Compressive Strength of Concrete by Partial Replacement of Cement using Granite Powder and Rice Husk Ash

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Abstract— Granite powder, one of the by-products in the granite stone crushing process, not being used for any applications other than filling up low lying areas is identified as a replacement material for cement in concrete. The quantities have been utilized and the rest has been unscrupulously dumped resulting in environmental problems. Presently, all the processing units are disposing this industrial waste by dumping it in open yards, that nearly occupying 25% of the total area of the industry. The reduction in waste generation by manufacturing value-added products from the granite stone waste will boost up the economy of the granite stone industry. The utilization of granite powder in high performance concrete could turn this waste material into a valuable resource with the added benefit of preserving the environment. Rice husk ash is found to be superior to other supplementary materials like slag, silica fume and fly ash. Due to its high pozzolanic activity, both strength and durability of concrete are enriched. Unlike other industrial by-products rice husk ash has to be produced out of the raw agricultural waste, husk. The increasing demand for producing durable construction materials is the outcome of the fast polluting environment. Supplementary cementitious materials prove to be effective to meet most of the requirements of durable concrete. In the present experimental investigation M40 grade concrete has been chosen as reference concrete specimen. Cement was partially replaced by granite powder with 10%, 15%, 20%, 25%, 30% and Rice husk ash was partial replaced by 5%,10%,15%,20%,25% and also in the combination of Granite powder and Rice husk ash was also partially replaced by cement in concrete. Compressive strength (cubes) was compared those of concrete made with natural aggregates. specific gravity of the materials was also studied .The test result indicates that it is possible to manufacture concrete containing with granite powder and rice husk ash with characteristics similar to those of cement concrete provided that percentage of granite powder and Rice husk ash is limited to 15% and combination of Granite powder and rice husk ash is partially replaced by cement is limited to 10% and 15% respectively.

Keywords: Concrete, Cement, Granite Powder and Rice Husk Ash

I. INTRODUCTION

Granite powder is obtained from crusher units in the form of finer fraction. This is a physical mechanism owing to its spherical shape and very small in size, Granite powder disperses easily in presence of super plasticizer and fills the voids between the quarry reverse sand and resulting in a well packed concrete mix. Granite powder can be used as filler as it helps to reduce the total voids content in concrete. Rice husk ash is found to be superior to other supplementary materials like slag, silica fume and fly ash. Due to its high pozzolanic activity, both strength and durability of concrete are enriched. Unlike other industrial by-products rice husk ash has to be produced out of the raw agricultural waste, husk. The increasing demand for producing durable construction materials is the outcome of the fast polluting environment. Supplementary cementitious materials prove to be effective to meet most of the requirements of durable concrete.

Specific gravity of cement = 3.15
Specific gravity of fine aggregate = 2.806
Specific gravity of coarse aggregate = 2.86
Specific gravity of granite powder = 2.64
Specific gravity of rice husk ash = 2.64

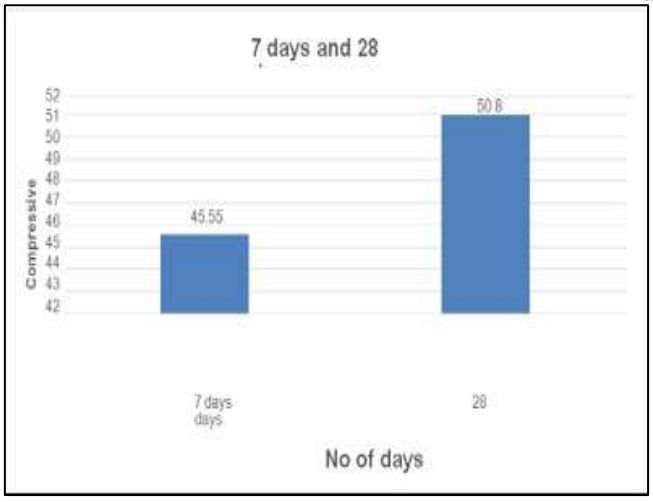
MIX PROPORTIONS:

Cement	= 465 kg/m^3
Water	= 160 kg/m^3
Fine aggregate	= 820 kg/m^3
Coarse aggregate	= 1062kg/m^3
Water-cement ratio	= 0.40
Mix proportion	= 1:1.763:2.284

II. RESULTS AND GRAPHS

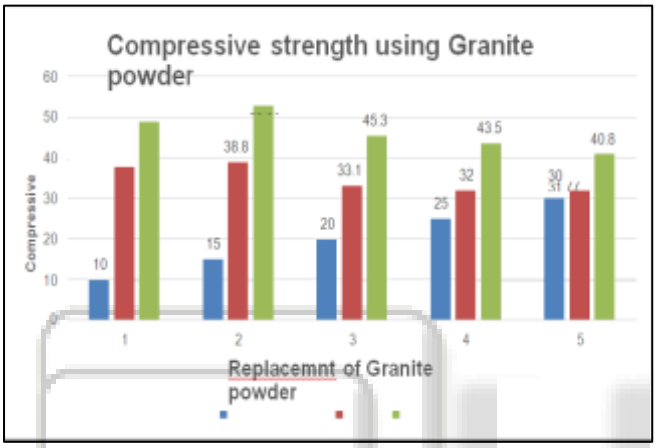
A. 0% Replacement:-

Sl no	PLAIN CONCRETE	
	Compressive strength	
	7 DAYS	28 DAYS
1.	45.55N/mm²	50.82 N/mm²



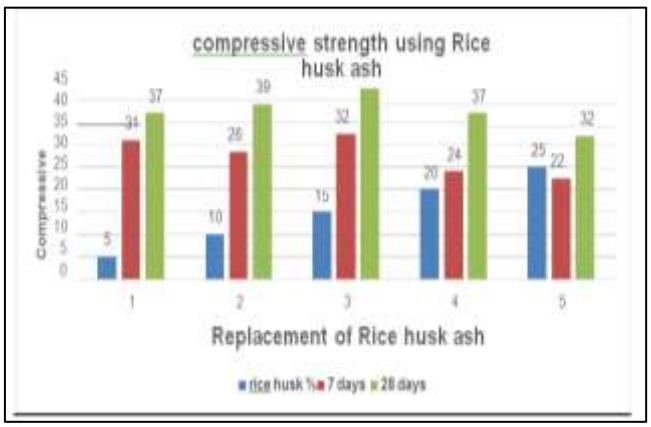
B. Replacement of Cement by Granite Powder:-

Sl no	COMPRESSIVE STRENGTH		
	GRANITE POWDER	7 DAY	28 DAY
1	10%	37.55 N/mm²	48.88N/mm²
2	15%	38.88N/mm²	52.89N/mm²
3	20%	33.11 N/mm²	45.33 N/mm²
4	25%	32 N/mm²	43.55N/mm²
5	30%	31.77 N/mm²	40.89N/mm²



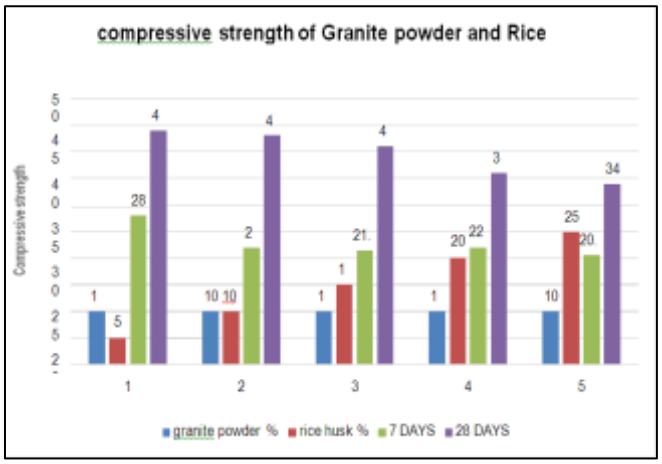
Replacement of cement by rice husk ash:-

Sl no	COMPRESSIVE STRENGTH		
	Rice husk ash	7 DAY	28 DAY
1	5%	31N/mm²	37N/mm²
2	10%	28.5N/mm²	39N/mm²
3	15%	32.5N/mm²	42.5 N/mm²
4	20%	24 N/mm²	37N/mm²
5	25%	22.5N/mm²	32N/mm²



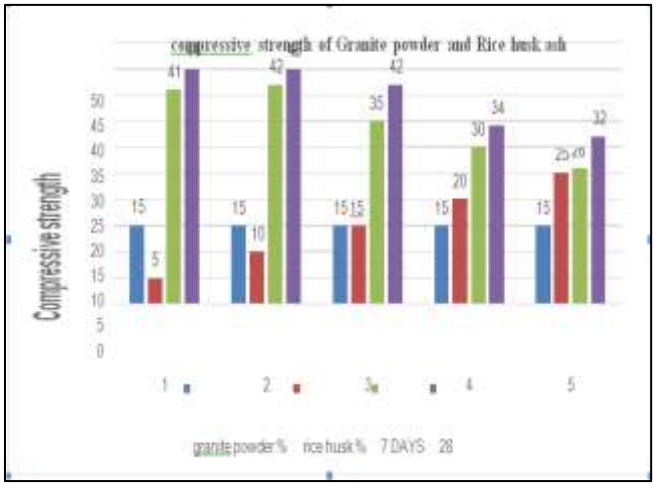
C. Partial Replacement of Cement by Granite Powder and Rice Husk Ash:-

GRANITE POWDER	10%	10%	10%	10%	10%
RICE HUSK ASH	5%	10%	15%	20%	25%
7 DAYS	28 N/mm²	22 N/mm²	21.5N/mm²	22 N/mm²	20.5 N/mm²
28 DAYS	44 N/mm²	43 N/mm²	41 N/mm²	36 N/mm²	34 N/mm²



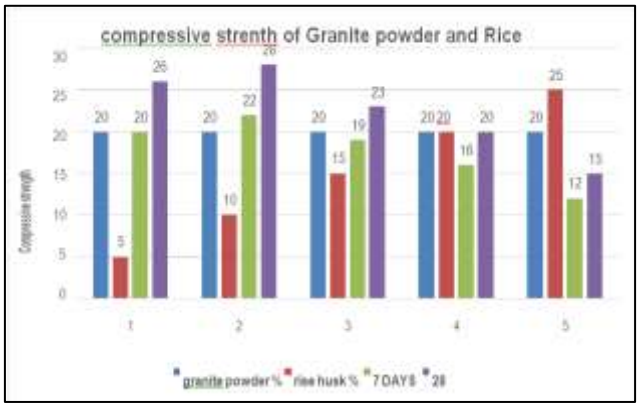
D. Partial Replacement of Cement by Granite Powder and Rice Husk Ash:-

GRANITE POWDER	15%	15%	15%	15%	15%
RICE HUSK ASH	5%	10%	15%	20%	25%
7 DAYS	41 N/mm²	42 N/mm²	35N/mm²	30 N/mm²	26N/mm²
28 DAYS	44 N/mm²	45N/mm²	42N/mm²	34N/mm²	32N/mm²



E. Partial Replacement of Cement by Granite Powder and Rice Husk Ash:-

GRANITE POWDER	20%	20%	20%	20%	20%
RICE HUSK ASH	5%	10%	15%	20%	25%
7 DAYS	20N/mm²	22N/mm²	19 N/mm²	16N/mm²	12 N/mm²
28 DAYS	26N/mm²	28N/mm²	23kN	20N/mm²	15N/mm²



III. CONCLUSION

1) From the above it is observed that when Granite powder is replaced by cement the compression strength values for 28 days is for 0% replacement is
2) 50.82 N/mm², 10% replacement is 41.92 N/mm², 15% replacement is 52.89N/mm², 20% replacement is 45.33N/mm², 25% replacement is 43.55 N/mm², 30% replacement is 40.89N/mm², Compression strength value is increased up to 15% replacement and the strength got reduced as the percentage of replacement increased further.
3) 2. From the above it is observed that when Rice husk ash is replaced by cement the compression strength values for 28 days is for 0% replacement is
4) 50.82 N/mm²,5% replacement is 37 N/mm², 10% replacement is 39N/mm², 15% replacement is 42.5N/mm², 20% replacement is 37 N/mm², 25% replacement is 32N/mm², Compression strength value is increased up to 15% replacement and the strength got reduced as the percentage of replacement increased further
5) 3.From the above when combination of granite powder and rice husk ash is partially replaced by cement at 15% of Granite powder and 10% Rice husk ash percentage gets the maximum compressive strength and the strength got reduced as the percentage of replacement increased further.
6) Further this can be increased to flexural strength, split tensile strength, modulus of and elasticity and also durability parameters like permeability. Variation of grade percentage of replacement can be made in this case study

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