IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

STUDY ON RICE HUSK ASH AND WASTE GRANITE POWDER IN M25 AND M60 GRADE CONCRETE

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ABSTRACT

Rice husk ash (RHA) is derived from Rice Husks, which is usually regarded as agricultural waste. Waste granite powder is derived from granite crushing industries. This paper incorporates the results from the experimental work attempted to assess the appropriateness of rice husk ash to be utilised as the partial substitutes for cement in both normal and high strength concrete accommodating waste granite powder as a partial substitute to fine aggregate. Normal grade of M25 and High strength concrete (HSC) mix of M60 are designed to attain 25 MPa and 60 MPa at 28 days including and excluding of rice husk ash. Waste granite powder is then replaced in the mixes with varying percentages ranging from 0% to 50%. The compressive strength, flexural strength, and mechanical properties development are monitored for 28 days and the tests are conducted. Depending on the results, the mixes containing 25% RHA of concrete in terms of compressive strength and mixes containing 25% RHA replacement and 40% waste granite powder replacement is preferred in terms of flexural strength. These findings assert that waste granite powder along with Rice husk ash can be replaced together partially in place of sand and cement. Durability tests are also conducted to assess the chemical attack which stems in the deterioration of concrete.

KEY WORDS:- RICE HUSK ASH (RHA), HIGH STRENGTH CONCRETE (HSC), COMPRESSIVE STRENGTH,FLEXURAL STRENGTH.

INTRODUCTION

Cement included in concrete is a blend of intricate of compounds. Cement being a considerable industrial artifact and is made in about 120 countries. Cement when mixed with water and aggregates, makes omnipresent concrete that is utilized in the raising of buildings, roads, bridges, and other structures. Producing concrete by incoporating portland cement is on the top priority to many countries due to the low cost of materials and construction besides, loss cost of preservation for concrete structures. But an enoromous levels of energy is essential for cement production which spits carbon dioxide (CO2) and is very deleterious to the environment. Specifically, this issue by employing the concept of supplementary cementitious material.

1. Rice husk ash

Rice husk is agricultural debris widely available in major rice-producing countries. Rice processing creates a result known as a husk as this pound the unrefined rice grain. While milling of the unrefined rice, around 78 % of the mass is procured as rice, broken rice, and bran. The other 22% of the mass of unrefined rice is acquired as a husk. The husk of the rice is pullout in the farming procedure before it is sold and consumed. Rice husks take very long to decompose and are not appropriate for composting or dung. Therefore, 100 million tons of rice husk creates worldwide which begins to influence the environment if not disposed of properly. This husk can be utilized as a combusting material in the ricemills to create heat for the scalding procedure. The husk consists of about 75% of fundamental evaporable matter and the other 25% is changed over into ash at the time of the burning process and is named Rice Husk Ash (RHA). RHA is widely considered as a waste material that is procured as a by-product of rice milling industries. For rice procuring countries like India, rice husks attracted more attention due to environmental pollution and increased interest in the conservation of energy and resources. The adding of RHA to concrete decreases the mass of concrete by 70-75%. So, RHA concrete can be prominently utilized as lightweight concrete for constructions where the weight of the construction is of majorly important.

2. Waste granite powder

Granite is a sort of rock that's granular and phaneritic in appearance having 20-60% of the quartz by volume and a minimal of 35% of the entire feldspar comprising of alkali feldspar. The Aforementioned rocks mostly abandon feldspar, quartz, mica. It is large, solid, and hard; thus, these qualities made granite a worldwide construction material. In general, the solidity of the granite is from 2.65 to 2.75 g/cm3 on an average and its compressive strength typically more than 200 MPa. Granite powder is the industrial remnant that is produced from the granite refurbishing industries and is being disposed of and dumped as filling materials. Being a fine material, it will be easily carried away by air and will cause health problems and environmental pollution. Fine granite powder has largely been utilized by the skilled labour of important projects around the world to introduce the incumbent utilization of fine granite powder in the view of the fact that is equal gamut and null impurities.

OBJECTIVES OF THE STUDY

- To study the strength of the concrete along with the inclusion of granite powder replacing fine aggregate and rice husk ash in place of cement.
- To study the durability characteristics.
- Strength comparison of Conventional and Non-conventional concrete.

LITERATURE REVIEW

Dahiya et al (2015) [India] carried out partial replacement of grade 53 portland cement with 20% RHA. In their result, they discovered that the initial setting time increased from 30 minutes to 60 minutes. The concrete samples were cast using 150mm*150mm*150mm mould, and the target strength was M25. The compressive strength of M25 (0% RHA) concrete a 3,7, and 28 days are 14.50, 20.50 and 30.3 respectively. Whereas on replacing cement with 20% of RHA it comes out to be 13.40, 21.60 and 30.70 respectively. In the highlight of his research, water demand increased from 0.6 o 0.8 to achieve a slump 75mm – 100mm, but strength gain was almost the same at 20% replacement.

Dilip K. Kulkarni and Priyanka A. Jadhas. focused on the effect of water cement ratio on hardened properties of cement mortar with a partial substitution of natural sand by artificial sand. It presents an experimental research on the effects of changing water cement ratios between 0.5 and 0.55. Compressive tests on mortar cubes are performed in this work. The maximum compressive test is performed when synthetic sand replaces natural sand by 50%. It also aids in the discovery of a suitable strategy for utilising garbage in an environmentally beneficial manner

MATERIALS

Locally available ordinary Portland cement, river sand, granite fine aggregate, and RHA are the prime constituents utilised in this experiment. The granite powder, a Outcome of the granite triturate process, is procured from an industry located about 10 km from Tekkali, Srikakulam, Andhra Pradesh, India. Granite sludge is available in the form of wet as an industrial by-product comes directly from the sediments of granite factories, and that forms concerning the sawing, shaping, and polishing processes of granite. The wet granite sludge is dried up preceding the preparation of the samples. The dried substance is sieved and at last, the granite powder is existed to be utilised in the experiments as fine aggregate.

Portland cement gives a more amount of lime. By the addition of a pozzolana substance, like RHA mixes to lime and by the addition of water, gives a sturdy and more amorphous hydrated calcium silicate. The lab examination and field examination exhibited that the employing pozzolana is extremely helpful in reduction the issues of cement. The RHA isn't utterly a "filling material, besides gives strength and accomplishment. The unrefined rice husks is procured from a rice mill in Tekkali, Andhra Pradesh, India. RHA is procured by burning the unrefined rice husks at steady temperature in a furnace and grind them in a "Los Angeles machine" in order to get the required fineness.

MIX PROPORTIONS

M25: The mix proportion for M25 grade concrete is done using the Indian standard code 10262:2019. For whose, the water-cement proportion is kept as the least value of 0.45 (0.55 maximum according to code IS 10262:2019) for the slump value is 150mm, the coarse aggregate of 20mm size and below. The proportion for the mix is 1:1.2:2

M60: The mix proportion of M60 grade concrete is done by utilizing the Indian standard code 10262:2019. For whose the water-cement proportion is kept as the minimal estimation of 0.35 for the slump value is 150mm, an admixture named Master Glenium sky 8777 is utilised to minimize the workability and increase the strength, the coarse aggregate of size 20mm and below. The proportion for the mix is 1:1.07:3.40.

STRENGTH TESTS ON CONCRETE

COMPRESSIVE STRENGTH TEST

The compressive strength tests on concrete are carried out on a compression testing machine accompanied by a range of 2.5 KN/s. The specimen utilised is a 150 mm cube and is cast and cured for 7,14 and 28 days. The specimens are tested after taking the cubes from the curing tank in surface dry condition.

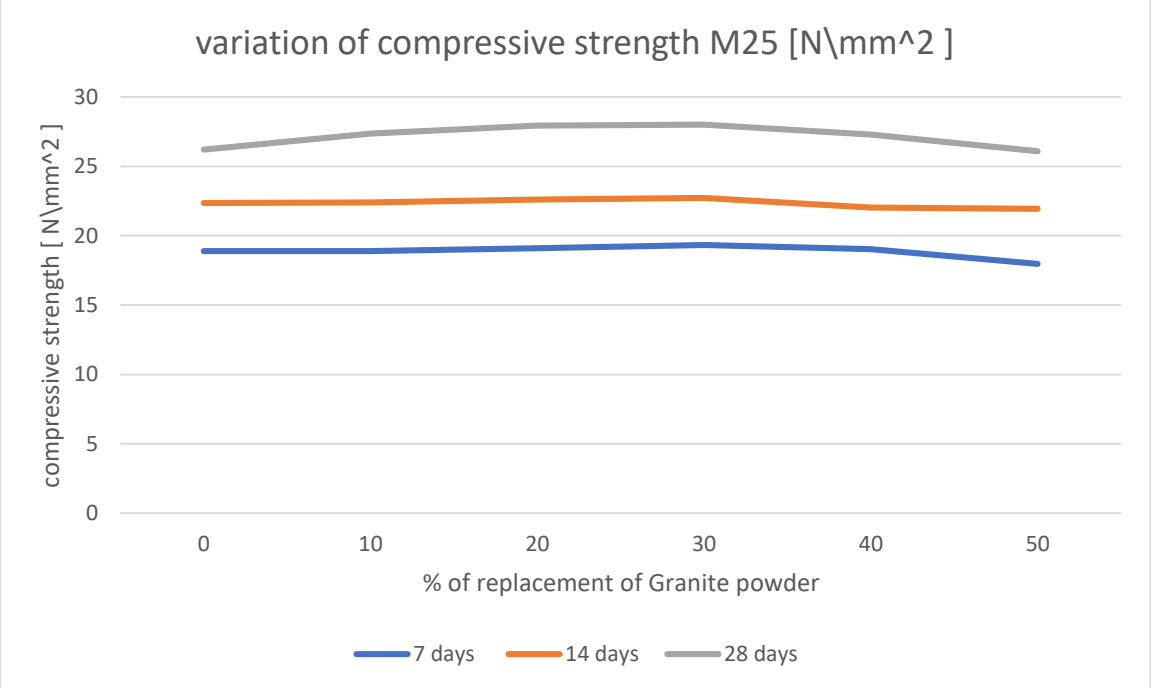
SPLIT TENSILE STRENGTH TEST

The split tensile strength test is executed on a universal testing machine accompanied by a range of 2.5KN/s. A cylinder specimen of 150mm dia and 300 mm height are cast and cured for 7,14 and 28 days. The specimens are tested after taking out from curing tank.

RESULTS

AVERAGE COMPRESSIVE STRENGTH OF CUBES [M25]

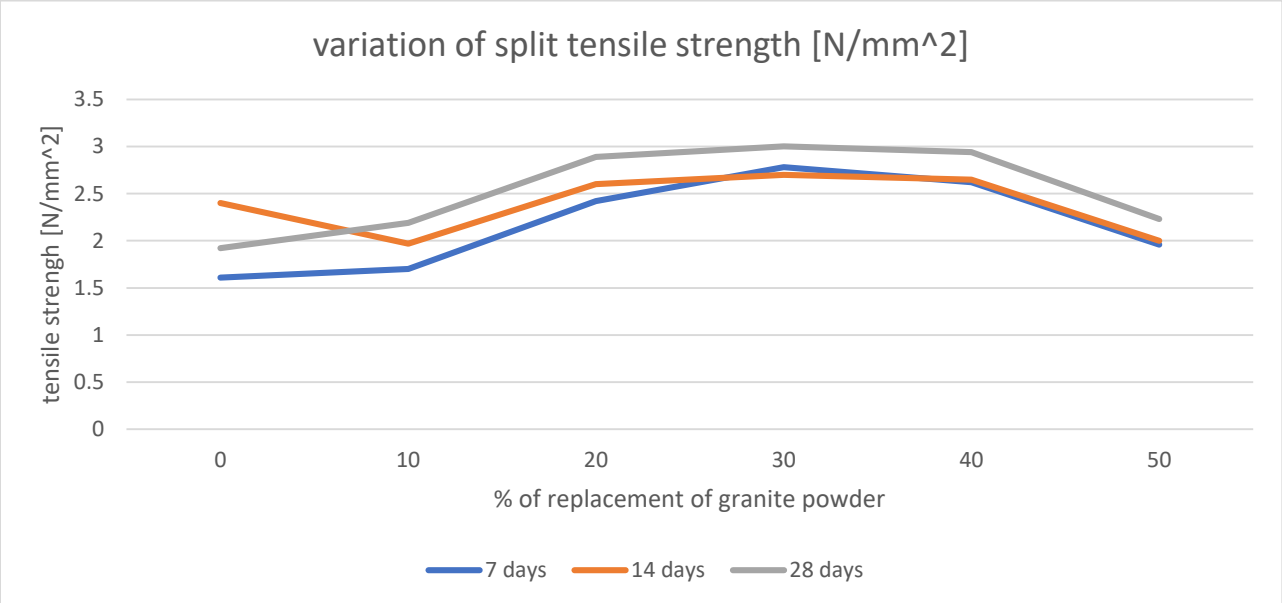
% of replacement of RHA	% of replacement of Granite powder	Compressive strength [n/mm^2]		
		7 days	14 days	28 days
0	0	18.89	22.36	26.22
25	10	18.90	22.41	27.36
25	20	19.10	22.60	27.95
25	30	19.32	22.73	28.02
25	40	19.03	22.04	27.30
25	50	17.96	21.94	26.10



Compressive strength of M25 concrete [N\mm^2]

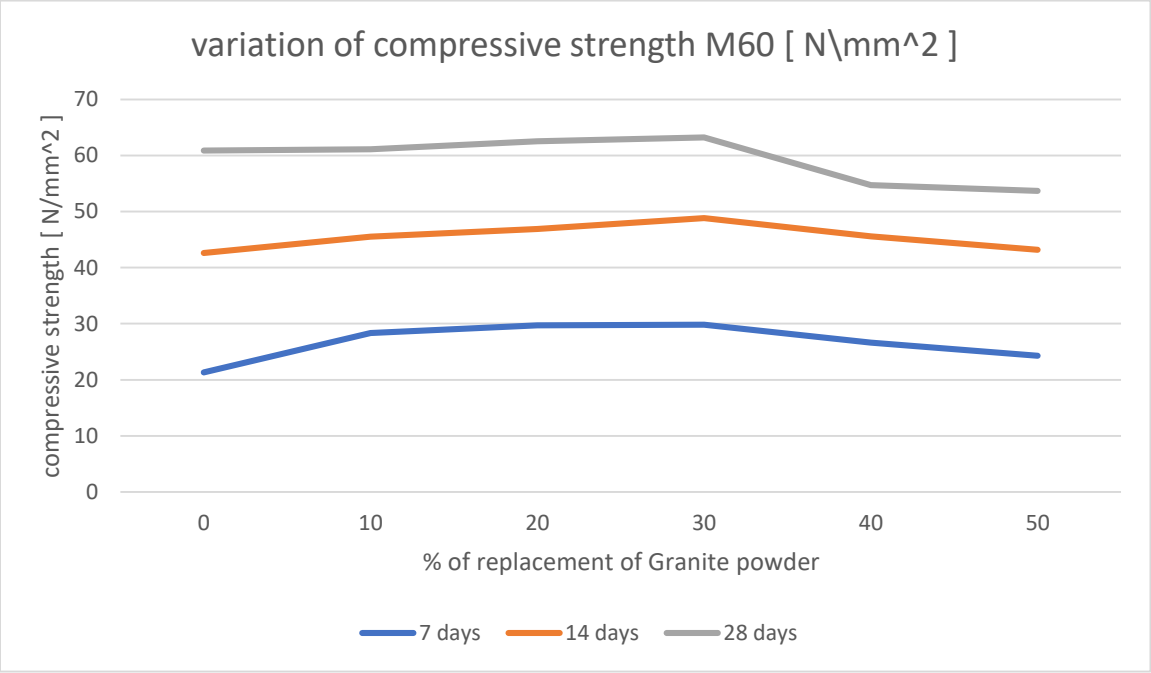
AVERAGE SPLIT TENSILE STRENGTH OF CYLINDER M25 CONCRETE { N/mm^2 }

% of Replacement of RHA	% of Replacement of Granite powder	Split Tensile strength N/mm^2		
		7 days	14 days	28 days
0	0	1.61	1.73	1.92
25	10	1.70	1.97	2.19
25	20	2.42	2.60	2.89
25	30	2.78	2.70	3.00
25	40	2.62	2.65	2.94
25	50	1.96	2.00	2.23



AVERAGE COMPRESSIVE STRENGH OF CUBES { M60 }

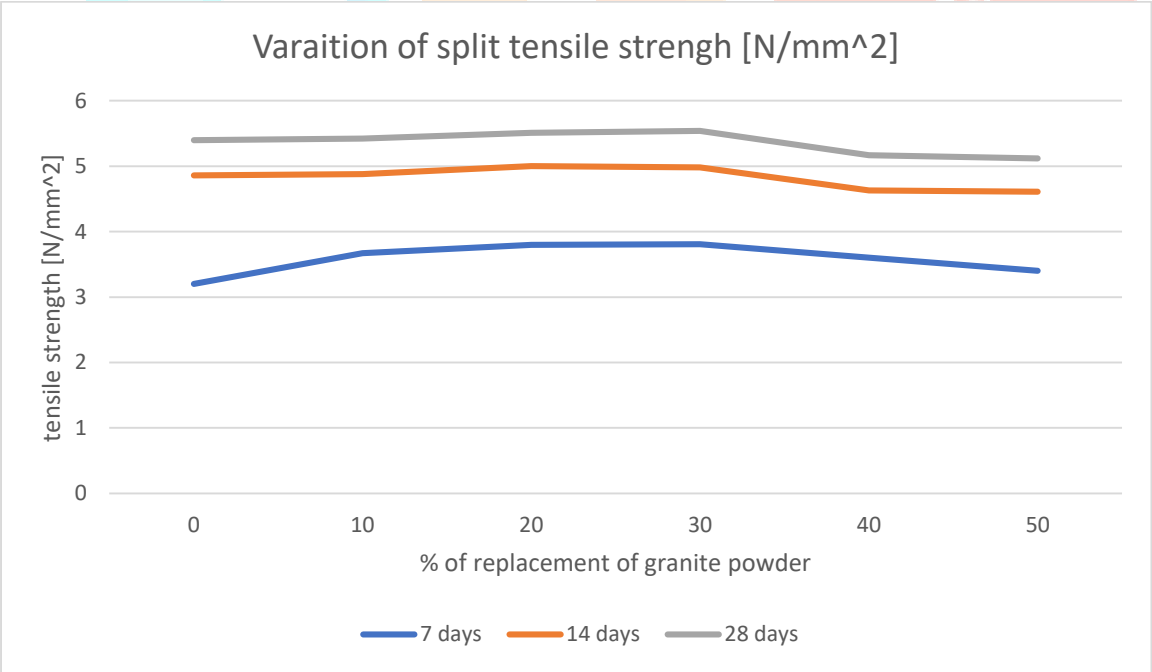
% of replacement of RHA	% of replacement of Granite powder	Compressive strength [N/mm^2]		
		7 days	14 days	28 days
0	0	21.30	42.59	60.90
25	10	28.33	45.50	61.12
25	20	29.70	46.92	62.52
25	30	29.81	48.83	63.20
25	40	26.62	45.60	54.71
25	50	24.30	43.21	53.69



COMPRESSIVE STRENGTH OF M60 CONCRETE [N\mm^2]

AVERAGE SPLIT TENSILE STRENGTH OF CYLINDER { M60 }

% of replacement of RHA	% of replacement of granite powder	Split tensile strength (N/mm^2)		
		7 days	14 days	28 days
0	0	3.20	4.86	5.40
25	10	3.67	4.88	5.42
25	20	3.80	5.00	5.51
25	30	3.81	4.98	5.54
25	40	3.60	4.63	5.17
25	50	3.40	4.61	5.12



DISCUSSION

The cube compressive strength results are obtained after the curing process of 7, 14, and 28 days for different replacement levels of 0%, 25% weight replacement of cement with RHA and 0%, 10%, 20%, 30%, 40%, and 50% of fine aggregate with granite powder. The Strength thus developed for the given different mixes is plotted as a graph and is shown in Figures. From the test results, it is noticed that the strength increased up to 30% of Replacement of sand with waste granite powder and then decreases, while it is more than 30% for M25 and M60 mixes. Thus, the maximum strength is obtained for a mixture of 25% of RHA and 30% of granite powder replacement at the water-binder ratio of 0.45 for M25 and 0.35 for M60 mixes in case of compressive and split tensile strengths.

CONCLUSION

1) Comparative study on waste granite powder concrete with various percentage replacements of granite powder showed that replacement percentage of 30% shows better results in terms of compressive and split tensile strengths

2) Utilization of Rice husk ash and Waste granite powder together can be utilised to manufacture conventional concrete

FUTURE SCOPE

The future study can be carried out by fixing the replacement percentage of the granite powder as 30% and varying the RHA replacement percentage and conducting the strength and durability tests on concrete.

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