



Flexural Behavior of Concrete Using Waste Paper Sludge Ash

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Abstract: The aim of project is to produce low cost concrete by blending various ratios of cement with hypo sludge & to reduce disposal and pollution problems due to hypo sludge it is most essential to develop profitable building materials from hypo sludge. To make good quality paper limited number of times recycled Paper fibres can be used which produces a large amount of solid waste. The innovative use of hypo sludge in concrete formulations as a supplementary cementitious material was tested as an alternative to traditional concrete. The initial results of experimental programs aimed at producing and evaluating the Hypo sludge concrete made with Hypo sludge (Paper Industry Waste) are presented and discussed. The mix design of Hypo sludge Concrete was arrived as per Indian Standard Guidelines. In this investigation, Hypo sludge Concrete was made by usual ingredients of Cement, Fine aggregate, Coarse aggregate and water and Hypo Sludge at various replacement levels (10, 20, 30 and 40 percent) of weight for M20 mix. Keeping all this view, the aim of investigation is the study on behaviour of concrete while adding of waste with different proportions of Hypo sludge in concrete by using tests like compression strength, split tensile strength and Flexural Strength of the Beam. Compressive Strength of the cubes and Split Tensile strength for the Cylinders have been determined. Based on the results Beam has been casted and placed for curing to determine the flexural properties of the Beam.

Keywords: hyposludge; paper waste; OPC

1. Introduction

Natural resources are not unlimited therefore, they must be optimally consumed. This shall help not only to control degradation of environment but conserve them also for the use of future generation. This can be achieved by the process of recycling and making use of industrial wastes, disposal of which otherwise is a serious problem. Hypo sludge is such an industrial waste produced in plenty by paper mills. Construction industry is found to be apprehensively reluctant to use wastes for making concrete mixes. This study presents the physical and chemical analysis of hypo sludge and its use in cement concrete as a partial substitute of cement which economizes the cost of concrete.

Concrete is a composite construction material composed of cement, aggregate (generally a coarse aggregate made of gravels or crushed rocks such as limestone, or granite, plus a fine aggregate such as sand), water, and/or admixtures. Concrete is made by mixing: Cement, water, course fine aggregates. The objectives are to mix these materials traditionally to make concrete that is easy to: Transport, place, compact, finish and to give a strong and durable product. The proportionate quantity of each material (i.e. cement, water and aggregates) affects the properties of hardened concrete.

2. Material Properties

The properties of materials used in the concrete are discussed below:

A. Cement

Ordinary Portland cement of 53 grades available in local market was used. The specific gravity of cement that was taken was 3.14

B. Fine Aggregate

The sand sieved through 4.75 mm sieve is used having specific gravity of 2.6. The fine aggregates belonged to grading zone I.

C. Coarse Aggregate

Locally available coarse aggregate having the maximum size of 12.5 mm is used. The specific gravity of coarse aggregate that was taken was 2.67

D. Hypo Sludge

Hypo Sludge is used as a replacement for cement. The specific gravity of Waste Paper Sludge that was taken was 2.6. The a property of Hyposludge is given in Table 1.

Table 1 Properties of Hyposludge

Sl.no	Constituent	Present in hypo sludge (%)
1.	Magnesium Oxide(MGO)	3.3
2.	Calcium Oxide (CAO)	46.2
3.	Loss on Ignition	27.00
4.	Acid Insoluble	11.1
5.	Silica(SIO ₂)	9.0
6.	R ₂ O ₃	3.6

3. Experimental Investigation

In this investigation the hardened properties of Light weight concrete for various partial replacement percentages of Hypo Sludge are determined.

3.1. Mix proportions

Based on the IS guidelines the mix proportions of Hyposludge Concrete were prepared for M20 grade.

3.2. Hardened properties of Hyposludge Concrete

3.2.1 Compressive Strength Test



Fig.1 Compressive Strength Test

In order to find the mechanical properties Compressive strength tests were conducted at 28 days of cube (150 X 150 X 150 mm) specimens. For each combination, two specimens were tested.

In order to find the split tensile strength of concrete 28 days of cylinder (150 X 300 mm) specimen are cast. For each combination, two specimens were tested.

The following table shows the Compressive strength of Hyposludge Concrete at 7 days:

Table II Compressive Strength of Hyposludge Concrete at 7 Days

Sl.no	Percentage of hyposludge in concrete (%)	Compressive strength(N/mm ²) at 7 days
1.	0	11.38
2.	10	11.48
3.	20	8.53
4.	30	6.35
5.	40	4.41

The following table shows the Compressive strength of Hyposludge Concrete at 28 days:

Table III Compressive Strength of Hyposludge Concrete at 28 Days

Sl.no	Percentage of hyposludge in concrete (%)	Compressive strength(N/mm ²) at 28 days
1.	0	19.9

2.	10	19.98
3.	20	16.89
4.	30	13.94
5.	40	11.21

The following graph shows the variation in the Harden properties of Hyposludge Concrete:

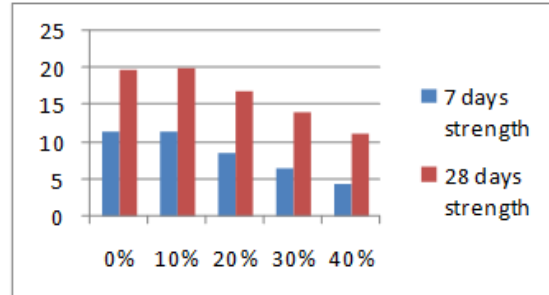


Fig.2 Chart for Compressive Strength of Hyposludge Concrete

3.2.2 Split Tensile Strength Test



Fig.3 Split Tensile Strength Test

The following table shows the split tensile strength of Hyposludge Concrete at 28 days

Table IV Split Tensile Strength of Hyposludge Concrete at 7 Days

Sl.no	Percentage of hyposludge in concrete (%)	Compressive strength(N/mm ²) at 7 days
1.	0	2.2
2.	10	2.32
3.	20	2.14
4.	30	2.06
5.	40	1.9

Table V Split Tensile Strength of Hyposludge Concrete at 28 Days

Sl.no	Percentage of hyposludge in concrete (%)	Compressive strength(N/mm ²) at 28 days
1.	0	2.92

2.	10	3.11
3.	20	2.86
4.	30	2.64
5.	40	2.44

The following graph shows the variation in the split tensile strength of Hyposludge:

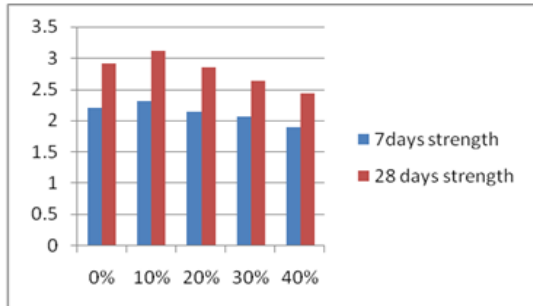


Fig.4 Chart for Split Tensile Strength of Hyposludge Concrete

3.2.3 Flexural Strength Test

Based on the compressive strength values optimum result was found to be at 10 % replaced mix for Hyposludge. Specimens were cast with this percentage replacement and flexural strength was calculated and described below.

The following table shows the flexural strength of concrete with Hyposludge.

Table 7: Flexural strength of concrete with hyposludge

Nominal mix		10% Hyposludge	
Load (kn)	Deflection (mm)	Load (kn)	Deflection (mm)
0	0	0	0
10	0.22	10	0.23
20	0.86	20	0.88
30	1.53	30	1.62
40	2.02	40	2.16
50	2.78	50	2.96
60	3.82	60	3.98
70	4.12	65	7.73
65	7.35		

The following graph shows the Flexural strength of Normal Concrete Mix:

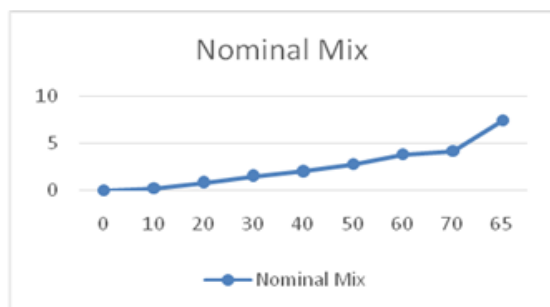


Figure 5: Chart for flexural strength of nominal mix

The following graph shows the Flexural strength of Normal Concrete Mix:

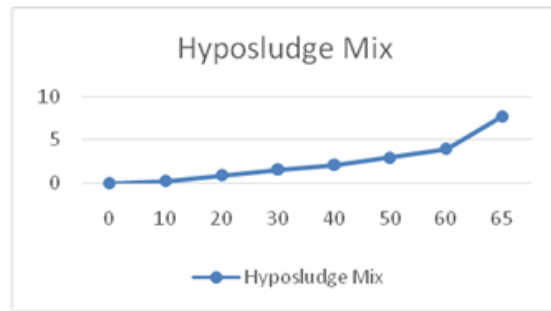


Figure 6: Chart for flexural strength of Hyposludge mix

4. Conclusion

Finally I Conclude Our Project With Full Satisfaction Of Completing the Project. Casting of Conventional Cement Concrete Cubes Has Been Done Casting of Concrete Cube Added with Industrial Waste (Hyposludge) has also been done. Comparison of Results Has Been Done. Testing Of Concrete Cubes With Various Methods Like Compression and Split Tensile Test Has Been Done For Both Cubes. For 10% of Hyposludge Concrete, The Compression Strength And Split Tensile Strength Has Been Increased, So Upto 10% Cement Has Been Replaced By Hyposludge By Replacement of Hyposludge. It is observed that in flexural strength of M20 grade concrete the strength of concrete has increased with 10% replacement of hypo sludge with cement as compare to conventional concrete and with 20% replacement it is slightly decreasing or we can say it as equivalent but with 30% its start decreasing in strength. The Cost Of Construction Should Be Minimized By Effective Utilization Of Waste Product Into Concrete To Also Reduce The Environmental Effects. If Silica Is Added Means The Strength Will Be Considerably Increased Because Of Lack Of Silica In Hypo Sludge Considerably this type of Concrete can be Used for Road Works Effectively with Less Consumption of Cement.

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