

COMPARISON OF COMPRESSIVE STRENGTH OF M20 GRADE CONCRETE WITH PARTIALLY REPLACED CEMENT WITH PAPER PULP

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Abstract — The use of paperpulp in concrete formulations was investigated as an alternative to landfill disposal. The cement has been replaced by waste paper sludge accordingly in range of 5% to 20% by weight for M20 mix. By using adequate amount of the waste paper pulp and water, concrete mixtures were produced and compared with the conventional concrete. The concrete specimen were tested for compression test. The test was carried out to evaluate the mechanical properties for 14days and 28days of curing. As a result, the compressive strength founds to be increased for the 5% addition of waste paperpulp. Further increase in percentage of waste paperpulp reduces the strength gradually. There search on use of paper sludge can be further carried out in concrete manufacturing as a new recycled material.

Keywords — Paper Pulp, M20 Grade concrete, Partial Replacement.

I. INTRODUCTION

The constant developmental activities in civil engineering and growing industrial activities have created a continuous demand for building materials which satisfy all the stringent requirements regarding the short term and long term performance of the structure. As the structures of tomorrow become taller and more complex, materials of construction will be required to meet more demanding standards of performance than those in force today. For instance the use of waste rubber glass powder industrial waste fibers wood dust and lime stone powder waste in building material production.

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TABLE 1 : ELEMENTAL ANALYSIS OF PAPER PULP

Content	O %	Ca %	Si%	Al%	Mg%	S%	Ti%	K%	Fe%
Paper pulp	15.83	14.94	60.97	2.06	3.59	1.07	0.15	0.16	0.92

TABLE 2 : PROXIMATE ANALYSIS OF PAPER PULP.

Sl.No.	Wt. in grams	Moist%	Ash%	Volatile Material%	Free Carbon%	GCV Kcal/kg
1.	420	5.8	40.6	44.7	8.9	2372

TABLE 3 : ULTIMATE ANALYSIS OF PAPER PULP

Sl.No.	Wt. in grams	C%	H%	N%	S%	O%
1.	420	22.7	2.5	0.3	0.4	23.6

II. OBJECTIVE

- 1.To prepare paper pulp and use it as partial replacement of cement in preparation of concrete.
- 2.To compare the compressive strength of M20 grade concrete with partially replaced cement with paper pulp.

III. EXPERIMENTAL PROGRAMME

1) Cement

Ordinary Portland cement 53 Grade conforming to IS: 269 – 1976. Ordinary Portland cement, 53 Grade was used for casting all the Specimens.

Different types of cement have different water requirements to produce pastes of standard consistence. Different types of cement also will produce concrete have a different rates of strength development. The choice of brand and type of cement is the most important to produce a good quality of concrete. The type of cement affects the rate of hydration, so that the strengths at early ages can be considerably influenced by the particular cement used.

2) Fine Aggregate

Locally available river sand conforming to Grading zone II of IS: 383 –1970. Clean and dry river sand available locally will be used. Sand passing through IS 4.75mm Sieve will be used for casting all the specimens.

3) Coarse Aggregate

Locally available crushed blue granite stones conforming to graded aggregate of nominal size 12.5 mm as per IS: 383 – 1970. Crushed granite aggregate with specific gravity of 2.77 and passing through 4.75 mm sieve and will be used for casting all specimens. Several investigations concluded that maximum size of coarse aggregate should be restricted in strength of the composite. In addition to cement paste – aggregate ratio, aggregate type has a great influence on concrete dimensional stability.

4) Paper pulp

Paper Pulp is also known as paper waste. It is the byproduct of the paper waste. This Paper Pulp contains low calcium and minimum amount of silica. Paper Pulp behaves like cement because of silica and magnesium properties. Paper Pulp may be used as part replacement of cement. Wood pulp comes from softwood trees such as spruce, pine, fir, larch and hemlock. A pulp mill is a manufacturing facility that converts wood chips or other plant fiber source into a thick fiberboard which can be shipped to a paper mill for further processing. Pulp can be manufactured using mechanical, semi-chemical or fully chemical methods.

IV. MATERIAL TEST:

1) Specific Gravity Test Result

Mix design

By using M₂₀ grade =1:1.5:3

2) Volume calculation

Total volume for one cube

$$= 150^3 \times 25 \times 10^{-9} \times 1000 / 9.81$$

$$= 8.6 \text{ kg}$$

Volume of cement for one cube

$$= 8.6 / 5.5$$

$$= 1.5 \text{ kg}$$

Volume of sand for one cube

$$= 1.5 \times 1.5$$

$$= 2.25 \text{ kg}$$

Volume of coarse aggregate

$$= 1.5 \times 3$$

$$= 4.5 \text{ kg}$$

Amount of cement = Weight of cement –

Weight of paper Pulp

For 5% amount of

$$\text{Cement} = 1.5 - 0.075$$

$$= \mathbf{1.425 \text{ kg}}$$

For 10% amount of

$$\text{Cement} = 1.5 - 0.15$$

$$= \mathbf{1.35 \text{ kg}}$$

V. RESULT AND DISSCUSSION

COMPRESSIVE STRENGTH VALUES OF SAMPLES

1) Slump test:

The concrete slump test is an empirical test that measures workability of fresh concrete. The test measures consistency of concrete in that specific batch.

TABLE 4 SLUMP TEST

Sl.No.	PERCENTAGE OF PAPER PULP (%)	TEST 1 mm	TEST 2 mm
1.	Conventional concrete	26.5	27
2.	5%	27.2	27.5
3.	10%	26.2	26.3
4.	15%	26	26.2
5.	20%	25.6	25.3

TABLE 5 - 14TH DAY COMPRESSIVE TEST (1ST SPECIMEN)

Sl.No.	PERCENTAGE OF PAPER PULP (%)	INITIAL CRACK kN	ULTIMATE LOAD kN
1.	Conventional concrete	110	230
2.	5%	115	232
3.	10%	106	142
4.	15%	68.2	77
5.	20%	50.7	62.4

TABLE 6 - 14TH DAY COMPRESSIVE TEST (2ND SPECIMEN)

Sl.No.	PERCENTAGE OF PAPER PULP (%)	INITIAL CRACK kN	ULTIMATE LOAD kN
1.	Conventional concrete	112	238
2.	5%	120	236
3.	10%	105	138
4.	15%	63.4	74
5.	20%	52.6	63

TABLE 7 - 28TH DAY COMPRESSIVE TEST (1ST SPECIMEN)

Sl.No.	PERCENTAGE OF PAPER PULP (%)	INITIAL CRACK kN	ULTIMATE LOAD kN
1.	Conventional concrete	139.6	260.7
2.	5%	145.7	292.5
3.	10%	124.6	146.7
4.	15%	70.3	112.4
5.	20%	61.3	72.7

TABLE 8 - 28TH DAY COMPRESSIVE TEST (2ND SPECIMEN)

Sl.No.	PERCENTAGE OF PAPER PULP (%)	INITIAL CRACK kN	ULTIMATE LOAD kN
1.	Conventional concrete	140.3	263.3
2.	5%	154.7	288.2
3.	10%	119.3	152.8
4.	15%	72.4	108.6
5.	20%	61.4	77.7

VI. CONCLUSION

The compressive strength increased up to 5% addition of paper pulp as a replacement of cement. The Compressive strength for 5% addition of paper pulp was found to be **232kN/mm²**. The Compressive strength for 10% addition of paper pulp was found to be **142kN/mm²**. Hence the reduction was found to be about **38%** between 5% to 10% addition of paper pulp. Water absorption of the paper pulp was found to be increased more than the 5% addition, Hence the decrease in the Compressive Strength. Therefore 5% addition of paper pulp is the permissible limit to attain a good Compressive strength .Use of waste paper pulp in concrete can save the pulp and paper industry

disposal costs and produce a 'greener' concrete for construction.

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