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BEHAVIOUR OF INDUSTRIAL WASTES IN CEMENT MORTAR

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Abstract - *In India, large quantity of Groundnut has being cultivated. The Groundnut shell which is generated are simply wasted, these Groundnut Husk Ash are partially replaced for cement. In this case, Quarry Dust wastes are largely generated in India these can also be replaced for Cement. These above materials are replaced for cement in mortar. In this project the Groundnut Husk Ash, Quarry Dust waste are utilized as a replacement material for cement in mortar mix, the size of the mortar cube is 70.6mm*70.6mm*70.6mm and they were tested with different mix proportions of 0%, 10%, 20%, 30%. In this study, the main constituents of the mortar cube are Ordinary Portland Cement, Fine aggregate and the replaced material. These mortar cubes are tested for Mechanical Properties, Compressive Strength development and Tensile Strength and Physical Properties of Dry Density Test, Saturated Density Test and Water Absorption Test are the investigated properties in this work. I will discuss in control mortar to 10% replacement of material in to a greater strength in Compressive Strength Test, and Tensile Strength Test as control mortar to Strength Varies from 10% replacement is reached. To determine the Flexural Strength of Beam of the mortar. The main aim of this research was to make economical and to maintain environmental balance.*

Key words: Groundnut Husk Ash, Quarry Dust, Mechanical Properties.

1. INTRODUCTION

Fine aggregates (sands) make up the main bulk of masonry mortar; therefore having a significant effect upon the properties of the product in both fresh and hardened state. The selection of suitable aggregates, which are capable The selection of suitable aggregates, which are capable of producing a product with the optimum properties, is very important. Mortar is one of the constituents of the composite. Anisotropic material denominated masonry. Mortar is responsible for creating a uniform stress distribution correcting the irregularities of blocks and accommodating deformations associated to thermal expansion and shrinkage. Mortar is the material responsible for the distribution of stresses in masonry structures. If the large amount of agricultural waste materials generated were used instead of natural materials in the construction industry there would be three benefits: conserving natural resources, disposing of waste materials (which are often unsightly) and freeing up valuable land for other uses. Based on Specific gravity, Grain Size, Sieve analysis and Fineness Modulus results obtained in this study, Groundnut Husk Ash are used as Fine Aggregate in Mortar.

2. MATERIALS USED

2.1 Cement

The most general sense of the word, cement is a binder, a substance that sets and hardens independently, and can bind other materials together. The cement used in this study is Ordinary Portland Cement of 53 grade as per IS 12269-1987.

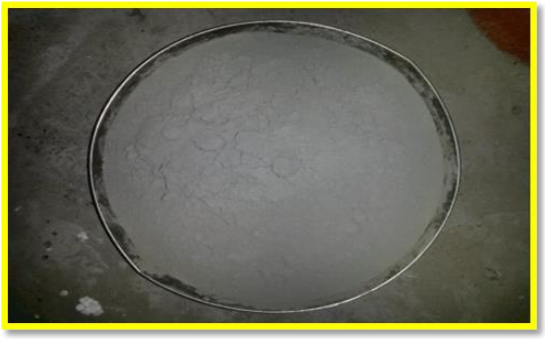

Fig – 1: Ordinary Portland Cement

2.2 Fine Aggregate

Those fractions from 4.75 mm to 150 microns are termed as fine aggregate. The river sand is used as fine aggregate conforming to the requirements of IS: 383. The river sand is washed and screens, to eliminate deleterious material

and oversize particles. The processed sand is marketed in three grades (Grade I, Grade II, and Grade III). The standard sand shell be of quartz. Light grey or whitish variety and shall be free from silt. The Sand grains shall be angular, the shape of the grains approximating to the spherical form; elongated and flattened grains being present only in very small or negligible quantities.

2.3 Groundnut Husk Ash

It was sun dried and then burnt. The burnt ash was passed through a IS sieve of 4.75 mm and it is used for cement.

Fig- 2: Groundnut Husk Ash

2.4 Quarry Dust

The Quarry Dust which is made in processing of granite stone into aggregate this is formed as a fine dust in the crusher. It was sun dried. The dust was passed through a IS sieve of 4.75 mm and it is used for cement.

Fig- 3: Quarry Dust

2.5 Water

Water is an important ingredient of mortar as it actually participates in the chemical reaction with cement. A tap water available in the concrete laboratory was used in manufacturing the mortar. The qualities of water samples are uniform and potable. pH value lies between 6 to 8 and the water is free from organic matter and the solid content. It should be within permissible limit as per IS 456-2000 and conforming to IS 3025-1964.

3. PROPERTIES OF MATERIALS

Table – 1: Properties of Cement

S.No.	Property	Result
1	Initial setting time	42 minutes
2	Final setting time	454 minutes
3	Consistency	31%
4	Specific Gravity	3.10
5	Colour	Grey

Table – 2: Properties of Fine Aggregate

S.No.	Property	Result
1	Fineness modulus	2.563
2	Specific gravity	2.13
3	Grading zone	I

Table – 3: Properties of Groundnut Husk Ash and Quarry Dust

2	Property	Groundnut Husk Ash	Quarry Dust
1	Initial setting time	35 minutes	130 minutes
2	Final setting time	597 minutes	295 minutes
3	Consistency	27.5%	28%
4	Specific gravity	2.18	2.32

4. RESULTS AND DISCUSSIONS

4.1 Compressive Strength Test of Mortar Cube

For the determination of cube Compressive Strength of mortar with specimen of size 70.6mm x 70.6mm x 70.6mm was casted and cured for 7 days, 14 days and 28 days in tap water. After that specimens are dried in open air, subjected to cube Compression Testing Machine. The Compressive Strength of Cement Mortar with Different Percentage of Groundnut Husk Ash and Quarry Dust is given below.

Table- 4: Compressive Strength of Cement Mortar

% of Addition Of Groundnut Husk Ash and Quarry Dust	Compressive Strength (f_{ck}) N/mm^2		
	7 days	14 days	28 days
0%	18.15	24.69	26.79
10%	22.98	25.54	28.29
20%	20.33	21.69	25.67
30%	18.69	19.93	24.05
40%	13.46	16.09	21.97

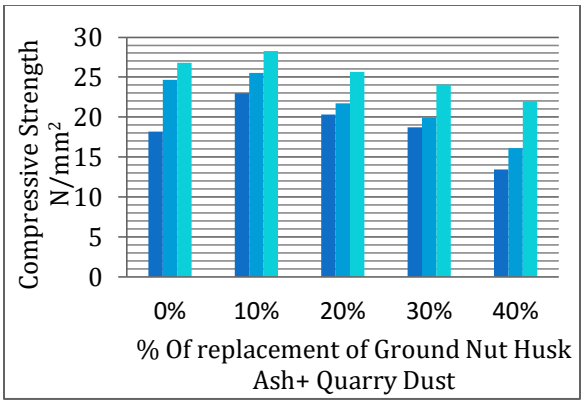

Chart – 1: Compressive Strength of Cement Mortar with Groundnut Husk Ash and Quarry Dust

From the above values the Compressive Strength of Cement Mortar have been studied with equal percentage of replacement of cement with Groundnut Husk Ash and Quarry Dust under 7 days, 14 days, and 28 days curing condition.

In 7days curing the Compressive Strength value for the control mortar was 18.15 MPa and Groundnut Husk Ash and Quarry Dust - 10% was 22.98 N/mm^2 and beyond this percentage of replacement of cement strength was gradually reducing 13.46 N/mm^2 for 40% replacement of percentage.

In 14th day curing the Compressive Strength value for the control mortar was 24.69 MPa and Groundnut Husk Ash and Quarry Dust - 10% was 25.54 N/mm^2 and beyond this percentage of replacement of cement strength was gradually reducing 16.09 N/mm^2 for 40% replacement of percentage.

Similarly In 28th day curing the Compressive Strength value for the control mortar was 26.79 MPa and Groundnut Husk Ash and Quarry Dust-10% was 28.29 N/mm^2 and beyond this percentage of replacement of cement strength was gradually reducing and reaching 21.97 N/mm^2 for 40% replacement of percentage. The reason for such variation for the first 30% the reaction present in the Groundnut Husk Ash and Quarry Dust and excess amount of Groundnut Husk Ash does not react with Fine Aggregate and therefore gradual reduction in strength was occurred with increasing the percentage.

4.2 Tensile Strength Test

For the determination of Tensile Strength of Cement Mortar with specimen of size 70.6mm x 70.6mm x 70.6mm were cast and cured for 28 days to tap water. After that specimens were dried in open air. Subjected to cube Compression Testing Machine. In Tensile Strength Test same machine is used which are used in Compression Strength Test. The mortar block will be placed at an angle of 45◦.

Fig – 4: Tensile Strength Test

Table- 5 Tensile Strength of Cement Mortar

S.No.	IDENTIFICATION	% ADDITION OF GROUNDNUT HUSK ASH AND QUARRY DUST	TENSILE STRENGTH AT 28th DAY (MPa)
1	C	0%	3.92
2	GQ-10	10%	4.34
3	GQ-20	20%	3.97
4	GQ-30	30%	3.72
5	GQ-40	40%	3.56

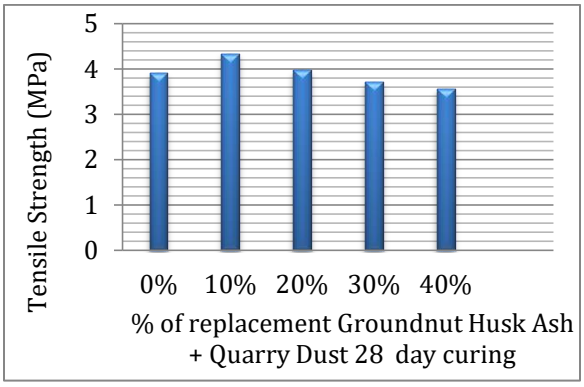

Chart- 2: Tensile Strength of cement mortar cubes at 28th day test

From the above values the Tensile Strength of Cement mortars have been studied with equal percentage of replacement of cement with Groundnut Husk Ash and Quarry Dust under 28 days curing condition.

The Tensile Strength of Cement mortar with 10% replacement of Groundnut Husk Ask and Quarry Dust (GQ) is 4.34MPa which indicate that, the Tensile Strength is more than the conventional cement mortar.

4.3 Flexural Strength Test

Table – 6 Flexural Strength of Cement Mortar cube with Groundnut Husk Ash and Quarry Dust

S. No.	Designation	Flexural Strength of 28th day (MPa)
1	C	3.90
2	GQ-10%	4.05
3	GQ-20%	3.98
4	GQ-30%	3.80
5	GQ-40%	3.35

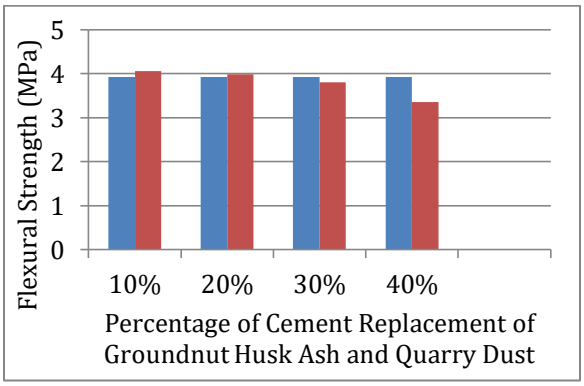

Chart – 3: Flexural Strength of Cement Mortar with Groundnut Husk Ash and Quarry Dust

From the Above values the Flexural Strength of Cement Mortar have been studied with equal percentage of replacement of cement with Groundnut Husk Ash and Quarry Dust under 28 days curing condition.

The Flexural Strength of Cement Mortar with 10% replacement of Groundnut Husk Ash and Quarry Dust (GQ) is 4.05MPa which indicate that, the Flexural Strength is more than the conventional Cement Mortar.

In the 20% of replacement of Groundnut Husk Ash and Quarry Dust (GQ), the Flexural Strength is 4.17MPa which shows, the Flexural Strength is more than the conventional mortar and 10% of GQ mortar. In 30% & 40% replacement of Groundnut Husk Ash and Quarry Dust (GQ), the Flexural Strength is 3.98MPa and 3.35MPa which indicate that the Flexural Strength is less than the conventional Cement Mortar.

5. CONCLUSION

Based on the test results and discussions, the following conclusions could be drawn for the current study as follows,

The Compressive Strength varies with 7th day, 14th day and 28th day curing condition. In 28th day curing the Compressive Strength value for the control mortar was 26.79 MPa and Groundnut Husk Ash and Quarry Dust-10% was 28.29 N/mm^2 and beyond this percentage of replacement of cement strength was gradually reducing and reaching 21.97 N/mm^2 for 40% replacement of percentage.

The Split Tensile Strength test of cement mortar has been studied with equal percentage of replacement of cement with Groundnut Husk Ash and Quarry Dust under 28 days curing condition. The Tensile Strength of cement mortar increased with 10% and 20% of replacement of cement with Groundnut Husk Ash and Quarry Dust, beyond this percentage of replacement of cement, the Tensile Strength is gradually reduced.

4.05% increase of the flexural strength was recorded for mix M10GQ at 28th day age over the control mix which means 10% replacement of instead of cement weight could be achieved and gives better enhancement in flexural strength when replacing Groundnut Husk Ash and Quarry Dust.

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