DURABILITY STUDIES OF RHA CONCRETE

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Abstract - *Concrete is a composite material comprising of fine aggregates and coarse aggregates bonded together with a cement paste that gains strength over time. There have been several efforts to add various waste materials as additives in concrete, one of such being rice husk ash (RHA).*
In the present study varying RHA percentage were used as a replacement of cement. Furthermore the effect of addition of RHA in concrete for various chemical attacks was also studied.

Key Words: Concrete, Rice Husk Ash, Corrosion, Strength, Porosity

1. INTRODUCTION

Concrete is considered to be the most versatile material of construction and widely used all over the world only second to water. According to the U.S Geographic Service in 2006, approximately 7.5 cubic kilometres of concrete is produced every year in the world. It has emerged as the material of choice for the construction of a large variety and number of structures in the world.

The most expensive component in concrete is cement and therefore several replacements for the same are experimented sucessfully. One of such being RHA. In the present study the optimum RHA percentage for sulphate and acid attack is determined.

2. LITERATURE REVIEW

V. Saraswathy and Ha-Won Song worked on corrosion performance of rice husk ash blended concrete. From their investigations it was found that the incorporation of RHA up to 30% replacement level decreases permeability, reduces the chloride penetration, improves corrosion resistance and strength properties. From this study it was concluded that the replacement level of RHA is recommended up to 25%.

K. Ganesan et al. worked on Rice husk ash blended cement: Assessment of optimal level of replacement for strength and permeability properties of concrete. According to their studies they concluded that as high as 30% by weight of OPC can be replaced with re-burnt rice husk ash without any adverse effect on permeability and strength properties of concrete.

Ayesha Siddika et al. carried Study on concrete with rice husk ash. They concluded that the concrete containing rice husk ash had same density within the range for normal weight concrete and, thus, it can be used for regular construction applications. They also concluded that the slump decreases and the water demand increases with increase in cement replacement with rice husk ash. They finally concluded the optimal percentage replacement of fly ash to be 10%.

N.K. Muhammed Koya and Deepa G Nair worked on Sustainable building blocks from Rice Husk Ash. There research verified that proposed RHA- concrete building blocks were successful in overcoming the drawbacks of the conventional concrete blocks with improved sustainability characteristics.

Muhammad Shoaib Ismail and A. M. Waliuddin studied on Effect of rice husk ash on high strength concrete**.** Their study indicated that the optimum replacement of cement by RHA will be around 10% to 20% with finely ground RHA.

On the basis of the extensive studies carried out in the past on various concretes against their durability for chemical attack it can be conclude that until now rice husk ash has been successfully added as a replacement in concrete. However, the effect of various chemical attacks on it to ascertain their durability still remains a mystery.

So in the present study an attempt has been made to study the impact of sulphuric acid and magnesium sulphate on rice husk ash concrete along with normal concrete.

3. OBJECTIVES OF STUDY

The following are the objectives of the current study

- To study the various general properties of coarse aggregates, fine aggregates and cement.
- To design M – 40 strength concrete mix using locally available materials.
- To study the effect of addition of rice husk ash (RHA) in varying percentage in concrete.
- To determine the optimum percentage of RHA in concrete.

- To compare the variation in properties of normal concrete and RHA concrete when exposed to acid and sulphate attack.

4. METHODOLOGY ADOPTED

The following methodology was adopted:

1. TESTS ON CEMENT AND AGGREGATES
   a. Impact Test
   b. Shape Test
   c. Specific gravity and water absorption test
   d. Sieve analysis
   e. Fineness test
   f. Consistency test
   g. Setting time test
   h. Soundness test
   i. Strength test

2. CONSTRUCTION OF MIX

3. TESTS ON CONCRETE
   a. Slump Cone Test
   b. Compressive strength test

4. DURABILITY TEST
   5% Volume/Volume solution of H_2SO_4 and 5% weight/Volume $MgSO_4$ were made. All types of concrete mixes were immersed in these solutions for 30 and 60 days after the curing period of 28 days. At the end of the immersion period the cubes were tested for their reduction in compressive strength.
   The mixes were denoted as RHA-0 (0% rice husk ash), RHA-5 (5% rice husk ash), RHA-10 (10% rice husk ash), RHA-15 (15% rice husk ash) and RHA-20 (20% rice husk ash).

5. RESULTS

Table -1: Average compressive strength of different mixes in 7 Days

Mix	Load	C.S
RHA-0	776.67	34.52
RHA-5	770.00	34.22
RHA-10	780.00	34.67
RHA-15	760.00	33.78
RHA-20	743.33	33.04

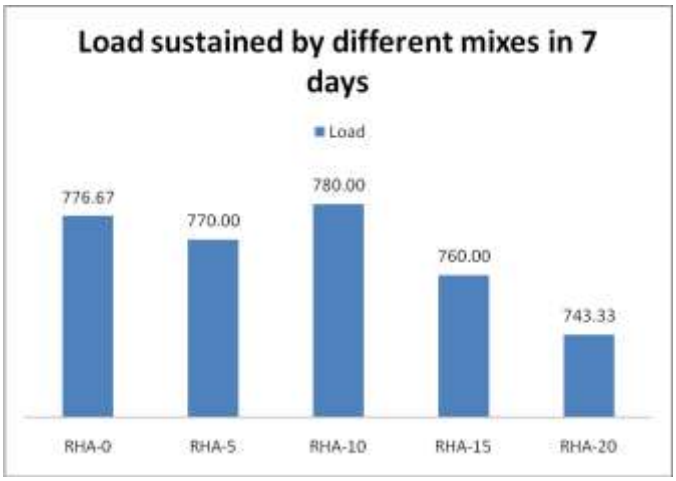

Chart -1: Average compressive strength of different mixes in 7 Days

Table -2: Average compressive strength of different mixes in 28 Days

Mix	Load	C.S.
RHA-0	950.00	42.22
RHA-5	973.33	43.26
RHA-10	1023.33	45.48
RHA-15	976.67	43.41
RHA-20	956.67	42.52

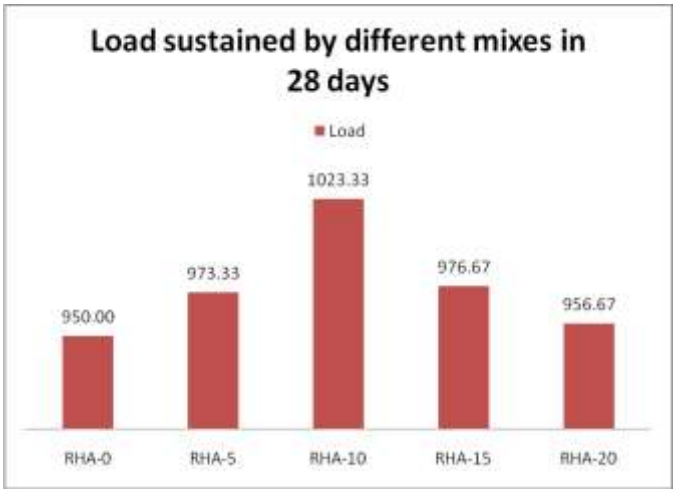

Chart -2: Average compressive strength of different mixes in 28 Days

Table -3: Average percentage compressive strength reduction of different concrete mixes in $MgSO_4$ solution for 30 and 60 days

MIX	% REDUCTION IN STRENGTH	
	(30 DAYS)	(60 DAYS)
RHA-0	5.61	8.42
RHA-5	4.11	6.16
RHA-10	2.28	3.91
RHA-15	3.76	5.46
RHA-20	4.53	6.97

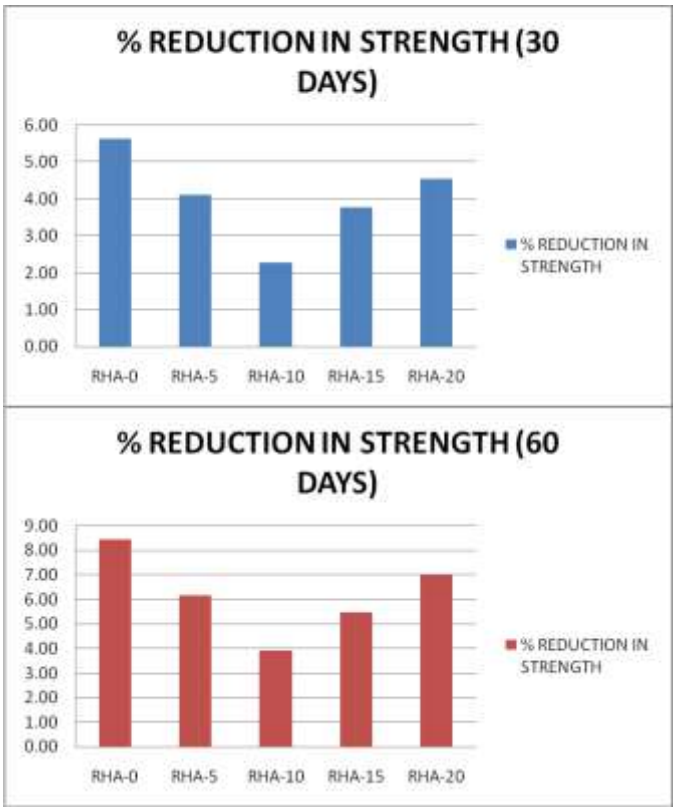

Chart -3: Average percentage compressive strength reduction of different concrete mixes in $MgSO_4$ solution for 30 and 60 days

Table -4: Average percentage compressive strength reduction of different concrete mixes in $H2SO_4$ solution for 30 and 60 days

MIX	% REDUCTION IN STRENGTH	
	(30 DAYS)	(60 DAYS)
RHA-0	9.12	12.28
RHA-5	8.22	10.96
RHA-10	6.19	8.47
RHA-15	8.19	9.22
RHA-20	8.71	11.15

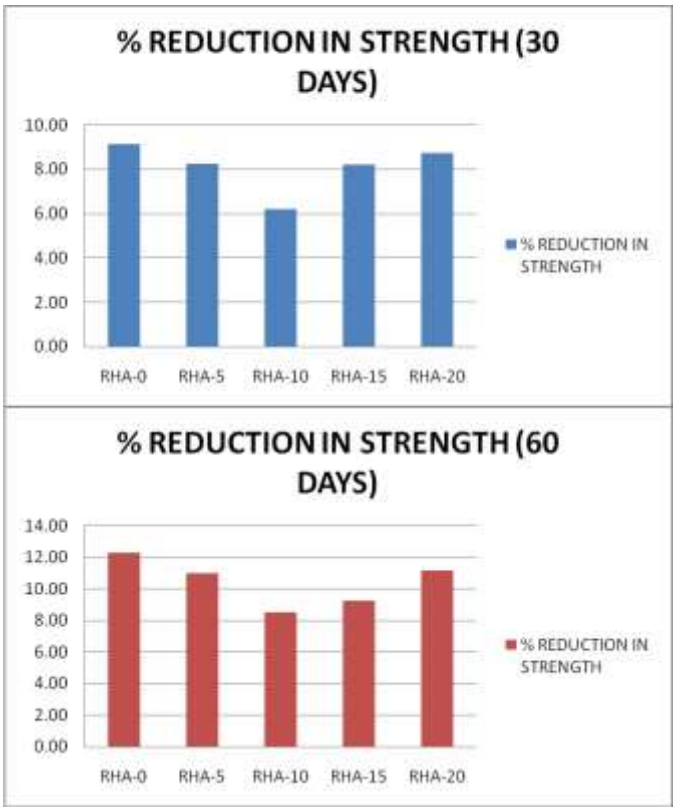

Chart -4: Average percentage compressive Strength reduction of different concrete mixes in $H2SO_4$ solution for 30 and 60 days

6. CONCLUSIONS

a) The average compressive strength for RHA-0, RHA-5, RHA-10, RHA-15 and RHA-20 concrete mixes were found to be 34.52, 34.22, 34.67, 33.78 and 33.04 respectively for 7 days. Similarly, compressive strength obtained for 28 days were 42.22, 43.26, 45.48, 43.41 and 42.52 respectively. The 7 days strength result is an incation that RHA does not contribute much in intial strength gain of concrete. However from 28 days strength it is clear that RHA-10 has maximum strength.

b) The average percentage compressive strength reduction of RHA-0, RHA-5, RHA-10, RHA-15 and RHA-20 concrete mixes in MgSO4 solution for 30 days were found to be 5.61, 4.11, 2.28, 3.76 and 4.53 respectively. Similarly, average percentage compressive strength reduction for 60 days were 8.42, 6.16, 3.91, 5.46 and 6.97 respectively indicating minimum reduction of strength in RHA-10 concrete mix in MgSO4 solution.

c) The average percentage compressive strength reduction of RHA-0, RHA-5, RHA-10, RHA-15 and RHA-20 concrete mixes in H2SO4 solution for 30 days were found to be 9.12, 8.22, 6.19, 8.19 and 8.71

respectively. Similarly, average percentage compressive strength reduction for 60 days were 12.28, 10.96, 8.47, 9.22 and 11.15 respectively indicating minimum reduction of strength in RHA-10 concrete mix in H2SO4 solution.

d) On the basis of results obtained from compressive strength test and durability tests against chemical attack the optimum percentage of rice husk to be added can be concluded to be 10%.

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