping Xi, "Development of processing method to improve strength of concrete with 100% recycled coarse aggregate", J. Mater. Civ. Eng., 10.106/ (ASCE) MT.1943-5533.0000909.

[2] Tsujino, M, "Completely Recyclable Concrete of Aggregate Recovery Type by Using Microwave Heating Technology" Proc2 third ACF International conf., Elsevier.R. Nicole, "Title of paper with only first word capitalized," J. Name Stand. Abbrev, in press.

[3] Shruti K, "A Study on the Recycling Techniques and Properties of Concrete Waste from Namma Metro Piles", M.tech thesis report, Department of Civil Engineering, BMSCE Bangalore.

[4] YG Zhu, and SC Kou, "Influence of Silicone Base Water Repellent on the Durability Properties of Recycled Aggregate Concrete", Cement and concrete composites Volume 35, Issue 1, January 2013, Page 32-38.

[5] Abdulkadir T.S, Oyejobi D.O and Lawal A.A, "Evaluation of Sugarcane Bagasse Ash as a Replacement in Concrete Works", ISSN: 2067-3809 (July-September).

[6] Anaam abusharkh and Amani zaher, "Strength and Durability Evaluation of Recycled Aggregate Concrete", International Journal of Concrete Structural and Material, Vol.9, No.2, PP.219-239, June2015.

[7] Shrinath.H, and Avinash, "Influence Of Treatment Methods on Recycled Aggregate Concrete Made With Recycled Coarse Aggregate"

[8] IS: 10262-1982(reaffirmed 1999), "Indian Standard Recommended Guidelines for Concrete Mix Design", Bureau of Indian Standards, New Delhi

[9] IS: 516-1959(reaffirmed 1999), "Indian Standard Methods of Test for Strength of Concrete", Bureau of Indian Standards, New Delhi.

[10] IS: 10262-1982(reaffirmed 1999),"Indian Standard Recommended Guidelines for Concrete Mix Design", Bureau of Indian Standards, New Delhi.

[11] IS: 1199-1982(reaffirmed 1999), "Indian Standard Methods of Sampling and Analysis of Concrete", Bureau of Indian Standards, New Delhi.

[12] IS: 5816-1970, "Indian Standard Methods Of Test For Splitting Tensile Strength Of Concrete Cylinders.

[13] IS: 12269-1987, Specification for 53-grade ordinary Portland cement.

[14] BIS: 383 – 1970, Specifications for Coarse and Fine Aggregates from Natural Sources for Concrete, New Delhi, Bureau of Indian Standards.

[15] IS 2386-3(1963), Methods of Test for Aggregates for Concrete, Part3: Specific Gravity, Density, Absorption and Bulking.