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Comparative Study on Performance of Rice Husk Ash and Pond Ash in Concrete

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ABSTRACT: This paper presents review on the comparative study on performance of Rice Husk Ash (RHA) & Pond Ash (PA) in concrete. The objective of this paper is to review the use, effects and performance of rice husk ash and pond ash in concrete. From the review it is found that RHA & PA can be used as alternating material of cement and sand. In construction industry, concrete is one of the main components, so it is important that the concrete should be good and eco-friendly. Hence many waste material have been tried in the substitution of cement and sand in certain quantities to give higher strength of concrete. In our project we are finding out the comparison between strength of concrete when RHA & PA have been used in equal quantities as a partial replacement of sand.

KEYWORDS: Rice husk ash (RHA), Pond ash (PA), Fine aggregates, Compressive Strength

I. INTRODUCTION

In construction industry, concrete is very essential and widely used material in construction work. The demand of concrete is continuously increasing. Construction industry largely depends upon cement, fine aggregate & coarse aggregate for the production of concrete. From this ingredients cement is very demanding material as well as sand is also demanding and expensive material. The sand found in river, lakes is best for the used in construction. Hence the demand of this type of sand is very larger, so it is very important to find out the alternating material for the sand which can gives the higher strength of concrete.

In India, production of rice is very widely. India is the second largest country in production of rice in world [1]. The outer shell of rice grain is rice hull which is an agricultural type of waste which can be obtained by separating rice from its outer shell. This type of waste is obtained during the process of rice burned and dumped in an open area. So it is harmful for the environment it can be causes the pollution. Hence we can use this waste material in replacement of sand or cement in concrete. Fig 1 shows the image of rice husk ash.

As rice husk ash can be used in concrete, pond ash can also be used as a replacing material for sand or cement in concrete. Because pond ash is also waste material which is obtained from thermal power station. About 25% of total ash generated in thermal power plants is pond ash; rest 75% is fly ash [2]. Pond ash also have a pozzolanic nature. Use of pond ash in concrete can reduce the environmental pollution, construction cost and also the disposal problem. Fig 2 shows the image of pond ash.

So, we have conducted research study on comparison of rice hush ash and pond ash in concrete with 0%, 5%, 10%, 15%, and 20% replacement of sand, for the purpose of finding out which is giving more strength with rice husk ash and pond ash replacement or with no replacement of sand. For this study we have calculated mix design for M20 grade of concrete and find out the proportions. After that we casted the concrete cubes size of 150mm×150mm×150mm and kept them for curing process. After that we have conducted compressive load test on concrete cubes and finding out which replacing material can gives the more strength of concrete. After the results, we can observed that which replacing material is most economical and environmentally beneficial.

Advantages of RHA-

The qualities of concrete, such as impermeability, workability, strength and corrosion of steel reinforcement, can all be enhanced by substituting rice husk ash for cement while creating concrete.

Advantages of PA-

1. Generally used to provide economical concrete.
2. Effective waste management.

3. Reduce cost of construction.
4. Improved workability of concrete.
5. Improved compressive strength of concrete.
6. Reduce heat of hydration.



Fig 1. Rice husk ash



Fig 2. Pond ash

II. RELATED WORK

In this paper the influence of rice husk ash as a replacement for cement by different percentages was discussed. It was seen that compressive strength of the concrete improved by using RHA as a partial replacement of cement. They made a conclusion that at 10% replacement of cement with RHA shows improvement in compressive strength [3]. The effect of partial replacement of cement by rice husk ash, waste of limestone powder and wood fiber was investigated. The results shows that the compressive strength of the sample increased when RHA content increased compared to others [4]. It was reported that the compressive strength of concrete made by using different proportions of RHA first increased up to 10%, after which it decreases. The optimum percentage of cement replacement with RHA was reported to be 7.5% for both compressive and split tensile strength [5]. They have carried out research on replacement of cement by RHA and plastic fibre. Experimental Result shows that the replacement of 5% & 10% RHA with 1% & 2% plastic fibres enhance compressive strength and split tensile strength of concrete [6]. In this study cement is replaced by three different percentage of RHA to investigate compressive strength of concrete. From the result it is found that compressive strength is increase up to 15% RHA content [7]. In this paper he has considered compressive, flexure and split tensile strength of concrete. He has replaced pond ash partially for sand and got higher flexural and split tensile strength up to 20% replacement of pond ash for sand [8]. He studied that fly ash and pond ash are obtained as by products from thermal power plants and conducted this replaced concrete will give higher compressive strength to normal concrete with OPC of 53 grade[9]. The objective of this paper is to achieve eco-friendly and economical high-strength concrete. Three parameters of hardened concrete are considered: compressive, flexural, and split tensile strength. From this study, he concluded that in areas like Goa, Kerala, and Mumbai, where pond ash is easily available, the partial replacement of sand by pond ash is highly useful and reduces environmental issues [10].

III. METHODOLOGY

MATERIALS-

Cement: Cement used in the experimental work is Ordinary Portland Cement of 53 grade. Specific Gravity is 3.15.

Fine Aggregate: Fine aggregate was purchased which satisfied the required properties of fine aggregate required for experimental work. In this experimental work wash sand is used as fine aggregate. Specific Gravity is 2.65.

Coarse Aggregate: Coarse aggregate used in the experimental work 20mm maximum size of aggregate. Specific Gravity is 2.7.

Rice Husk Ash (RHA): Rice husk ash used in the present experimental study was obtained from Koppal Plant Karnataka, India.

Pond Ash (PA): Pond ash is obtained from NTPC, Tanda, Ambedkar Nagar, Uttar Pradesh, India.

Admixture: In this experimental work Complast SP430SRV water reducing admixture is used.

Water: Clean potable water available in the laboratory satisfying the requirements of IS 456:2000 is used for concrete mix.



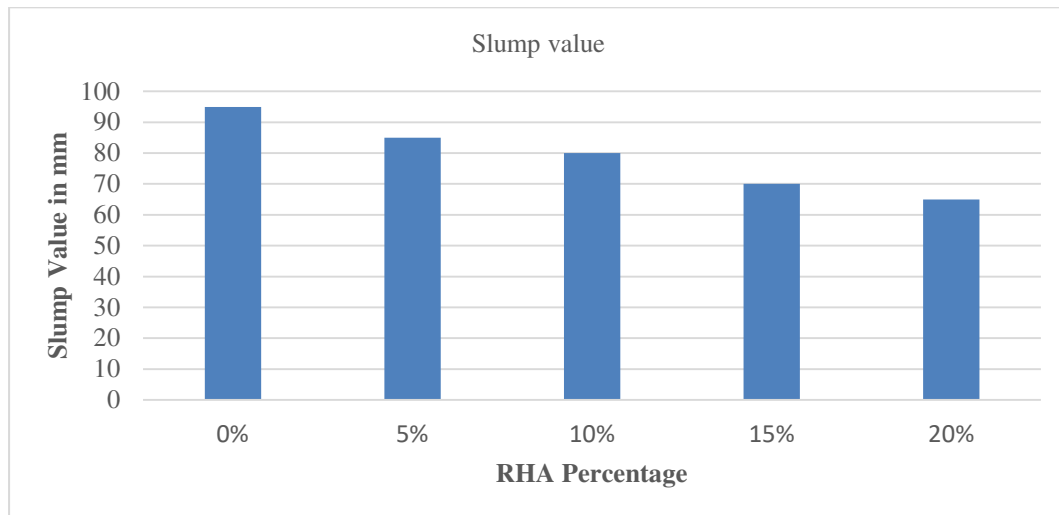
In this present study partial replacement of sand has done by using rice husk ash and pond ash with varying percentage of 0%, 5%, 10%, 15% and 20% in different concrete. The grade of concrete is M20. The required material were weighed and mixed with concrete drum mixer. The concrete was filled into moulds in layers, each layer was compacted. After the top layer had been compacted, the surface of the concrete was finished level with the top of the mould, using a trowel. After 24 hours, test specimens are removed from mould and marked for later identification. The specimens were stored in water at a temperature of 27°C for 7 days, 14 days and 28 days until the time of test. After that the test was conducted on that specimens.

IV. EXPERIMENTAL RESULTS

Test results of concrete cube specimens for M20 grade with RHA:

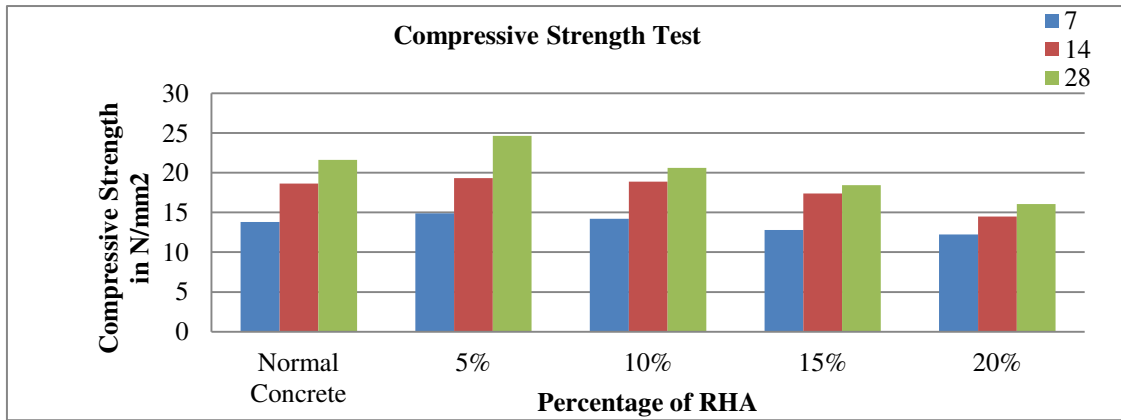
1. Workability of Concrete-

Mix	Percentage of RHA	Slump Value (mm)
Mix-1	0%	95
Mix-2	5%	85
Mix-3	10%	80
Mix-4	15%	75
Mix-5	20%	65



2. Compressive Strength Test-

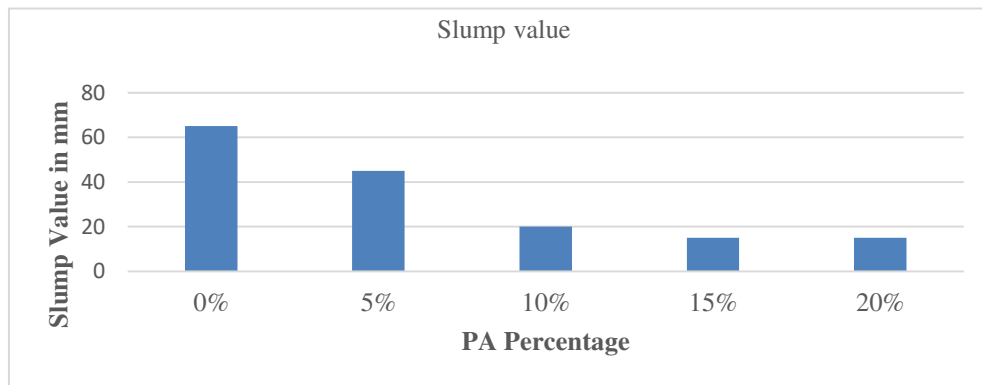
Curing Days	Normal Concrete	5%	10%	15%	20%
7	13.80	14.88	14.22	12.81	12.22
14	18.66	19.33	18.88	17.40	14.49
28	21.64	24.66	20.63	18.44	16.07



Test results of concrete cube specimens for M20 grade with PA:

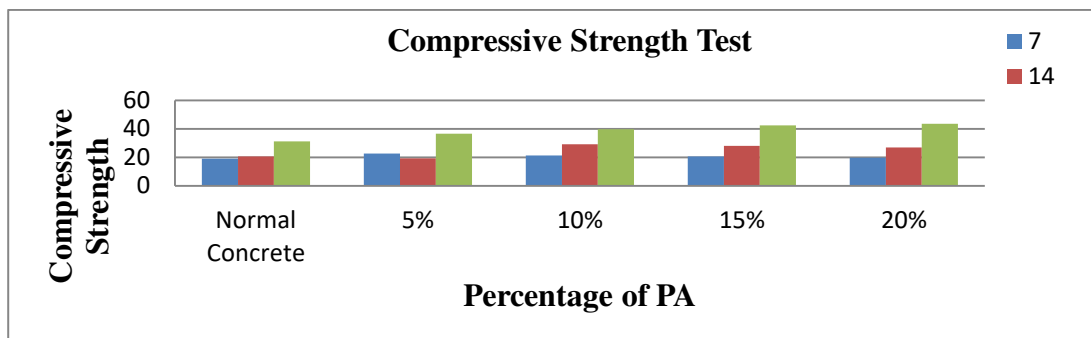
1. Workability of Concrete-

Mix	Percentage of PA	Slump Value (mm)
Mix-1	0%	65
Mix-2	5%	45
Mix-3	10%	20
Mix-4	15%	15
Mix-5	20%	15



2. Compressive Strength Test-

Curing Days	Normal Concrete	5%	10%	15%	20%
7	19.1	22.5	21.3	20.6	19.7
14	20.6	19.3	29	27.9	26.8
28	31.2	36.6	39.7	42.3	43.4



V. CONCLUSION

The following conclusions are drawn from the observation of test in concrete.

- With rice husk ash as partial replacement for fine aggregate:
 1. The workability of concrete had been found to be decrease with increasing the RHA content in concrete. But it is within the desired range of 75-100mm.
 2. Maximum compressive strength obtained for 28 day is 24.66 Mpa with the replacement of 5% of sand by RHA.
- With Pond ash as partial replacement for fine aggregate:
 1. The workability of concrete had been found to be decrease with increasing the PA content in concrete, hence use of plasticizer is necessary.
 2. Maximum compressive strength obtained for 28 day is 43.5 Mpa with the replacement of 20% of sand by RHA.

From the above results concluded that, as compare to concrete with replacement of sand by pond ash gives higher strength than of replacement of sand than concrete with replacement of sand by rice husk ash. Upto 20% replacement of sand by pond ash gives more strength. Use of pond ash in concrete can reduce the environmental pollution, construction cost and also the disposal problem.

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