Study on Durability of RCC Structure When Cement is Partially Replaced with Fillers

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Abstract : This These days, different kinds of pozzolanic material are used. Partial replacement of cement with pozzolanic material like fly Ash, sugarcane bagasse ash, and rice husk Ash etc. are common now a days. These ashes are the by product or dispose. These ashes contain mineral properties and are well known as pozzolanic material. The concrete properties can easily increase or reduce by adding specific quantity of cement. The chemical composition of these materials can affect strength, workability, setting time etc. These pozzolanic materials enhanced the assets of concrete when added in specified proportion. The fly ash is replaced by 15-35% by weight from cement manufacture. This research focused on partial replacement of sugarcane bagasse ash, fly ash and rice husk ash. Some of these pozzolanic also resist chemical attack from nature and increase the durability property of concrete. The intention of this investigation is to detect the durability property of these pozzolanic or filler materials. For the study the cement is replaced by 10% of rice husk ash, fly ash, sugarcane bagasse ash. The reinforced beam samples of 100*100*500 mm were casted. After 7 days of tap water curing the reinforced beam samples are introduced to salt water which is pollutant. The exposure to salt water allows corrosion in reinforcement. The non-destructive test is used to identify the corrosion. The corrosion in the samples are compared in this paper**.**

Index Terms **- pozzolanic materials, partial replacement, non-destructive tests, salt water curing.**

I. INTRODUCTION

The cost of cement large construction is very high, so it is needed to provide these material with affordable prices in some part of the world cement is very costly, as a result people are attracted towards pozzolanic material. The pozzolanic materials are used for a long period to reduce the price of cement. In early days lime is most used natural pozzolanic material. Now researchers are studying on different pozzolanic material aiming to produce good binding material which is easily available, economical and environment friendly. These days pozzolanic material are generally industrial waste, agricultural waste like sugarcane bagasse ash, fly ash, rice husk ash etc. the waste also identified as mineral admixture due to their pozzolanic property. These ashes are prepared by burning the waste product under controlled temperature. Ashes are mixed with cement to prevent high cost, harm to nature, and difficulty in disposal. Most of these ashes increase the strength, some ashes increase the durability of concrete. The structures generally have 30-40 years of life after that the structure starts deterioration. But buildings last around 70 years, because of their durability. The concrete resist weathering effect, chemical attack abrasion. The different adulterated concrete requires different degree of durability depending on chemical properties of their pozzolanic material.

II. RESEARCH METHODOLOGY

2.1 Cement

The commonly used cement of PPC 53 grade confirm to IS 12269 used for this research. 3.15 is the specific gravity of cement.

2.2 Fine Aggregate

Regular sand confirms IS-383 1987 is taken as fine aggregate. The sand confirms to zone II with specific gravity of sand is 2.62.

2.3Coarse Aggregates

The crushed aggregates used were 20mm size which confirms to IS 383 with specific gravity 2.8

2.4 Fly Ash

It is west product from coal industries. Fly Ash used as per IS-3812. Percentage of replacement is 10.

2.5 Rice Husk Ash

Locally available RHA is used. It is the agro waste product which is obtain by burning rice husk ash at a temperature of 700-800° C. Percentage of replacement 10 with cement.

2.6 Sugarcane Bagasse Ash

Sugarcane bagasse was burnet at 72 hours. Under the temperature of range 700 to 6000° c. the ash was sieved through 75 µ sieve. The specific gravity was about 1.84. Percentage of replacement is 10.

2.7 Mix Proportion

The design mix of M20 grade concrete were adopted. Confirming to IS: 10262.

2.8 Casting of Samples

For the experiment work concrete cubes of size 150x150x150mm, and beams of size 500x100x100mm of M20 grade were prepared. The 53 grade PPC was replaced with 10% SCBA, RHA and Fly Ash respectively. Water cement ratio was 0.5. A 6 mm diameter reinforced bars are placed in each of the beam specimen with cover of 20 mm.

2.9 Curing

After 7 days curing in tap water the specimen where placed in salt water (pollutant) and alternate drying and wetting process is adopted which allows the atmospheric air to enter in the specimen. After 28th day of curing the specimen are tested for strength and durability.

2.10 Testing of Sample

Sample were tested at 3rd, 7th day for compressive strength and at 28th day specimens were examined for compressive, flexural strength and half-cell potential test.

III. RESULTS AND DISCUSSION

Table 1 Slump cone test

Mix-design	Slump in (mm)
Mix-I	15
Mix-II	55
Mix-III	15
Mix-IV	10

Table 2 Compressive strength test

Design Mix	3rd day strength MPa	7th day strength MPa	28th day strength MPa
Mix-I	8.4	13.93	25.7
Mix-II	8.93	15.34	26.22
Mix-III	8.8	12.5	22.7
Mix-IV	8.3	13	22

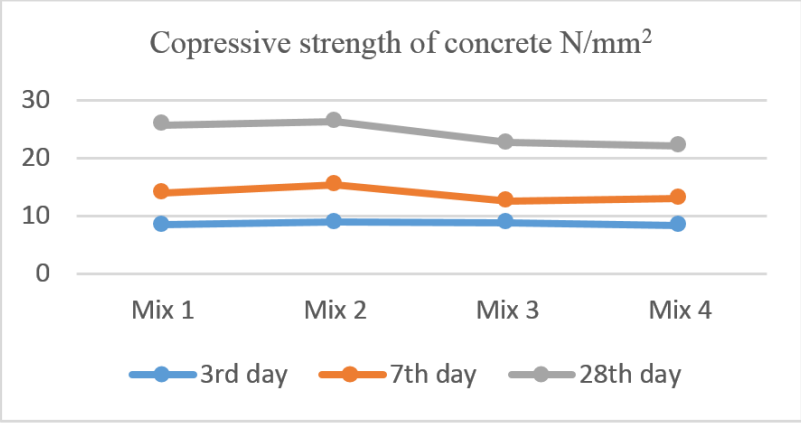

Fig.1 Graph showing rate of strength gaining of concrete.

Table 3 Flexural strength of concrete at 28th day

Design Mix	Flexural strength MPa
Mix-I	5.88
Mix-II	6
Mix-III	5.9
Mix-IV	5.2

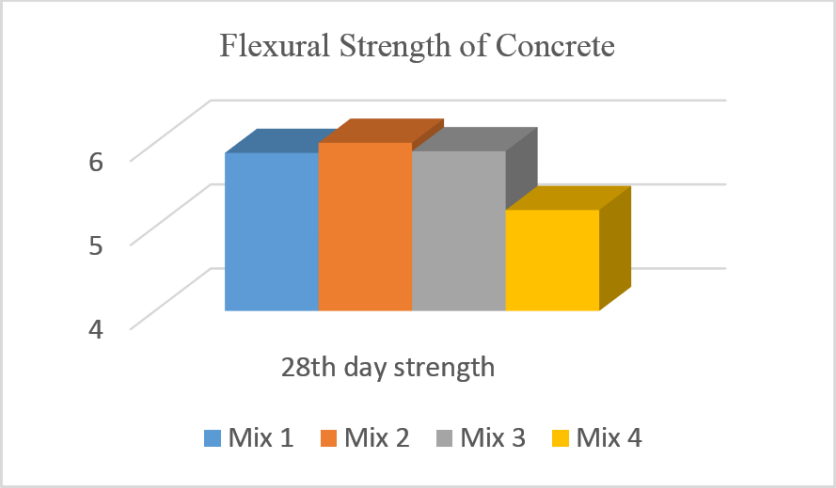

Fig. 2 Graph representing flexural strength gain after 28th day.

Table 4 Half-Cell Potential Test

Sr. No.	Mix-I (-mv)	Mix-II (-mv)	Mix-III (-mv)	Mix-IV (-mv)
1	-320	-355	-290	-320
2	-300	-400	-281	-340
3	-298	-460	-285	-336
4	-305	-436	-300	-360
5	-328	-415	-330	-356
6	-305	-392	-326	-360

IV. CONCLUSION

- It is concluded that Rice husk ash is alkaline in nature so it delay carbonation which is it have good productive layer for long time.
- Rice husk ash provide resistance to corrosion.
- Sugarcane bagasse ash shows higher strength than other.
- Compressive strength is decreases when RHA is added to cement.
- The rate of strength gain reduces after salt water curing is adopted.
- The cost of Fly Ash, Rice husk ash, Sugarcane bagasse ash is zero and thus we partially replace cement with fillers in concrete as compare to silica fumes which is also uneconomical.
- It is observed that rice husk ash show more resistance to corrosion comparing to others specimens.
- Sugarcane bagasse ash shows highest workability than other mix with same water cement ratio.

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