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AN EXPERIMENTAL INVESTIGATION AND DURABILITY PROPERTY ON RECYCLED CONCRETE WITH PARTIAL REPLACEMENT TO FINE AGGREGATE IN COCONUT SHELL CONCRETE

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ABSTRACT
Concrete is a matrix mixture in the 18th century this mix has become a revolutionary material and used in the site for construction, the latest replacement to fine aggregate has invented and is name as recycled aggregate. The crushed building material is used as a sand replacement in concrete. The compressive strength and impact strength will be compared to normal concrete. Coconut shell aggregate concrete has been established using other conventional concrete constituents expect coarse aggregate. Nowadays, the resources of river sand are exploited and facing many problems by the society because of nonavailability of river sand. Hence recycled aggregate is used for the production of concrete at presents. Here coconut shell is taken as a coarse aggregate and recycled aggregate as fine aggregate in the production of concrete. This study is aimed to investigate the durability performance of coconut shell aggregate concrete with demolished aggregate.
Keywords: Recycled aggregate, Coconut shell, Newborn material, Compressive strength, Tensile strength.

INTRODUCTION
Concrete is used in construction and nowadays lot of investigation is going on to enhance some properties in concrete, with the help of some materials mixed with concrete to increase the strength and their properties. Because of removal of the aged building, that removal creates environmental pollution and now planning for replacing so this will be introduced in concrete as fine aggregate.
The concrete with recycled aggregate (RA) has been investigated and compared with control concrete. RA obtained by crushing or other process is less than 4.75mm the potential of waste coconut shell as a substitute for coarse aggregate in concrete. This can be effectively used in cement concrete as a coarse aggregate, thus helps in prevent the environment and improve the economy by providing a new use of coconut shell to develop LWC.

EXPERIMENTAL
Material used
Cement, sand, demolished material, coconut shell. Materials are collected from near hardware shops and recycled aggregate is gotten from the building's waste stored place.

Cement: The 53 grade OPC cement material is used and gotten from the hardware shop.

Sand: Fine aggregate is the main constitution for making the concrete and is collected from a near available place then sieved through 4.75mm.

Recycled Fine Aggregate [RA]: Fine aggregate in concrete was replaced by demolished building material, then it was collected in the lab and it demolished with the hammer with 4kg weight and it was sieved through 4.75mm sieve.

Vol. 11 | No. 2 |702 - 708 | April - June | 2018

Coconut Shell: Coconut shell used as not more than 12.5mm as coarse aggregate in concrete. One side of the shell will be smooth and another side little rough. Coconut shell aggregate is high water absorption nearly, 20%

RESULTS AND DISCUSSION

The test was done on the concrete cube, cylinder, and prism. The concrete specimens are tested at age of 3rd, 7th and 28th days.

Compressive Strength Test

The compressive testing machine (CTM) is used and the cube is kept at in between the two supporting where the contacting surfaces must be leveled. The size of the cube specimen is 100mmx100mmx100mm. The results are shown in Table-1.

Table-1: Result for compressive strength of CC, CSC along with RA

Compressive strength (Mpa)				
Mix	% of Recycled aggregate as fine aggregate	3rd Day	7th Day	28th Day
Control Concrete	00	16.74	19.92	27.92
Coconut Shell Concrete	10	16.12	19.05	27.53
	20	16.07	18.83	27.09
	30	15.40	17.53	26.18
	40	15.32	16.5	25.76
	50	14.07	16.0	25.09

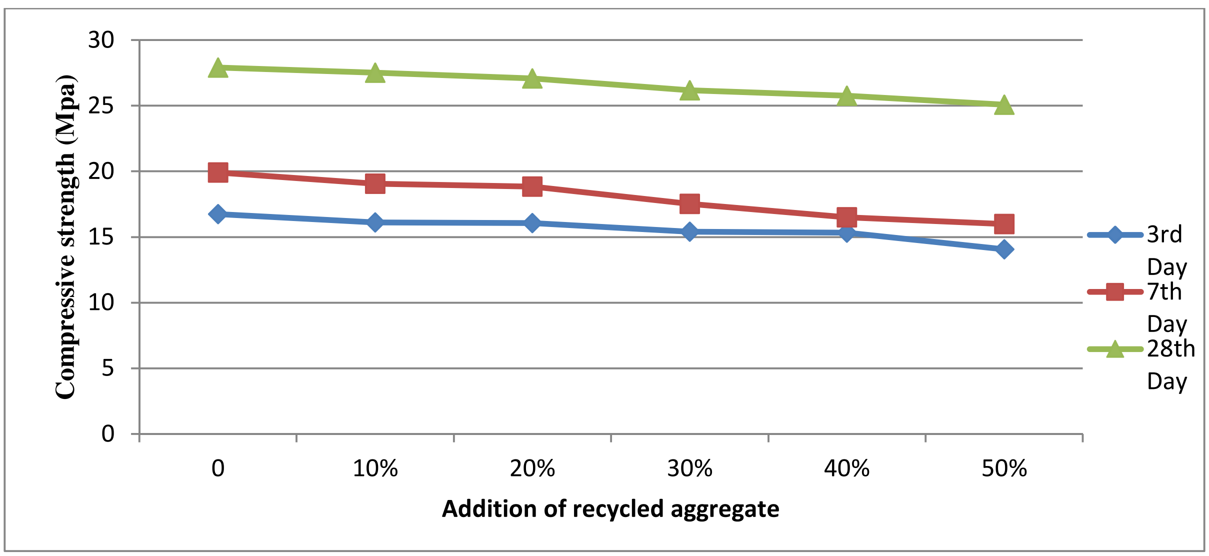

Fig.-1: Results on Compressive Strength of CC, CSC, with RA

Split Tensile Strength

The test was performed on cylinders the specimen used for testing as the size of 200mm height and 100mm dia and the results are given in Table-2.

Table -2: Split tensile strength results for CC, CSC with RA

Split tensile strength (Mpa)				
Mix	% of Recycled aggregate as fine	3rd Day	7th Day	28th Day

RASĀYAN J. Chem.
Vol. 11 | No. 2 |702 - 708 | April - June | 2018

	aggregate			
Control concrete	00	2 .34	3.81	4.03
Coconut shell concrete	10	2.13	3.74	4.02
	20	2.08	3.65	3.91
	30	2.06	3.57	3.89
	40	2.07	3.56	3.84
	50	2.05	3.48	3.73

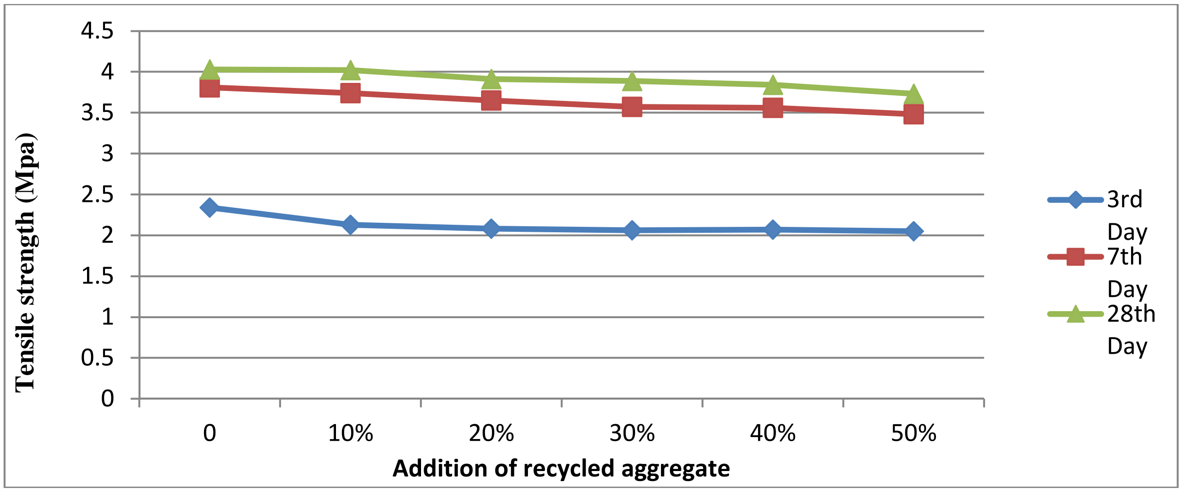

Fig.-2: Tensile strength of CC, CSC with RA

Flexural Beam Test

This test was done in the universal testing machine, for carrying out the test the beam specimen of size 100x100x500mm is used. To compute the stress, the formula of (PL/bd^2) N/mm^2.

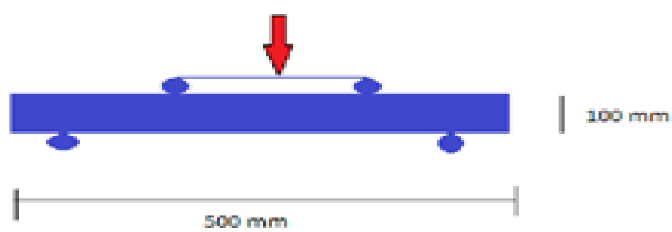

Table-3: Flexural Strength of concrete results for CC, CSC with RA

Flexural Strength (Mpa)				
Mix	% of recycled aggregate as fine aggregate	3^{rd} day	7^{th} day	28^{th} day
Control concrete	00	2.4	4	7
Coconut shell concrete	10	2.8	4.5	7
	20	2.3	3.8	6.4
	30	2.1	3.54	6.2
	40	2	3.18	5.8
	50	2	3.20	6

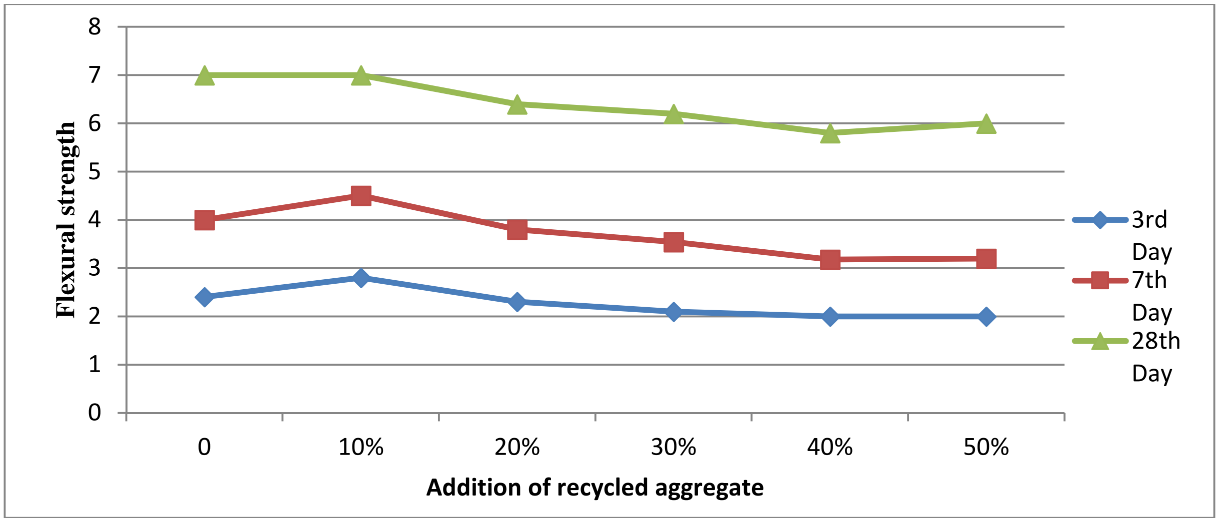

Fig.-3: Flexural Strength of CC, CSC with RA

Absorption and VPVs Test

VPV is one of the properties and it affects the transfer mechanisms through the concrete, that outpouring of liquid and gases. Absorption and permeable voids of the concrete test are done based on ASTM C 642-97 (oven dry method). The test conducted on three samples of 100mm height. Absorption test result for control concrete and coconut shell concrete for 3days, 7 days and 28th day.

Table-4: Absorption test of control concrete & coconut shell concrete along with RA

	Conventional concrete		Conventional concrete with Recycled aggregate		Coconut shell concrete with Recycled aggregate	
DAY	Absorption after immersion %	Absorption after immersion and boiled%	Absorption after immersion %	Absorption after immersion and boiled %	Absorption after immersion %	Absorption after immersion and boiled %
3	7.62	8.15	7.62	8.91	14.2	17.15
7	2.6	6.4	2.32	6.52	4.71	7.65
28	2.30	2.72	2.41	2.76	3.8	4.67

This test method covers the determinations of density, percent absorption, and percent voids in the hardened concrete. The conventional concrete decrease in absorption value at 0.96% by replacing recycled aggregate instead of sand.

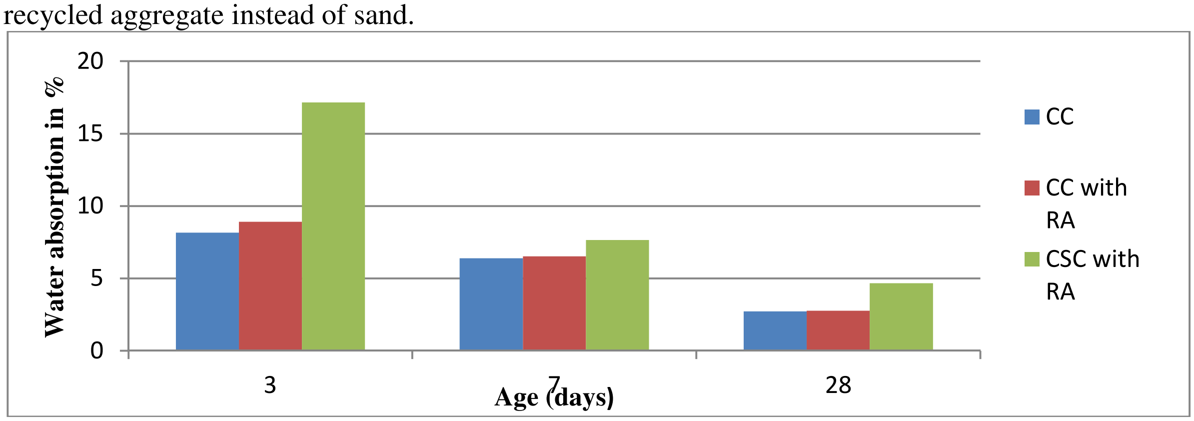

Fig.-4: Absorption test immersion in water of CC and CSC with RA

Coconut shell aggregate concrete decreases in absorption value at 2.9% by replacing recycled aggregate instead of sand. Volume of permeable voids results for control concrete and CS concrete for 3rd, 7th and 28th days.

Table-5: Volume of permeable voids of CC with RA and CSC with RA

Day	Conventional concrete	Conventional concrete with RA (%)	Coconut shell concrete with RA (%)
3	23.33	22.89	34.11
7	16.42	17.95	15.18
27	6.83	6.82	8.76

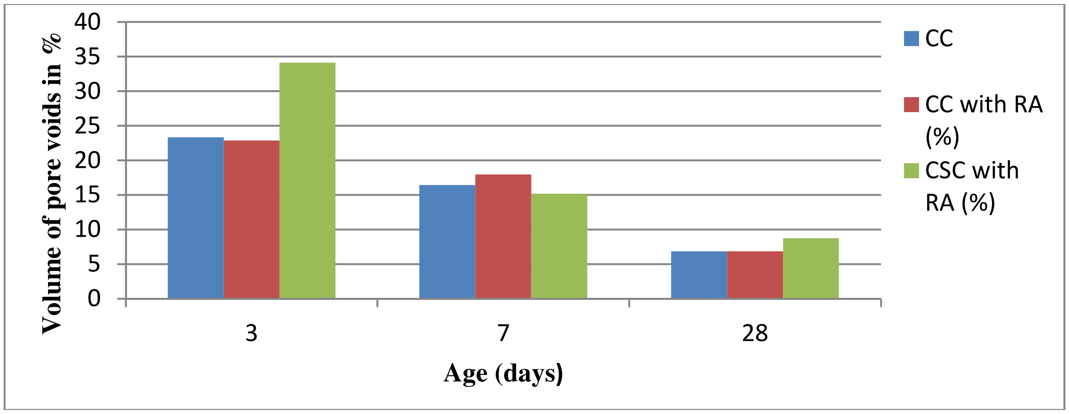

Fig.-5: Volume of permeable voids of CC and CSC with RA

The conventional concrete decrease in volume of permeable of voids (VPN) at 0.17 % by replacing recycled aggregate instead of sand. Figure 4 shows the volume of permeable voids test results of coconut shell aggregate concrete.

Sorptivity Test

The test will be conducted on three samples of 100 mm dia and 50 mm thick, it will be collected from 100 mm dia and 200mm higher. Dry the samples for 7 days at 50°C and it was cool in a container for 3 days. Sorptivity test results for control concrete and CS concrete for 3rd, 7th and 28th days are shown in Table-6.

Table-6: Sorptivity test of control concrete and CS concrete along with RA

Day	Conventional concrete($mm/min^{0.5}$)	Conventional concrete with RA($mm/min^{0.5}$)	Coconut shell concrete with RA($mm/min^{0.5}$)
3	0.081	0.080	0.120
7	0.078	0.083	0.114
28	0.072	0.075	0.101

Conventional concrete increase in sorptivity at 5 % by replacing recycled aggregate instead of sand at 28 days. Coconut shell aggregate concrete increases in sorptivity at 6.18 % by replacing recycled aggregate instead of sand at 28 days.

Rapid chloride penetration test (RCPT)ASTM C1202 test on 50mm x 100mm dia specimen is applied to 60 V as Direct Current for 6 h. On one side is a 3 % sodium chloride solution and opposite side is 0.3 M sodium hydroxide solution.

Conventional concrete decreases in rapid chloride penetrability test (RCPT) at 1.77 % y replacing recycled aggregate instead of sand. The coconut shell aggregate concrete decrease in rapid chloride penetrability test (RCPT) at 4.26% by replacing recycled aggregate instead of sand.

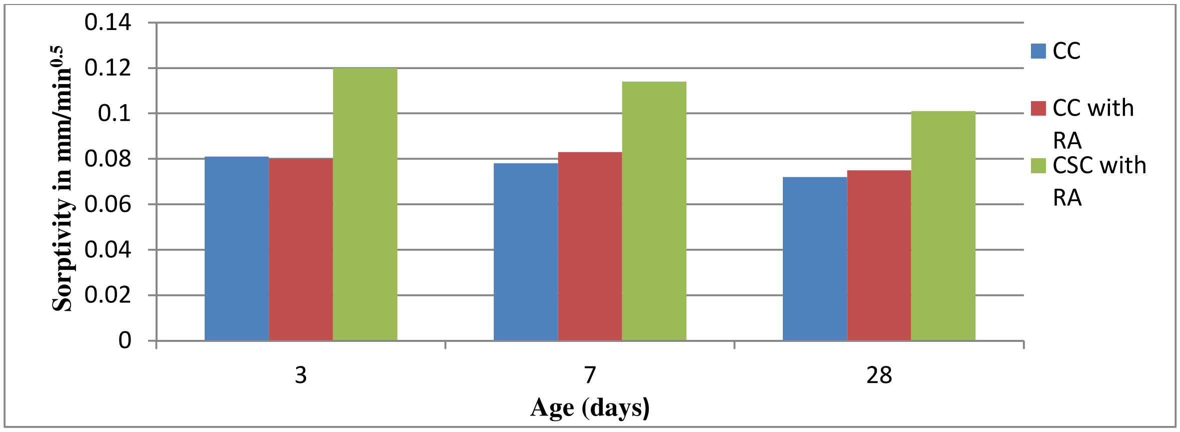

Fig.-6: Sorptivity of control concrete and CS concrete with RA

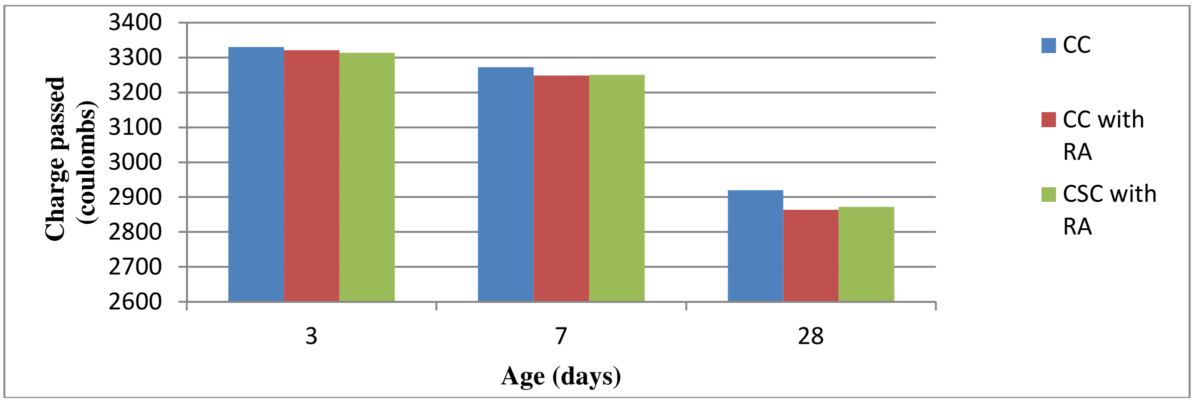

Fig.-7: RCPT of control concrete and CS concrete with RA

Table-7: Rapid chloride penetration test of Control concrete and CS concrete add of RA

Day	CC (charge passed-coulombs	CC with recycled aggregate (charge passed-coulombs)	CSC with recycled aggregate (charge passed-coulombs)
3	3330	3321	3314
7	3272	3248	3250
28	2920	2864	2872

CONCLUSION

- The compressive strength of control Concrete is 27.92 N/mm^2 and coconut shell concrete is 27.60 N/mm^2 at an age of 28 days respectively. Replacement of fine aggregate by demolished concrete is possible up to 50% and its compressive strength at 25.09 N/mm2
- For the conventional concrete decrease in absorption value at 0.96 % by recycled aggregate replaced for sand and coconut shell aggregate concrete decrease in absorption value at 2.9 % by recycled aggregate replaced for sand.
- For the conventional concrete decrease in volume of pore voids at 0.17 % by recycled aggregate replaced for sand and coconut shell aggregate concrete decrease in volume of pore voids at1.3 % by recycled aggregate replaced with sand.

- For the conventional concrete increase in sorptivity at 5 % by recycled aggregate replaced for a sand coconut shell aggregate concrete increase in sorptivity at 6.18 % by recycled aggregate for sand.
- For the conventional concrete decrease in rapid chloride penetrability test (RCPT) at 1.77 % by recycled aggregate for the sand coconut shell aggregate concrete decrease in rapid chloride penetrability test (RCPT) at 4.26 % by recycled aggregate as replaced for sand.

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