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Investigation On Mechanical Properties Of Concrete On Partially Replacement Of Cement With Rice Husk Ash And Steel Fiber With Coarse Aggregate

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ABSTRACT- Globally, the demand of sustainable development is increased; the industry's basic challenge is to fully extract the advantages with diminished use of Portland cement. This can be possible if we use blended cement and recyclable material in concrete which not only reduce cost of construction but also reduce pollution.An experimental program was planned in which one lean concrete mix which did not include any percentage of rice husk ash and rubber fibres and fifteen different mixes with different combinations of Rice Husk Ash and steel Fibres were prepared. Cubes and cylinder specimens were casted to obtain the different physical properties of sixteen concrete mixes with 0%, 7.5%, 12.5%, 17.5% and 22.5% of rice husk ash as to replace some part of cement and 0%, 3%, 6% and 9% of steel fibers as to replace some part of natural coarse aggregates. The cube specimens, cylindrical specimens and beam specimens will be tested after the recommended curing time of curing period of 7 days and 28 days respectively.

KEYWORDS- Steel Fibre, Rice Husk, Coarse Aggregate, Rubber Fibre, Concrete

I. INTRODUCTION

Concrete does an artificially solidified mass comprise cement, aggregates (fine and coarse aggregates) as well as water in definite proportion, divided on the basis of user's requirements [1]. The plastic mass obtained by mixing the above ingredients is capable of being poured into suitable mould to set into a hard solid mass. Cement acts as a binding material in the above mentioned mixture [1]. The addition of water to the above said mixture of the ingredients commences the process of hydration. The chemical reaction is relatively a slow one and it requires time and favourable temperature for its completion. To achieve enhancement of characteristics of the mixture to suit the different site parameters, [2] various experiments and researches have laid down the use of composite materials in the mixture. The composite material is a blend of two mutually compatible materials to yield [2] a stronger material which imparts properties superior to those of the individual components.

Cement being basic ingredient in concrete, its demand is increasing day by day. As its demand increases, its production also increases and it directly effects our environment by emission of tremendous amounts [3] of carbon-dioxide into atmosphere, it tends to impart global warming. So it is necessary to minimize the use cement and this can be achieved [4] only if cement is replaced by alternative binding material either fully or partially. The useful research has been conducted to channelize the utilization of industrial waste like fly ash, blast furnace slag [4], silica fume etc. in concrete without adversely affecting its inherent characteristic. This is due to the fact that such materials because of their filler effect and pozzolanic reactions have the ability to improve and enhance the characteristics and performance of cement.

Globally, the demands of rational development are increasingly rapidly. Basic challenge is to exploit the desirable advantages of concrete, with diminishing the reliance [6] on Portland cement. There are basically four basic concepts to realize the requirement; the first in this direction is the increased use of recycling process of materials. Since the dominant [6] constituent of concrete is aggregates, the most recycling strategy will have to incorporate the substitute of recycled materials for good ones, second is to improve durability. To enhance the life of the structure the amount of materials needed for their replacement can be cut to half amounts. Third is to improve the mechanical characteristics, the improved mechanical strength and similar properties leads to a reduction of materials needed. For example, for members designed [5] on the basis of strength, if the concrete strength is described the amount of materials is reduced to about 50%. Fourth is to augment the use of replaceable cementitous materials there is a lot of carbon dioxide produced during the production of Portland [5] cement, since the process is energy intensive. The increased use of other materials, especially those which are by-products of industrial processes, will tend to have a definite positive effect .Fly ash and Slag are some of the common examples [5] of such by products. Implementation of all these tools and strategies will readily help in sustainable development. A lot of research work is already been conducted towards the utilization of such materials which are easy available and cheaper in cost. Nowadays ash got from rice husk is attracting the attention of users. It is well accepted that the use of pozzolana in concrete improves the beneficial properties e.g. such as diminished heat of hydration, high ultimate strength, high sulphate resistant, low permeability and low alkali silica activities. It has been established that the use of cementitous materials [7] in the presence of pozzolana imparts sustainability to cement and the allied concrete industries. Use of such material is not only important for the energy efficiency and environmental aspects of the cement industry, but also improves the durability and life cycle performance and costs of the concrete structures [8].

With the increase in the construction activity in India and other countries, there is allied increase in the consumption of energy at an alarming rate. Most of the developing [8] nations have diminished the use of native materials like aggregates in construction because they consume energy and resources extensively in an alarming way, so they seriously considered the environment and [8] conservation of natural resources by adopting the concept of recycling of waste materials. These topics are becoming more popular, this study recommends establishment of quality standards for recycled materials and wastes. This would really help in the conservation of natural resources and management of waste material [9].

SOLID WASTE MANAGEMENT

With the population explosion and urbanisation, the waste management is posing big challenges to the country. Due to increase in quantity, there is remarkable [9] change in the characteristics of waste over the period. The country is generating an alarming amount to the tune of 62 million tonnes annually [9] of such waste. Out of which urban waste mostly comprises organic matter (approx. 46%), paper (approx. 6%), glass (approx. 0.7%), plastic (approx. 1%), and rest is moisture. Waste generation analysed on per capita basis with regard to Indian cities ranges from 0.2kg to 0.6kg daily [9]. Out of 43 million tons per annum waste collected, 11.9 million tonnes is treated the rest (to the time of 31 million tonnes) is dumped on land. Thus 75-80% of city waste is collectedand merely 22-28%is processed and treated. According to reports waste generation will increase from 62 million tonnes to about 165 million tonnes by the end of 2030 [9].

II. OBJECTIVES

The objective of this experimental study is to study the mechanical properties of concrete on partially replacement of cement with rice husk ash and coarse aggregates by steel fibers in M25 grade of concrete.

The objective of this study is as follows:

- To investigate the compressive strength of cube specimens on partially replacement of cement with rice husk ash and coarse aggregates by steel fibers after 7 days and 28days respectively.
- To investigate the split tensile strength cylinder specimens on partially replacement of cement with rice husk ash and coarse aggregates by steel fibers after 7 days and 28 days respectively.
- To investigate the flexural strength beam specimens on partially replacement of cement with rice husk ash and coarse aggregates by steel fibers after 7 days and 28 days respectively.
- To investigate workability (slump cone test) of fresh concrete on replacement of cement with rice husk ash and coarse aggregates by steel fibers.

III. METHODOLOGY

An experimental program was planned to investigate strength properties of concrete with rice husk ash as partial replacement of cement and steel fibers as partial replacement of natural coarse aggregates. Sixteen concrete mix samples containing different percentage of rice husk ash and steel fibers were used in this study. The concrete mixes for the investigation of different percentages of concrete using rice husk ash(RHA) and rubber fibers were designated as MF01, MF02, MF03, MF04, MF05, MF 06, MF07, MF08, MF09, MF10, MF11, MF12, MF13, MF14, MF15 and MF16 The experimental study was divided into the following stages

- Properties of material used in the study.
- Workability test of concrete mixes.
- Casting and curing of specimens.
- Strength tests on specimens.

PROPERTIES OF MATERIAL

The test specimens were prepared using cement, fine aggregate, coarse aggregate, rice husk ash, rubber fibers and water. The materials, in general, conformed to the specifications laid down in the relevant Indian standard codes. The materials used for making concrete mix specimens were having the following characteristic shown in Table 1. The fineness modulus of fine aggregate & coarse aggregate is given in Table 2 & Table 3 respectively.

Table 1: Physical properties of cement

Sr. No.	Properties	Observations
1	Specific gravity	3.15
2	Initial setting time	30 min
3	Final setting time	600 min
4	Standard Consistency	5-7%
5	Fineness (90 micron IS Sieve)	4%
6	28-days compressive strength	40.17Mpa

Table 2: Fine aggregate fineness modulus

iI.S. iSieve (mm)	iWeightiRetained(gm)	i% iRetained	iCumulated% iRetained (x)	iCumulative % iPassing (100-x)	iRequirement as per iI.S0383-01970
					iZONE II
010 mm	00	00	00	0100	0100
04.75 mm	021	01.75	01.75	098.25	090-100
02.36 mm	055	04.58	06.33	093.67	075-100
01.8 mm	0167	013.92	020.25	079.75	055-90
00.600 mm	0641	053.42	073.67	026.33	025-50
00.300mm	0183	015.25	088.92	011.08	005-15
00.150 mm	0102	08.50	097.42	02.58	00-5
Ipan	031	02.58			

Table no 3: Fineness modulus of coarse aggregates

I.S. Sieve (mm)	Weight Retained (gm.)	% Retained	Cumulated% Retained (x)	Cumulative % Passing (100-x)	Requirement as per I.S 383-1970
40mm	0	0	0	100	100
20 mm	251	13.94	13.94	86.06	85-100
10 mm	1317	73.16	87.10	12.90	05-20
4.75 mm	208	11.56	98.66	1.34	0-05
Pan	24	1.34			

The physical properties of Rice Husk Ah and its chemical composition is given in Table 4 & Table 5.

Table 4: Physical properties of Rice husk ash

Sr. No.	Properties	Observations
1	Colour	Grey
2	Form	Powder
3	Shape texture	Irregular
4	Particle size	< 45 micron
5	Odour	Odourless
6	Mineralogy	Non crystalline
7	Appearance	Very fine

Table 5:Chemical Composition of rice husk ash

Chemicals	Percentage
Silicon dioxide	85 % (minimum)
Calcium oxide	0.3 - 2.2%
Aluminium oxide	0.2%
Iron oxide	0.1%
Magnesium oxide	0.2 – 0.6%
Sodium oxide	0.1 – 0.8%

COMPRESSIVE STRENGTH TEST

Out of general test to designate concrete, this is the most relevant to access the quality of concrete. This single test ensures whether concreting has been accomplished properly or not.

For cube tests, cubes sizes of 15 cm X 15 cm X 15 cm are selected. Concrete is placed in the layers in the cubes and tempered thoroughly to remove voids. Tests specimens are removed from the moulds after 24 hours and are immersed in water for curing[16-17. The top surface of the cube must be smoother and even this achieved by spreading cement paste 2on all the faces of the specimens. The rate of loading should be 350 kg/cm2/minute and uniform. Three cube moulds to be casted for each mix proportion and at last the average value be adopted for the designed strength for 7 days and 28 days of curing. Specimens should be tested immediately after removal from water so that they are in surface dry condition [18]. Compression test was performed on standard compression testing machine of 2000KN capacity in the usual manner according to Indian Standard guidelines. Concrete cubes are placed on the machine so that the opposite faces are subjected to the load rather than the cast faces of the cube. Load should be applied so that it is free from impact effect. It increases gradually at the approximate rate of 140 kg/cm2/min. until the specimen fails to sustain further load and breaks down under resistance. Average of three samples was taken from one batch. The measured strength of the specimen is the failure load divide by X-section area of cube. Thus the compressive strength of different specimens was obtained [19].

SPLIT TENSILE STRENGTH TEST

The test was conducted on cylinders of size 150 mm diameters and 300mm length. Specimens were taken out from curing tank at the age of 28 days of water curing. Surface was then allowed to drip down. Specimens were tested on 200 tones capacity compression testing machine. The bearing surface of the machine was cleaned and the test specimen was placed in the machine such that the load was applied to the faces other than the cast faces of the specimen.

The maximum split tensile strength on the specimen were record as the load at which the specimen failed to take any further increase in the load. The average of the three samples was taken as the representative value of split tensile strength.

Hardboard strips 15 mm wide and 4 mm thick is inserted between the cylinder at the top and bottom of the testing machine bearing surfaces. The split tensile strength was calculated by using formula

$\sigma t = 2 P / \pi L d$

where, P = Splitting load in KN

σ = splitting tensile strength in N/mm2

L = length of cylinder sample (in mm) and

d = diameter of cylinder sample in mm

FLEXURAL STRENGTH TEST

Flexural test evaluates the tensile strength of concrete indirectly. It tests the ability of unreinforced [11] concrete beam or slab to withstand failure in bending.The results of flexural test on concrete expressed as a modulus of rupture which denotes as (MR) in MPa or psi. The flexural test on concrete can be conducted using either three point load test (ASTM C78) or center point load test (ASTM C293) and IS:516-1959.

Procedure of Flexural Test on Concrete

- The test should be conducted on the specimen immediately after taken out of the curing condition so as to prevent surface drying which decline flexural strength.
- Place the specimen on the loading points. The hand finished surface of the specimen should not be in contact with loading points. This will ensure an acceptable contact between the specimen and loading points.
- Center the loading system in relation to the applied force.
- Bring the block applying force in contact with the specimen surface at the loading points.
- Applying loads between 2 to 6 percent of the computed ultimate load.
- Employing 0.10 mm and 0.38 mm leaf-type feeler gages, specify whether any space between the specimen and the load-applying or support blocks is greater or less than each of the gages over a length of 25 mm or more.
- Eliminate any gap greater than 0.10mm using leather shims (6.4mm thick and 25 to 50mm long) and it should extend the full width of the specimen.
- Capping or grinding should be considered to remove gaps in excess of 0.38mm.
- Load the specimen continuously without shock till the point of failure at a constant rate (Indian standard specified loading rate of 400 Kg/min for 150mm specimen and 180kg/min for 100mm specimen, stress increase rate 0.06+/-0.04N/mm2.s according to British standard).
- The loading rate as per ASTM standard can be computed based on the following equation:
- The following expression is used for estimation of modulus of rupture

MR = 3PL/2bd2

Where: MR: modulus of rupture P: ultimate applied load indicated by testing machine L: span length b: average width of the specimen at the fracture d: average depth of the specimen at the fracture

RESULTS

The objective of the present work is to develop cement concrete with good strength and workability by using both steel fibres as partial replacement of coarse aggregates and rice husk ash as a partial replacement of cement together in different combinations. Table 6 shows the slump value with variations in RHA & Steel Fibres. Table 7, Table 8 & Table 9 shows the compressive strength, Split Tensile Strength & Flexural Strength after 7 days.

Table 6: Variation in slump with rice husk ash and steel fibres

Mix designation	Replacement of cement by rice husk ash	Replacement of coarse Aggregate by steel fibbers	Height of frustum cone (mm)	Height of sample (mm)	Slump (mm)
MF00	0%	0%	300	258	42
MF01	7.5%	0%	300	251	49
MF02	12.5%	0%	300	248	52
MF03	17.5%	0%	300	244	56
MF04	22.5%	0%	300	242	58
MF05	7.5%	3%	300	236	64
MF06	12.5%	3%	300	234	66
MF07	17.5%	3%	300	231	69
MF08	22.5%	3%	300	229	71

MF09	7.5%	6%	300	223	77
MF10	12.5%	6%	300	216	84
MF11	17.5%	6%	300	209	91
MF12	22.5%	6%	300	203	97
MF13	7.5%	9%	300	196	104
MF14	12.5%	9%	300	193	107
MF15	17.5%	9%	300	185	115
MF16	22.5%	9%	300	182	118

Table 7: Compressive Strength after 7 days

Mix	Percentage of cement	Percentage of rice husk ash	Percentage of coarse aggregate	Percentage of steel fibber	Percentage of fine aggregate	Compressive strength after 7 days (N/mm2)
MF00	100	0	100	0	100	19.31
MF01	92.5	7.5	100	0	100	19.34
MF02	87.5	12.5	100	0	100	19.48
MF03	82.5	17.5	100	0	100	19.55
MF04	77.5	22.5	100	0	100	19.75
MF05	92.5	7.5	97	3	100	20.22
MF06	87.5	12.5	97	3	100	20.43
MF07	82.5	17.5	97	3	100	20.65
MF08	77.5	22.5	97	3	100	20.74
MF09	92.5	7.5	94	6	100	21.09
MF10	87.5	12.5	94	6	100	21.67
MF11	82.5	17.5	94	6	100	21.88
MF12	77.5	22.5	94	6	100	21.76
MF13	92.5	7.5	91	9	100	21.85
MF14	87.5	12.5	91	9	100	21.42
MF15	82.5	17.5	91	9	100	21.24
MF16	77.5	22.5	91	9	100	21.28

Table 8: Split tensile strength after 7 days

mix	Percentage of cement	Percentage of rice husk ash	Percentage of coarse aggregate	Percentage of steel fibber	Percentage of fine aggregate	Split tensile strength after 7 days (N/mm2)
MF00	100	0	100	0	100	2.05
MF01	92.5	7.5	100	0	100	2.16
MF02	87.5	12.5	100	0	100	2.27
MF03	82.5	17.5	100	0	100	2.31
MF04	77.5	22.5	100	0	100	2.25
MF05	92.5	7.5	97	3	100	2.39
MF06	87.5	12.5	97	3	100	2.62
MF07	82.5	17.5	97	3	100	2.78
MF08	77.5	22.5	97	3	100	2.82
MF09	92.5	7.5	94	6	100	2.94
MF10	87.5	12.5	94	6	100	2.99
MF11	82.5	17.5	94	6	100	3.11
MF12	77.5	22.5	94	6	100	3.14
MF13	92.5	7.5	91	9	100	3.28
MF14	87.5	12.5	91	9	100	3.16
MF15	82.5	17.5	91	9	100	2.88
MF16	77.5	22.5	91	9	100	2.74

Table 9: Flexural strength after 7 days

Mix	Percentage of cement	Percentage of rice husk ash	Percentage of coarse aggregate	Percentage of steel fibber	Percentage of fine aggregate	Flexural strength after 7 days (N/mm2)
MF00	100	0	100	0	100	2.68
MF01	92.5	7.5	100	0	100	2.74

MF02	87.5	12.5	100	0	100	2.79
MF03	82.5	17.5	100	0	100	2.84
MF04	77.5	22.5	100	0	100	2.87
MF05	92.5	7.5	97	3	100	2.98
MF06	87.5	12.5	97	3	100	3.05
MF07	82.5	17.5	97	3	100	3.12
MF08	77.5	22.5	97	3	100	3.01
MF09	92.5	7.5	94	6	100	3.16
MF10	87.5	12.5	94	6	100	3.22
MF11	82.5	17.5	94	6	100	3.31
MF12	77.5	22.5	94	6	100	3.04
MF13	92.5	7.5	91	9	100	3.25
MF14	87.5	12.5	91	9	100	3.20
MF15	82.5	17.5	91	9	100	3.03
MF16	77.5	22.5	91	9	100	2.98

IV. CONCLUSION

- The with the increase in the percentage of rice husk ash there is constant increase in the workability of concrete and the maximum was attain at 22.5% of rice hush ash was added to concrete.
- The maximum increase in compressive strength was found when partial replacement of coarse aggregates and cement by steel fibers and rice husk ash at 17.5 % and 6 % for 7 days and 28 days which was attained as 21.88 N/mm2 and 32.63 N/mm2.
- The maximum increase in split tensile strength was found when partial replacement of coarse aggregates and cement by steel fibers and rice husk ash at 7.5 % and 9 % for 7 days and 28 days which was attained as 3.28 N/mm2 and 4.01 N/mm2.
- The maximum increase in flexural strength was found when partial replacement of coarse aggregates and cement by steel fibers and rice husk ash at 7.5 % and 9 % for 7 days and 28 days which was attained as 3.25 N/mm2 and 4.25 N/mm2 which was 6.40 N/mm2.

CONFLICTS OF INTEREST

I Fahad Ali Wani declare that I have no conflicts of interest.

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REFERENCES

[1] Gao, D.; Zhang, L.; Nokken, M. Mechanical behavior of recycled coarse aggregate concrete reinforced with steel fibers under direct shear. Cem. Concr. Compos. 2017, 79, 1–8.

[2] Gao, D.; Zhang, L.; Nokken, M. Compressive behavior of steel fiber reinforced recycled coarse aggregate concrete designed with equivalent cubic compressive strength. Constr. Build. Mater. 2017, 141, 235–244.

[3] Saidani, M.; Saraireh, D.; Gerges, M. Behaviour of different types of fibre reinforced concrete without admixture. Eng. Struct. 2016, 113, 328–334.

[4] Senaratne, S.; Gerace, D.; Mirza, O.; Tam, V.W.Y.; Kang, W. The costs and benefits of combining recycled aggregate with steel fibres as a sustainable, structural material. J. Clean. Prod. 2016, 112, 2318–2327.

[5] Pepe, M.; Toledo Filho, R.D.; Koenders, E.A.B.; Martinelli, E. A novel mix design methodology for Recycled Aggregate Concrete. Constr. Build. Mater. 2016, 122, 362–372.

[6] Karadelis, J.N.; Lin, Y. Flexural strengths and fibre efficiency of steel-fibre-reinforced, roller-compacted, polymer modified concrete. Constr. Build. Mater. 2015, 93, 498–505.

[7] Dr.Aseel B. Al-Zubaidi1, Dr.Ahmed A.AL-TabbakhRaghad, U. Abaas, Eman A. Hameed(2015), "Study Mechanical Behaviors Rice husk ash and carrot powders as Mortar for cement replacement". IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 2 Issue 3, March 2015.

[8] Liang, Y.; Ye, Z.; Vernerey, F.; Xi, Y. Development of Processing Methods to Improve Strength of Concrete with 100% Recycled Coarse Aggregate. J. Mater. Civ. Eng. 2015, doi:10.1061/(ASCE)MT.1943-5533.0000909.

[9] Carneiro, J.A.; Lima, P.R.L.; Leite, M.B.; Toledo Filho, R.D. Compressive stress-strain behavior of steel fiber reinforced-recycled aggregate concrete. Cem. Concr. Compos. 2014, 46, 65–72.

[10] Guo, Y.; Zhang, J.; Chen, G.; Xie, Z. Compressive behaviour of concrete structures incorporating recycled concrete aggregates, rubber crumb and reinforced with steel fibre, subjected to elevated temperatures. J.Clean. Prod. 2014, 72, 193–203.

[11] Carneiro, J., (2014) "Compressive Stress- strain Behavior of steel fibre reinforced-recycled aggregate concrete". Cement & concrete composite. Vol-46, pp 65-72.

[12] Obilade, IO (2014), investigates "the use of rice husk ash as partial replacement for cement in concrete." IJEA-International Journal of Engineering and Applied Sciences, Vol.5 No.4, September 2014.

[13] Medina, C.; Zhu, W.; Howind, T.; Sánchez De Rojas, M.I.; Frías, M. Influence of mixed recycled aggregate on the physical—Mechanical properties of recycled concrete. J. Clean. Prod. 2014, 68, 216–225.

[14] Radonjanin, V.; Malešev, M.; Marinković, S.; Al Malty, A.E.S. Green recycled aggregate concrete. Constr.Build. Mater. 2013, 47, 1503–1511.

[15] Lim, W.F.; Chew, K.C.; Zayed, T.; Lee, Y.P.K.; Low, G.L.; Ting, S.K.; Ho, N.Y. Efficient Utilization of Recycled Concrete Aggregate in Structural Concrete. J. Mater. Civ. Eng. 2013, 25, 318–327.

[16] Ahmad, Uzair. (2018). A Study on Effect of Polymers on the Properties of Vg-10 Grade Bitumen. International Journal for Research in Applied Science and Engineering Technology. 6. 2572-2576. 10.22214/ijraset.2018.4433.

[17] Singh, J., Singh, B. and Singla, S., Enhancement of Expensive Soil by Addition of Stone Dust and LDPE Fibre.

[18] Singh, P. and Singla, S., 2023. Estimation of Land Surface Temperature of Srinagar City, India Using Landsat 8 Data.

Sustainability, Agri, Food and Environmental Research, 12(1).

[19] Irshad, U and Singla, S.,2019 "Impact of Road Conditions on Traffic Management-A Case Study of Chenab Valley." International Journal of Scientific & Technology Research 8 1179-1186.

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