

Investigation and feasibility of fly ash and rise husk ash and quarry sand in M-25 concrete.

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Abstract - The proposed research is aimed at investigating the performance of rise husk ash and fly ash and quarry dust and black sand as partial replacement of standard sand in concrete. The study also includes investigation of rise husk ash and fly ash in different proportion in different grades of concrete. The research outcome may also be beneficial in developing and utilizing locally available rise husk ash and fly ash in abundant quantity. The studies also include fly ash used as a admixture or pozzolana in concrete making so in current condition no study available on the use of fly ash, rise husk ash with quarry dust as partial replacement of sand in concrete.

Keywords – Fly Ash, RHA, Quarry Sand

1. INTRODUCTION

Incorporating fly ashes of both types (low and high calcium) in cementations systems is nowadays considered a common practice in the construction sector. However, the fly ash quantities that are produced globally are steadily increasing, exceeding the utilization rates that in most countries remain low. In Greece, a recent report (Papadacos V.G. 2010) revealed that although about 10 million tons of fly ash is generated annually, their absorption in several applications (mainly the cement industry) is stuck at 10%. The amounts that remain unused obviously create acute environmental problems and moreover inhibit the path towards sustainability (Mehta K. 1998, Fraay A.L.A. 1989). For increasing the utilization rate of this by-product, it is necessary to fully explore its dynamic and pozzolanic potential, but also to come up with methods of enhancing its slow reaction. This task however becomes difficult when dealing with a very heterogeneous product, where not all streams are the same, chemically or physically, and furthermore, when the effect of each of those parameters on the hydration of fly ash/cement (FC) systems has not yet been completely understood. Raman S. N. et al. (2008), reports the experimental study undertaken to investigate the influence of partial replacement of sand with quarry dust, and cement with fly ash on the concrete compressive strength development. Two types of replacement proportion of sand with quarry dust, 20% and 40% were practiced in the concrete mixes except in the control concrete mix. Besides, replacement proportion of 10 % cement content

with fly ash was practiced in some of the concrete mixes. Two types of curing methods, water curing and air curing under controlled laboratory conditions were practiced during the entire study. Recorded results indicate that concrete incorporating quarry dust without the inclusion of fly ash exhibited lower compressive strength than the control concrete at all ages. This weakness was overcome by the inclusion of fly ash into the quarry dust concrete in which it resulted in the enhanced compressive strength at almost all conditions. It can be concluded that quarry dust can be utilized as partial replacement material to sand, in the presence of fly ash, to produce concretes with fair ranges of compressive strength. Satakhun Detphan et al. (2008), presents the fundamental data of fly ash based geopolymer mixed with the openfield rice husk ash, the basic properties viz., setting time, burning temperature of rice husk heap, temperature and pH during mixing were presented, furthermore, the 7 days strength of geopolymer mortar replaced by rice husk ash of 0, 20, 40 and 60% were also investigated. Alireza Naji Givi et al. (2010), presents an overview of the work carried out on the use of RHA as partial replacement of cement in mortar and concrete. Habeeb G.A. et al. (2009) & Muhammad Harunur Rashid et al. (2010) conducted an experimental investigation on the influence of Rice Husk Ash (RHA) Average Particle Size (APS) on the mechanical properties and drying shrinkage of the produced RHA blended concrete. Dao Van Dong et al. (2008) presents several key properties of high a five-space indentation. A colon is inserted before an equation is presented, but there is no punctuation following the equation. All equations are numbered and referred to in the text solely by a number enclosed in a round bracket (i.e., (3) reads as "equation 3"). Ensure that any miscellaneous numbering system you use in your paper cannot be confused with a reference [4] or an equation (3) designation. The first aspect is economics. In most of market fly ash is less expensive than Portland cement. Therefore as replacement level of fly ash increases the cost to produce concrete decreases. The second aspect and arguably the most important is the environment. As it is industrial by-product much which is deposited in landfill if not used in concrete. As more fly ash use less demand for Portland cement. So it will lower CO₂ emission. Final aspect influencing the use of High replacement level is technical benefit of high volume of fly ash concrete (HVFAC). HVFAC has improved performance over ordinary Portland cement concrete, especially in term of durability when appropriate used.

2. Chemical composition of Cement in % of RHA and FA are near about same.

Materials	SiO2	Al2O3	Fe2O3	CaO	MgO	LOI	SO3	K2O	Na2O3
Cement	19.71	5.20	3.73	62.91	2.54	0.96	2.72	0.90	0.25
Fly ash	40	25	6	20	3.71	3.0	1.74	0.80	0.96
Rice husk ash	78.21	(SiO2+ Al2O3+ Fe2O3) =82.64		0.99	4.89	-----	-----	-----	-----

MATERIAL TO BE COLLECTED

Fly ash will be collected from koradi khaperkheda power plant.

Rise husk ash will be collected from chimur district from ash agro limited.

Quarry dust will be collected from Sidheshwar crushing plant panchgao.

MATERIAL SELECTION

1. Cement (OPC 53 Grade)
2. Rice Husk Ash (RHA)
3. Fly Ash (FA)
4. Quarry Dust (Stone Sand)
5. Fine aggregate
6. Coarse aggregate.

Fig -1: Name of the figure

EXPERIMENTAL METHODOLOGY

- Collection of Materials
- Weight Batching
- Test on Concrete
- Casting of Concrete Cube, cylinder, Beam
- Compaction

By Hand

By Vibrator

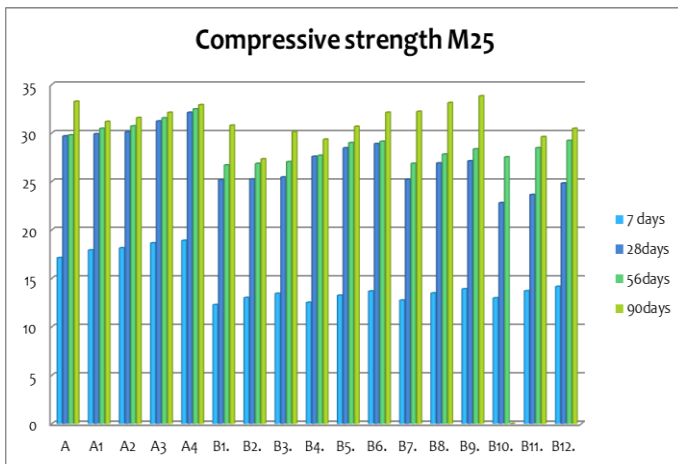
- Curing
- Specimen Testing
- Compression Testing
- Test Result

TEST THAT WILL PERFORM

- 1) Compressive strength on cube (150mmx150mmx150mm)
- 2) Flexural strength on beam (150mmx150mmx750mm)
- 3) Split tensile test on cylinder as per IS-516 (150mm diameter and 300 mm height)
- 4) Workability slump test, vee bee test.

RESULT

Type of	Mix 25					Strength after curing in days in N/mm ²			
	Mix Proportion					7 Days	28 Days	56 Days	90 Days
	cement%	FA%	RHA by %	NS by %	QS by %				
A	100	0	0	100	0	17.11	29.67	29.78	33.25
A1	100	0	0	85	15	17.9	29.89	30.45	31.16
A2	100	0	0	70	30	18.13	30.1	30.70	31.56
A3	100	0	0	55	45	18.64	31.2	31.54	32.1
A4	100	0	0	40	60	18.89	32.1	32.45	32.89
B1.	70	30	0	85	15	12.26	25.14	26.67	30.77
B2.	70	25	5	85	15	12.994	25.22	26.83	27.3
B3.	70	22.5	7.5	85	15	13.43	25.43	27.02	30.11
B4.	70	30	0	70	30	12.5	27.56	27.66	29.33
B5.	70	25	5	70	30	13.23	28.44	28.98	30.66
B6.	70	22.5	7.5	70	30	13.66	28.87	29.11	32.11
B7.	70	30	0	55	45	12.73	25.19	26.84	32.2
B8.	70	25	5	55	45	13.46	26.88	27.79	33.11
B9.	70	22.5	7.5	55	45	13.89	27.10	28.33	33.8
B10.	70	30	0	40	60	12.96	22.78	27.51	28.3.
B11.	70	25	5	40	60	13.69	23.62	28.45	29.6
B12.	70	22.5	7.5	40	60	14.13	24.80	29.2	30.45



Phase-1(Replacement cement by FA and RHA)	Identification symbol	Flexural strength N/mm2	
		28 days	90 days
Mix- M20 concrete			
Controlled Mix	M25-A	3.15	3.9
CM 70%+FA 30%	M25-A1	3.19	3.8
CM 70%+FA 27.5%+RHA 2.5%	M25-A2	3.54	3.36
CM 70%+FA 25%+RHA5%	M25-A3	3.5	3.8
CM70%+FA22.5%+RHA 7.5%	M25-A4	3.68	3.74
CM70%+FA20%+RHA10%	M25-A5	2.8	3.11
Phase -2 (Replacement natural sand by quarry sand and cement by FA and RHA)			
Controlled Mix	M25-A	3.15	3.4
CM70%+FA30%+15%QS	M25-B1	3.31	3.4
CM 70%+FA 25%+5%RHA+15%QS	M25-B2	3.63	3.7
CM 70%+FA 22.5%+7.5%RHA+15%QS	M25-B3	3.48	3.5
CM70%+FA30%+30%QS	M25-B4	3.15	3.7
CM 70%+FA 25%+5%RHA+30%QS	M25-B5	3.38	3.75
CM 70%+FA 22.5%+7.5%RHA+30%QS	M25-B6	3.74	3.88
CM70%+FA30%+45%QS	M25-B7	3.56	3.81
CM 70%+FA 25%+5%RHA+45%QS	M25-B8	3.68	3.7
CM 70%+FA 22.5%+7.5%RHA+45%QS	M25-B9	3.73	3.87

Phase-1(Replacement cement by FA and RHA)	Identification symbol	Split tensile strength N/mm2	
		28 days	90 days
MIX- M 25 concrete			
Controlled Mix	M25-A	3.11	3.9
CM70%+FA30%	M25-A1	2.26	3.8
CM 70%+FA 27.5%+RHA 2.5%	M25-A2	2.83	3.65
CM 70%+FA 25%+RHA5%	M25-A3	2.26	3.8
CM70%+FA22.5%+RHA 7.5%	M25-A4	2.85	3.74
CM70%+FA20%+RHA10%	M25-A5	2.8	3.11
Phase -2 (Replacement natural sand by quarry sand and cement by FA and RHA)			
Controlled Mix	M25-A	3.15	3.4
CM70%+FA30%+15%QS	M25-B1	3.41	3.4
CM 70%+FA 25%+5%RHA+15%QS	M25-B2	3.63	3.7
CM 70%+FA 22.5%+7.5%RHA+15%QS	M25-B3	2.96	3.1
CM70%+FA30%+30%QS	M25-B4	2.93	2.95
CM 70%+FA 25%+5%RHA+30%QS	M25-B5	3.73	3.9
CM 70%+FA 22.5%+7.5%RHA+30%QS	M25-B6	3.97	4.4
CM70%+FA30%+45%QS	M25-B7	2.69	3.7
CM 70%+FA 25%+5%RHA+45%QS	M25-B8	2.84	3.5
CM 70%+FA 22.5%+7.5%RHA+45%QS	M25-B9	3.53	3.8

3. CONCLUSIONS

1. Compressive strength increases with the increase in the percentage of Fly ash, Rice Husk Ash up to replacement (22.5%FA and 7.5% RHA) of Cement without quarry sand.
2. Compressive strength increase by addition of quarry sand in addition to fly ash and rice husk ash.
3. For a mix by replacement of 22.55% FA and 7.5% RHA to cement and 30% quarry sand as a

replacement of fine aggregate (sand) gives maximum strength.

4. The Maximum Splitting Tensile is given by Concrete mix of Partial replacement in cement by 22.5 % Fly Ash, 7.5 % RHA and Fine Aggregate by 30% Quarry Sand.

5. The unit weight of concrete increases uniformly with the increase in Quarry Sand and decreases with the increase of Rice Husk Ash and Fly Ash content.

REFERENCES

- [1] D. S. Rajendra Prasad, S. M. Maheshwarappa, S. Suresh⁽³⁾, in this **study focuses on utilization of waste Pozzuolana products such as fly ash and Rice Husk Ash (RHA) as an alternative to OPC to produce ternary blended cement with an objective to increase the optimum percentage of replacement of pozzuolana to OPC without affecting the concrete properties.** CO₂ curing is carried out to reduce the curing duration without affecting the compressive strength and trying to achieving the 28 days compressive strength in a short period of 18 hours. The study of CO₂ cured specimens kept in air and water for 3 days, 7 days is also carried out along with comparison of the compressive strength of normal concrete.
- [2] Nagabhushana and H. Sharada bai⁽⁴⁾, in this **study of properties of mortar and concrete in which Crushed Rock Powder (CRP) is used as a partial and full replacement for natural sand.** For mortar, CRP is replaced at 20% 40%, 60%, 80% and 100%. The basic strength properties of concrete were investigated by replacing natural sand by CRP at replacement levels of 20%, 30% and 40%. This study reveals that in case of cement mortars, the natural sand can be replaced by Crushed Rock Powder (CRP). The strength of mortar containing 40% CRP is much higher than normal mortar containing only sand as fine aggregate.