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Experimental Behaviour of Short Column using Coconut Shell Ash, Iron Powder and Steel Fibers to Enhance the Properties of Concrete

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Abstract:
Concrete is a material used in building construction, consisting of a hard chemically inert particulate substance, known as aggregate (usually made for different types of sand and gravel), that is bounded by cement and water. This paper presents an experimental investigation carried out to characterize the optimum percentage of coconut shell ash, iron powder with steel fiber. The concrete industry is constantly looking for supplementary cementations material with the objective of reducing the solid waste disposal problem. Steel fibers are used to increase flexural strength. The use of waste material like coconut shell ash, fly ash, rice husk ash, micro silica, iron powder, granite powder which are hazardous to the environment may be used as a partial replacement for cement and in addition by utilising the industrial wastes in the useful manner the environment pollution is reduced to a greater extent and which leads to sustainable development. The work also focuses on M30 concrete with replacement of cement by CSA with 4%,8% and 12%, iron powder is kept constant with 10% replacement and 0.75% of contant addition of steel fibers to study the mechanical properties such as compressive, split tensile and flecxural strength. This paper presents the results on the structural behaviour of CIS RC column and its comparison with ordinary RC column. The reinforced column size is 100mmx100mmx600mm were prepared to study the structural behaviour.The compressive behaviour of CIS concrete columns has been studied and the results are compared with ordinary RC columns. It has been observed from the experimental investigation of the columns, that the CIS columns also exhibited a lot of cracking, thus the crack width and crack spacing was small. The CIS columns exhibited higher deflection under constant load until failure ,compared to ordinary RCC columns.

Key words: Coconut shell ash, Iron Powder, Steel fibers, Waste utilization

I.INTRODUCTION

Concrete is the single most widely used construction material in the world today. Various types of building materials are used during the construction work at different stages according to structural requirements. Coconut shells are considered as light weight aggregate and it should be often dumped as agricultural waste. The aim of this project is to spread awareness of using coconut shell ash as partial replacement of cement in concrete and determine its strength. The water cement ratio is obtained by conducting various workability tests. The obtained results are compared with that of conventional concrete.

II.MATERIALS AND METHOD

The materials used in this project were locally available. Use Ordinary Portland cement(OPC) and coconut shell ash as binding agent, river sand and Iron powder as fine aggregate and addition of hooked end steel fibers are used. Potable tap water was used for mixing and curing.

Cement: The cement used for this study is 53-ordinary portland cement.

S.No	Physical Property	Test Results
1	Specific gravity	3.15
2	Fineness of cement (%)	97
3	Initial setting time	30 mins
4	Final setting time	600 mins

Fine Aggregate: The sand used for all the specimens were Natural river sand. It plays very important role in concrete in both its plastic and hardened state.

S.No	Physical Property	Test Results
1	Specific Gravity	2.74
2	Water Absorption	1
3	Bulk density (kg/m^3)	1600

Coarse Aggregate: Aggregate have large influence on the properties of concrete. Use 20mm size aggregate are used.

S.No	Physical Property	Test Results
1	Specific Gravity	2.74
2	Water Absorption	0.5
3	Bulk density (kg/m^3)	1650

Coconut shell Ash: coconut shells are collected from nearby houses, temples to find out the properties of coconut shell ash

S.No	Physical Property	Test Results
1	Specific Gravity	1.3
2	Fineness (%)	4
3	Bulk density (kg/m^3)	800

Iron Powder: The concrete mix with Iron Powder shows good workability and increased compressive strength of concrete.

S.No	Physical Property	Test Results
1	Specific Gravity	7.86
2	Fineness (%)	4
3	Bulk density (kg/m^3)	2804

III.PREPARATION OF SPECIMENS

Mix Design: M-30 grade of concrete was designed by I.S 10262-1982.The cement were replaced with Coconut Shell Ash as 4%,8% and 12%, Iron Powder constanly replaced with sand as 20% and addition of steel fibers as 0.75% constantly. The test results are analysed and compared with theoretical values, obtained from various codes.

Batching and Mixing: Batching was done as per mix proportions with the help of electronic weigh balance and do the Hand Mixing and machine mixing

Placing and Compaction: Moulds are cleaned and oiled to prevent the formation of bond between concrete and moulds. Place the fresh concrete and tamping each layer 25 times.

Demoulding: After placing fresh concrete in moulds, it was set up for 24 hours and some permanent identification marks are marked on their faces. it should be kept on curing tank on 7, 14 and 28 days. After 28 days , removed from curing tank to conduct tests.

IV.RESULTS AND DISCUSSION

Compressive strength: Specimens used for the test are 150x150x150mm cubes. Cubes are placed in universal testing machine and load applied. The reading on dial gauge was noted and strength was calculated. The test results are shown in Table 1.

Table.1.Compressive strength

Replacement of cement	7days	14 days	28days
0	22.78	30.04	35.17
4	23.55	31.31	40.96
8	26.11	34.87	43.40
12	25.33	33.05	41.85

Split tensile strength: The test is carried out by placing a cylindrical specimen of diameter 150mm and height 300mm,horizontaly between then loading surfaces of a compression testing machine and the loading is applied untill failure of the cylinder, along the vertical diameter. The test results are shown in Table 2.

Table.2.Split Tensile Strength

Replacement of cement	7days	14 days	28days
0	1.08	1.74	2.52
4	2.27	2.48	3.15
8	2.73	2.87	3.64
12	2.41	2.56	3.29

Flexural strength: This test carried by placing a mould of prism of size 500mmx100mm. The test results are shown in Table 3.

Table.3.Flexural Strength

Replacement of cement	7days	14 days	28days
0	4.71	4.98	5.30
4	5.12	5.34	5.79
8	5.94	6.12	6.55
12	5.48	5.67	5.98

Table.4.Load and deflection for ordinary RCC column

Si no	Load(KN)	Deflection in (mm)
1	10	0
2	20	0.5
3	30	0.7
4	40	0.98
5	50	1.26
6	60	1.58
7	70	1.72
8	80	1.99
9	90	2.31
10	100	2.55
11	110	2.79
12	120	2.94
13	130	3.33
14	140	3.69
15	150	3.87
16	160	3.95
17	170	4.16
18	180	4.37
19	190	4.54
20	200	4.97
21	210	5.13
22	220	5.41
23	230	5.86
24	240	6.43
25	250	6.58

The can be fixed longitudinally on the UTM machine and field .dial gauge is attached at the end. The deflection was measured at one points using the dial gauge, fixed at one end. The deflection increased according to load increases..Load and

displacement values for ordinary reinforced concrete column are shown in table.

Table.5.Load and Deflection for CIS1 RCC column

Si no	Load(KN)	Deflection in (mm)
1	10	0
2	20	0.2
3	30	0.4
4	40	0.73
5	50	0.99
6	60	1
7	70	1.39
8	80	1.53
9	90	1.76
10	100	1.95
11	110	2.15
12	120	2.36
13	130	2.53
14	140	2.73
15	150	2.99
16	160	3.12
17	170	3.32
18	180	3.57
19	190	3.76
20	200	3.97
21	210	4
22	220	4.39
23	230	4.6
24	240	4.91
25	250	5.3
26	251.1	5.8

The deflection was measured at one points using dial gauge, fixed at one end. The deflection increases according to gradually increasing load. Load and deflection values for CIS1 reinforced concrete column are shown in the below

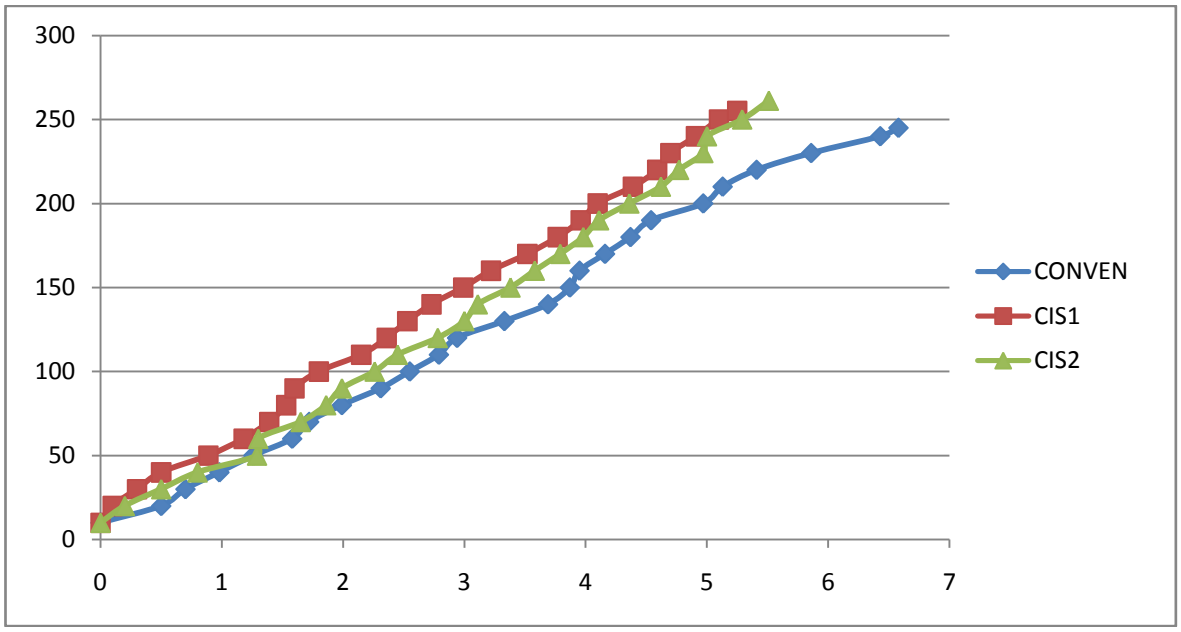
Table.6. Load and Deflection for CIS2 RCC column

Si no	Load(KN)	Deflection in (mm)
1	10	0
2	20	0.3
3	30	0.7
4	40	0.99
5	50	1.29
6	60	1.57
7	70	1.75
8	80	1.96
9	90	2.16
10	100	2.16
11	110	2.75
12	120	2.98
13	130	3.99
14	140	3.11
15	150	3.38
16	160	3.58
17	170	3.79
18	180	3.98
19	190	4.11
20	200	4.36
21	210	4.62
22	220	4.77
23	230	4.97
24	240	5
25	250	5.29
30	261.15	5.51

The deflection was measured at one points using dial gauge, fixed at one end. The deflection increases according to gradually increasing load. Load and deflection values for CIS2 reinforced concrete column are shown in the below table.

Table.7. Comparison between ordinary RCC column with CIS1 and CIS2

	Load	Deflection
Ordinary column	125	6.58
CIS1	162.98	5.38
CIS2	171.1	5.51



V.CONCLUSIONS AND RECOMMENDATIONS

The fiber reinforced concrete exhibits better fatigue strength and increased static and dynamic tensile strength.
1.In this project, to find the coconut shell ash accurate strength and it was investigated as partial replacement of cement with coconut shell ash as 4%,8%and 12% and fine aggregate with Iron Powder 20% constantly and Steel fiber was added in the order of 0.75% constantly by the total volume of concrete.
2. When the accurate strength is achieved from 8% of replacement of cement as Coconut shell ash (M30grade).The rate of gain of compressive strength of coconut shell ash is slow at initial stages and as curing period increases strength also increases.
3. The constant addition of Iron Powder gives to increase the compressive and flexural strength of concrete by addition of steel fiber 0.75% constantly.
4.Replacing the cement with coconut shell ash create good mixture ,Iron Powder makes the concrete more harder and steel fibers is one of the good solution available to the problem of environmental impacts.
5. Finally, it was found that the use of coconut shell ash, Iron Powder and Steel Fibers in concrete increases the compressive, split tensile and flexural strength.
6. CIS1 and CIS2 material column made from 8% replacement of coconut shell ash and constant replacement of iron powder and steel fibers proves exceptionally well in compression, tensile and flexural strength.
7. Comparison of material and conventional short column can be studied by using load – deflection curve and found out the maximum crack obtained.

VI. REFERENCES

[1].Nithesh kumar,"Utilisation of coconut shell in different forms in concrete", Interrnational Jounal for Scientific Research and development, Vol.2,Issue 07,2014.

[2].Vishwas P Kukarni," Comparitive Study on Coconut Shell Aggregate with Conventional Concrete", International Journal of Engineering and Innovative Technology", Vol.2, Issue 12, June 2013.

[3].Utsev ,J.T.,Taku, J.K,"Coconut Shell Ash As Partial Replacement of Ordinary Portland Cement In Concrete Production",International Journal of Scientific and Technology Research, Volume 1,Isssue 8,September 2012.

[4]. Shehdah Ghannam ,Husan najm,Rosa Vasconez," Experimental Study of Concrete made with Granite and Iron Powders as Partial Replacement of Sand", June 16, 2016.

[5].Patil Shweta,Rupali Kavilkar,"Study of Flexural Strength in Steel Fiber Reinforced Concrete", International Journal of Recent Development in Engineering and Technology, Volume 2,Issue 5, May 2014.

[6]. Gurpineet Singh, Hemant Sood, Harvinder Singh, "Improving Structural Performance Using Fibers in Concrete", International Research Journal of Engineering and Technology, Volume 2, Issue 4, July 2015.

[7].I.S 10262-1982:"Recommended guidelines for concrete mix design", 1982.

[8].I.S 12269-1987:"Specifications for 53 grade Ordinary Portland Cement", 1987.

[9].I.S 383-1970:"Specifications for coarse and fine aggregates", 1970. 10. I.S 456-2000:"Indian Standard: Plain and Reinforced Cement Concrete" Code of Practice

[10]. "High Strength Concrete Columns under Axial Compression Load: Hybrid Confinement Efficiency of High Strength Transverse Reinforcement and Steel Fibers".

[11]. "Experimental investigations on hybrid fibre reinforced (hfrc) concrete columns 2012,