



“IMPLEMENTATION OF INDUSTRIAL & AGRICULTURAL WASTE IN CONCRETE”

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Abstract

In the present scenario all over the world, there is trend to investigate the utilization of industrial byproducts in the concrete. In the present study attempt has been made to investigate utilization of foundry sand, by product of industry, as plasticizer to reduce the cost of waste disposal and make positive environmental impact. In the present, foundry sand with rice husk has not been used in all over the world, foundry sand with rice husk will more beneficial and economical for user as a construction purpose. The implementation of various waste material from industries in **GUJRAT, INDIA** like foundry sand, rice husk, plastic waste to improve the strength of concrete and reduce the weight of concrete by using as a fine aggregate, coarse aggregate and ad-mixers. The way of using various industrial waste will help to reduce the environmental pollution. It also help low cost by product and make a light weight concrete. Lower the cost of by products is use as an aggregate will be reduce the overall cost of project.

Keywords-Foundry sand, rice husk, economic concrete, industrial waste material, agricultural waste material

1. INTRODUCTION

Due to increasing demand of performance of concrete in the present scenario, fresh and hardened properties needs to be studied. With the rapid growth of industrialization there is increase in industrial by product. Disposal of these wastes in one of the major issue in the present world, thus many researches has been carried to find the proper solution. Increasing usage of concrete put heavy burden on the usage of naturally available sources such as crushed stone like sand, coarse aggregate etc. It is necessary to find replacement of these resources. Due to high cost of disposal of foundry sand, there is need to find new field for its utilization. Due to high hardness of foundry sand its grinding turned out to be unprofitable to be used as cement addition [1]. Thus research works were focused on the use of foundry sand as an aggregate in concrete.

2. MATERIALS AND MIX PROPORTIONS

2.1 Experimental Materials

In the experimental work, The cementitious materials used were Ordinary Portland Cement (OPC), rice husk as admixture, foundry sand of maximum size 20 mm as replacement of coarse aggregate, naturally available crushed aggregate and fine aggregate having maximum size 4.75 mm

2.1.1 Cement

All the mixes in the present work were prepared using Ordinary Portland Cement-53 Grade (OPC-53 Grade). The Chemical and physical properties of cement are given in Table 1. The obtained results of cement satisfied the criteria as per IS 12269:1987

Properties of Cement (OPC-53 grade)		
Sr No	Particulars	Test Result Obtained
A. Chemical Properties		
1	Lime Saturation Factor (LSF)	0.92
2	Alumina to iron Oxide Ratio % (A/F)	1.19
3	Insoluble Residue (% by mass)	1.10
4	Magnesia - MgO (% by mass)	3.73
5	Sulfuric Anhydride - SO ₃ (% by mass)	2.48
6	Total loss on ignition (% by mass)	1.37
7	Maximum Chloride (% by mass)	0.05
B. Physical Properties		
1	Fineness (Blaine)	340
	1. Specific Surface (m ² /kg)	
2	Soundness : Expansion by	
	1. Le-chatelier Method (mm)	1.80
	2. Auto clave (%)	0.18
3	Compressive strength (MPa)	
	1. 3 Days	30.0
	1. 7 Days	42.0
	1. 28 Days	59.0

2.1.2 Fine Aggregate

The fine aggregate used throughout the experimental investigation were alluvial sand from single source. Sieve analysis of fine aggregate was performed to determine the particle size distribution of fine aggregate. As per IS: 383-1970 grading zone of fine aggregates were confirmed as Zone III.

2.1.3 Coarse Aggregate

The coarse aggregate used throughout the experimental investigation were naturally irregular and partly rounded at the edge having 10-20 mm size of aggregate. Also coarse aggregate (grit) having size 5-10 mm were considered for the study. Sieve analysis of coarse aggregate was performed on both the samples to determine the particle size distribution of coarse aggregate. As per IS: 383-1970 grading of coarse aggregates were confirmed as well graded aggregate for both sample.

2.1.4 Foundry sand

Foundry sand used for the centuries as a molding casting material because it's high thermal conductivity. The physical and chemical characteristics of foundry sand will depend in great part on the type of casting process and the industry sector from which it originates. In the casting process, molding sands are recycled and reused multiple times. However, the recycled sand degrades to the point that it can no longer be reused in the casting process. At that point, the old sand is displaced from the cycle as byproduct, new sand is introduced, and the cycle begins again. Two general types of binder systems are used in metal casting depending upon which the foundry sands are classified as: clay bonded systems (Green sand) and chemically- bonded systems. Both types of sands are suitable for beneficial use but they have different physical and environmental characteristics .Over the last decades, much research has been conducted on the mechanical, chemical and durability aspects of foundry sand. But inadequate research focus is given to the study of the strength and durability aspects of foundry sand concrete.

2.1.5 Rice husk

The Specific gravity of rice husk ash is 2.10 and bulk density is 0.781 g/cc RH, produced after burning of Rice husk (RH) has high reactivity and pozzolanic property. Indian Standard code of practice for plain and reinforced concrete, IS 456-2000, recommends use of RH in concrete but does not specify quantities. Chemical compositions of RH are affected due to burning process and temperature. Silica content in the ash increases with higher the burning temperature. As per study by Houston, D. F. (1972) RH produced by burning rice husk between 600 and 700°C temperatures for 2 hours, contains 90-95% SiO₂, 1-3% K₂O and < 5% sunburnt carbon. Under controlled burning condition in industrial furnace, Studies have shown that RHA resulting from the burning of rice husks at control temperatures have physical and chemical properties that meet ASTM (American Society for Testing and Materials).Standard C 618-94a. Studies have shown that to obtain the required particle size, the RHA needs to be grown to size 45 µm – 10 µm.

2.2 Mix Design

Mix design for different concrete mixes were prepared according to IS 10262:2009 (first revision), for each concrete of a cubic meter. The water/cement ratio of concrete was taken as 0.45 for all mixes of M25 grade of concrete.

Consequently, the dosage of admixture (rice husk) varied according to the mix to alter the fresh properties of concrete. Concrete composition for mix is been given in Table 2.

The modification was made by replacing the natural aggregate with foundry sand by proportion of 0%, 10% and 25%.

Grade of concrete	F.S.%	R.H%	Cement	<20mm	Water	Sand	Rice husk	F.S.	Total F.A.
	Kg/m	Kg/m	Kg/m	Kg/m	liter	Kg/m	Kg/m	Kg/m	Kg/m
M25	0%	0% and 10%	406	1161	203	795	0	0	795
	10%					596	1.23	199	796.23
	25%					397	2.46	397	796.46

3. SPECIMEN PREPARATIONS AND TESTING PROCEDURE

3.1 Specimens

In the present experimental work to study the fresh properties of concrete, slump cone test was performed for all mixes. Also in order to study and compare compressive strength and split tensile strength for each mix of concrete, cube of size 150mm x 150 mm x 150 mm and cylinder of size with diameter of 150 mm and length of 300 mm were casted in gunmetal moulds. After being de-moulded at the age of one day, all specimens were cured in water at room temperature until the age of 7 and 28 days. Using compression testing machine having capacity of 3000 kN, compressive strength at 7 and 28 day and split tensile strength 28 day were measured. The results reported are the average of three specimens.

3.2 Tests

To investigate effect of black FOUNDRY SAND 7 RICE HUSK in concrete, slump cone test, compressive strength and split tensile test were performed to evaluate the fresh and hardened properties of concrete mix.

3.2.1 Slump Cone Test

As per the IS 1199:1959, standard slump cone test is used to measure the workability of concrete mixes.

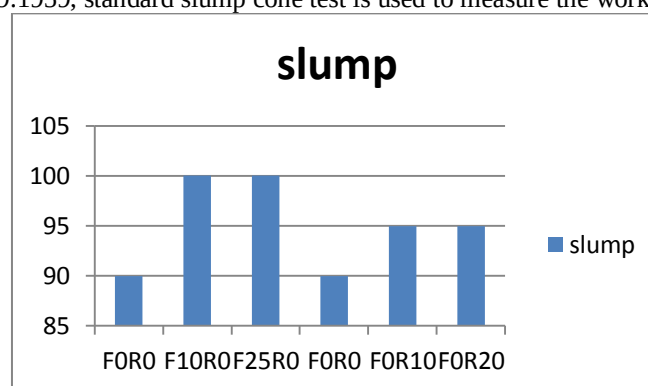
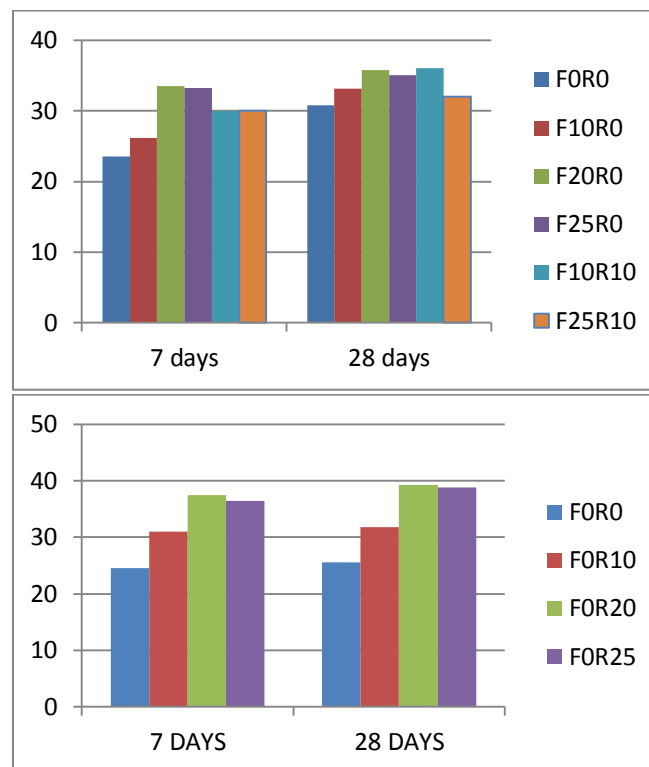


Figure 1 SLUMP TEST

From the observed result of slump cone test is been shown in Fig 3. The workability of concrete mix is been improved by adding the admixture

3.2.2 Compressive Strength Test

The cube specimen were subjected to a sustained varying compressive force until there ultimate load carrying capacity or failure of specimen. The observed result of compressive strength test is been shown in fig.



In the present work, compressive strength was determined according to IS 516:1959 at various ages of a period of 7 and 28 days.

3.2.3 Split Tensile Strength Test

The cylindrical specimen were subjected to a sustained varying tensile force until there ultimate load carrying capacity or failure of specimen. The observed result of compressive strength test is been shown in Fig.



In the present work, split tensile strength was determined according to IS 5816:1999 at ages of a period 28 days.

4.RESULTS AND DISCUSSION

4.1 Workability of fresh concrete

From the results shown in figure , it can be observed that the mixes incorporating admixture demonstrate better dispersion of cement particle hence improved workability of concrete mix. Also, from the experimental results it can be observed that there is increase in workability of concrete mix in which natural aggregate is replace by foundry sand by 0%, 10%,20% and 25% respectively. This type of pattern is been observed in all the mixes of concrete.

4.2 Compressive Strength

For concrete cube specimen cured in water, the result of compressive strength with ages is shown in figure. It can be observed that the compressive strength increases up to certain replacement of natural aggregate with foundry sand. Also

addition of admixture, rice husk, in concrete mixes shows increase in strength in early period and up to certain replacement of natural aggregate with foundry sand and then decreases its strength at some critical point.

Therefore, the inclusion of rice husk in concrete mix, mainly affects short-term strength of concrete. Considering the same mix proportion obtained results shows increase in strength as 7% and 10% without and with addition of rice husk for the 20% replacement of natural aggregate by foundry sand. By increase in the replacement up to 25% it reduces in both cases.

4.3 Split Tensile Strength

For concrete cylinder specimen, the result of split tensile strength with 28 day age is shown in figure. It can be observed that split tensile strength decreases with increasing replacement of natural aggregate with foundry sand. Addition of admixture, rice husk, in concrete mixes shows very few variations in the test results. For the same mix proportion obtained results shows decrease in strength without and with addition of rice husk for the 25% replacement of natural aggregate by rice husk. By increase in the replacement up to 25% it reduces in both cases respectively.

5 CONCLUSIONS

The influence of foundry sand and rice husk in concrete were evaluated in this study and the following findings are concluded:

- The mix for 0%, 10% and 25% replacement of Natural Aggregate for the grades M25 to be cohesive, workable, no sign of any segregation and bleeding, and matrix.
- The test results showed that the compressive strength of the foundry sand is found to be higher than natural aggregate.
- The workability (slump test) of foundry sand rice husk is lower than Natural Aggregate Concrete because the rate of absorption of foundry sand rice husk is higher than Natural Aggregate.
- Due to higher water absorption of foundry sand, more is the water requirement for appropriate workability.
- The strength of concrete made by using foundry sand and rice husk, after 7 days and 28 days of Normal curing and increases strength about 7-8% of natural concrete for M25 grade of concrete.
- The use of foundry sand is more suitable for mix design of high grade concrete.

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