Experimental Investigation of Solid Block Made With Quarry Dust and Partially Replacing the Cement by Lime Sludge

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Abstract— **In India huge tones of waste materials were generated from industries per annum and also it is estimated as 300 million tones. The toxic waste creates disposal and health hazard problems to environment and humans. Paper industry produces huge amount of solid waste in the form of sludge. This research work deals with the sludge from paper mill and the recycling of sludge into useful products. Paper mill sludge takes huge area for dumping the waste on the land in the form of landfill. Some paper mills incinerates the sludge by creating air pollution problems. To reduce and prevent the pollution problem by paper mill sludge, it is used for replacement of building material and make waste as profitable material for construction purpose. Lime sludge from paper mill were used to produce low cost concrete by blending various ratios of cement. Experimental investigation on strength of concrete and optimum percentage of the partial replacement by replacing cement via 10%, 20%, 30%, and 40% of lime sludge were identified.**

Keywords—Quarry Dust, Lime Sludge, Hollow block. Partially replacing of cement in lime sludge, comressive strength.

I. INTRODUCTION

The cement industry continues to introduce more sustainable practices and products for constructing and maintaining our concrete infrastructure and buildings.

Hypo sludge is a recent arrival among cementitions materials. It was originally introduced as artificial pozzolana while producing paper the various wastes are comes out from the various processes in paper industries.

In cement concrete as a partial substitute of cement which economizes the cost of concrete. Preliminary Test on Materials

A. Testing of cement

1. *Fineness Test of Cement*

Correctly 100grms of cement was weighed and taken in a standard IS sieve no.9 (90 microns).The lumps were broken down and the material was sieved continuously for 15 minutes using sieve shaker. The residue left on the sieve was weighed .This weight does not exceed 5% for ordinary cement. Percentage of residue left on sieve = (weight retained/weight taken) x 100

Result: Percentage of residue left on sieve = 0.4

2. *Consistency Test of Cement*

500 grams of cement was taken and a paste was prepared with 24% quantity of water. After completely filling the mould, shake the mould to expel the air. A standard plunger 10mm diameter and 50mm long was attached and brought down to touch the surface of the paste in the test block and quickly released allowed it to sink to the paste by its own weight. The depth of penetration of plunger was noted down. The second trail was conducted by 25% of water and the depth of penetration was found out. Similarly number of trials was

conducted till the plunger penetrates for a depth of 33 to 35mm from top.

Result: Consistence of given sample of cement = 34 %

B. Testing of Quarry Dust

1. Sieve analysis of Quarry Dust

The sample was brought to air – dried condition before weighing and sieving was achieved after drying at room temperature. The air – dry sample was weighed
Fineness modulus =2.80
Zone conformation = Zone-II

2. Specific Gravity Test of Quarry Dust

The pycnometer was dried thoroughly and weighed as W_1 gram. 200 gram of fine aggregate was taken in the pycnometer and weighed as W_2 gram. The pycnometer was filled with water up to the top. Then it was shacked well and stirred thoroughly with the glass rod to remove the entrapped air. After the air has been removed the pycnometer was completely filled with water up to the mark. The outside of pycnometer was dried with a clean cloth and it was weighed as W_3 grams. The pycnometer was cleaned thoroughly. The pycnometer was completely filled with water up to the top. Then outside of the pycnometer was dried with a clean cloth and it was weighed as W_4 grams.
Result: Specific Gravity of Fine Aggregate (G) = 2.63

C. Testing of Coarse Aggregate

1. Sieve Analysis of Coarse Aggregate

The sample was brought to air – dried condition before weighing and sieving was achieved after drying at room temperature. The air – dry sample was weighed and achieved successively on the appropriate sieves starting with the largest size sieve.
Result: Fineness modulus =4.46

2. *Specific Gravity Test of Coarse Aggregate*

The container was dried thoroughly and weighed as W_1 gram. 800 gram of fine aggregate was taken in the container and weighed as W_2 gram. The container was filled with water up to the top. Then it was shacked well and stirred thoroughly with the glass rod to remove the entrapped air. After the air has been removed the container r was completely filled with water up to the mark. The outside of container r was dried with a clean cloth and it was weighed as W_3 grams. The container was cleaned thoroughly. The container was completely filled with water up to the top. Then outside of the container was dried with a clean cloth and it was weighed as W_4 grams.

Result: Specific Gravity of Coarse Aggregate (G) = 2.62

II. Mix Design

The mix design of concrete is a trial and error method. These guidelines gives the range for coarse aggregate and fine aggregate content and based on the limit the approximate mix design for M30 grade of concrete is obtained.
Proportion:

Cement = 1 (499/499)

F.A = 1.01 (507.04/499)

C.A = 2.25 (1121.93/499)

Therefore ratio =1 : 1.05 : 2.25

W/C = 0.43

III. MATERIALA USED

CEMENT

The ordinary Portland cement conforming to IS: 4031 was used for the preparation of the test specimens.

QUARRY DUST

The quarry Dust used in experimental investigation was quarry sand confirming to zone I of IS: 383 – 1970.

COARSE AGGREGATE

Crushed granite aggregate particles passing through 20mm and retained on 4.75 mm I.S sieve used as natural aggregates which met the grading requirement of IS: 383 – 1970.

LIME SLUDGE

Lime sludge is also known as paper industry waste. It is the byproduct of the paper waste. This hypo sludge contains low calcium and minimum amount of silica. Lime sludge behaves like cement because of silica and magnesium properties.

CHEMICAL PROPERTIS OF LIME SLUDGE

The Chemical Properties of Lime Sludge is added in the concrete Lime sludge is also known as paper industry waste. It is the byproduct of the paper waste. This hypo sludge contains low calcium and minimum amount of silica.
Table.1 Chemical Properties Of Lime Sludge

`S.NO	CHARACTERISTICS	RESULTS
1	Loss on Ignition % by mass, including Moisture	52.28
2	Acid In soluble % by mass	7.27
3	Calcium Oxide as Cao % by mass	35.93
4	Magnesium Oxide As Mgo % by mass	0.86
5	Iron Oxide as Fe_2O_3 % by mass	1.89
6	Aluminum Oxide as Al_2O_3 % by mass	1.09

V.*EXPERIMENTAL INVESTIGATION*

LIME SLUDGE ADDED IN CONCRETE

MIX PROPORTION OF LIME SUDGE

Table.2A MIX PROPORTION FOR LIME SLUDGE

% of Partially Added in Lime Sludge	CEMENT	LIME SLUDGE	QUARRY DUST	COARSE AGGREGATE	W/C RATIO
10%	1.98	0.22	1.9	4.1	0.43
20%	1.76	0.44	1.9	4.1	0.43
30%	1.54	0.66	1.9	4.1	0.43
40%	1.32	0.88	1.9	4.1	0.43

A. Compression Test

The compressive strength test is a mechanical test measuring the maximum amount of compression load a material can bear before fracturing. Due to compression load, the cube or cylinder undergoes lateral expansion owing to poisons ratio effect.

B. Flexural Strength Test

The splitting test is simple to perform and gives more uniform results than other tension tests. Strength determine in the splitting test is believed to be closure to the true tensile strength. Splitting strength gives about 5 to 12% higher value than the direct tensile strength.

It is a method of determining the tensile strength of mortar using a cylinder which splits across the vertical diameter .It is expresses as the minimum tensile stress (force per unit area) needed to split the material apart. The specimen used was 100×200 mm cylinder. The test was performed at 7 and 28 days.

Split tensile strength = $2P/\pi DL$

Where,

P= Compressive load in Kn

L= Length of specimen in mm

D= Diameter of specimen in mm

VI.*SOLID BLOCK*

Compressive strength of Solid Blocks or concrete masonry units are required to know the suitability of these in construction works for various purposes.

Solid blocks are generally made of aggregate and water, Partially replacement of cement in Lime Sludge. Which are usually rectangular and are used in construction of masonry structure. They are available in solid and hollow forms.

VII.RESULT AND DISCUSSION

A.GENERAL

In this study of concrete and compressive strength of partially added in solid block.

B.MECHANICAL PROPERTIES

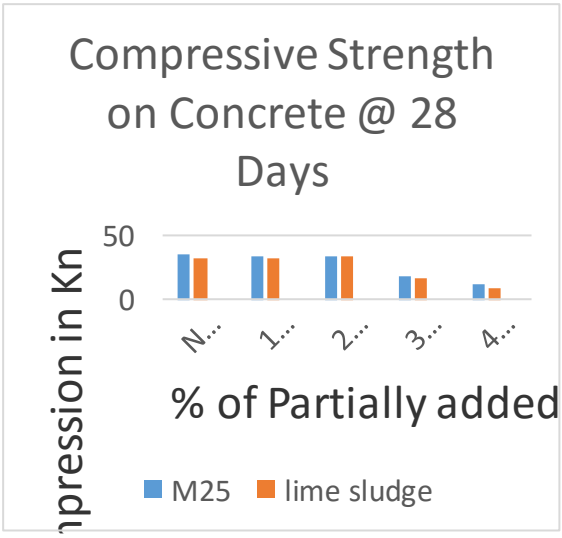
The results of tests were conducted on cement concrete cube and cylinder at 28 days water curing compressive strength, split tensile strength.

C.COMPRESSIVE STRENGTH

Table 4 Compressive strength of concrete

The compressive strength test is a mechanical test measuring the maximum amount of compression load a material can bear before fracturing. Due to compression load, the cube or cylinder undergoes lateral expansion owing to poisons ratio effect

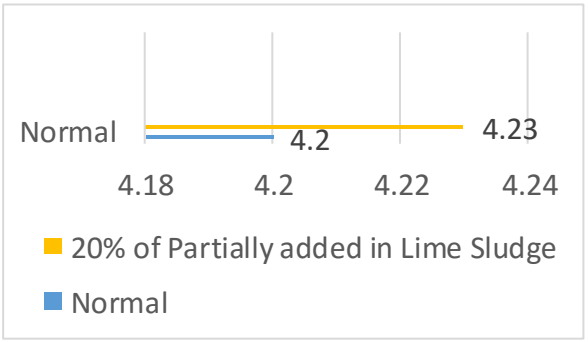
SAMPLES	CUBE
% of Partially Added in Lime sludge	Compressive Strength in Kn
10%	32.88
20%	32
30%	33.77
40%	16
50%	8.9



D.SOLID BLOCK

Result for Compression Test on Solid Block

TYPES OF BLOCK	GRADES OF BLOCK	COMPRESSIVE STRENGTH OF BLOCK in Kn
SOLID BLOCK	Normal block	4.2
	20% of partially added in lime sludge replacing of cement	4.23



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