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Replacement of cement with hypo sludge (partial replacement)

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ABSTRACT

Paper Industry creates a lot of strong waste. That wastage can be reused just in a predetermined number. So that the broken, low-quality paper filaments are squander material get as muck. It is called as Hypo Sludge. Paper Industry Hypo Sludge are dumped as waste in the ground each year. Barely any Industries are utilizing 10% ooze for their incinerators yet it makes air contamination issues another 2% of waste slop is utilized for cropland as compost. Staying 88% of the cases those squanders are blended with streams and lakes. Here we are utilizing those waste material called Hypo slop by halfway substitution of concrete. In the first place, the hypo muck washed off the reused strands to join the waste solids. The fundamental point of this undertaking is to create low cast cement by halfway supplanting of concrete with hypo slime. To diminish the mechanical wastage sum and reuse that wastage in some other configuration just the answer for this. This undertaking is worried about the test examination on quality of concrete and ideal level of the halfway substitution by supplanting bond by means of 10%, 20%, 30%, 40%, half, of Hypo Sludge. The test outcomes acquired show that Hypo muck of minimal amount as incomplete concrete substitution beneficially affects the mechanical properties, for example, compressive quality, split rigidity, modulus of versatility.

Keywords: Hypo Sludge, Flexural, Split

INTRODUCTION

Energy plays a crucial role in growth of developing countries like India. In the context of low availability of non-renewable energy resources coupled with the requirements of large quantities of energy for Building materials like cement, the importance of using industrial waste cannot be under estimated. During manufacturing of 1 tones of Ordinary Portland Cement we need about 1-1.5. Tones of earth resources like limestone, etc. Further during manufacturing of 1 tones of Ordinary Portland Cement an equal amount of carbon-di-oxide are released into the atmosphere. The carbon-di-oxide emissions act as a silent Killer in the environment as various forms. The industrial wastes such as hypo sludge due to its low calcium are taken out for our project to replace the cement utilization in concrete. For producing 4million tones of cement, they emit 1 million ton green house gases are emitted. Also, to reduce the environmental degradation, this sludge has been avoided in mass level disposal in land. To eliminate the ozone layer depletion, production of cement becomes reduced. For this, the hypo sludge is used as replacement in the concrete as high performance concrete. By utilizing this waste the strength will be increased and also cost reduction in the concrete is achieved [1].

OBJECTIVES

To investigate the utilization of Hypo Sludge as Supplementary Cementitious Materials (SCM) and influence of these hypo sludge on the Strength on concretes made with different Cement replacement levels [2].

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Need for Hypo Sludge Utilization

While producing paper the various wastes are comes out from the various processes in paper industries. From the preliminary waste named as hypo sludge due to its low calcium is taken out for our project to replace the cement utilization in concrete. Due to the cement production green house gases are emitted in the atmosphere. For producing 4million tones of cement, they emit 1 million ton green house gases are emitted. Also, to reduce the environmental degradation, this sludge has been avoided in mass level disposal in land. To eliminate the ozone layer depletion, production of cement becomes reduced. For this, the hypo sludge is used as partial replacement in the concrete as high performance concrete. By utilizing this waste the strength will be increased and also cost reduction in the concrete is achieved.

Solid Waste from Paper Industry

The hypo sludge contains, low calcium and maximum calcium chloride and minimum amount of silica. Hypo sludge behaves like cement because of silica and magnesium properties. This silica and magnesium improve the setting of the concrete.

Figure 1: Raw Hypo sludge disposal from SPB PAPER MILL

Table 1: Comparison of Cement and Hypo Sludge

Sl. No	Constituent	Cement (In %)	Hypo Sludge (In %)
1.	Lime(CaO)	62	46.2
2.	Silica(SiO_2)	22	9
3.	Alumina	5	3.6
4.	Magnesium	1	3.33
5.	Calcium sulphate	4	4.05

Mix Design

A mix M_{25} grade was designed as per Indian Standard method and the same was used to prepare the test samples. The design mix proportion is as follows

Table 2: Mix design

	Water	Cement	Fine Aggregate	Coarse Aggregate
By weight(kg)	191.6	547.42	456.96	1255.475
By volume	0.45	1	0.834	2.29

DETAILS OF THE EXPERIMENTAL STUDY

Compressive strength test

150 mm X 150mm X 150mm concrete cubes were casted using M_{25} grade concrete. Specimens with ordinary Portland cement (OPC) and OPC replaced with hypo sludge at 10%, 20%, 30%, 40%, and 50%, levels were cast and repeated the same with Granite powder. During casting the cubes were mechanically vibrated by using a table vibrator. After 24 hours, the specimens were removed from the mould and subjected to water curing for 7 and 28 days. After curing, the specimens were tested for compressive strength using a calibrated compression testing machine of 2000kN capacity.

Split tensile strength test

Split tensile strength of concrete is usually found by testing plain concrete cylinders. Cylinders of size 150mm x 300 mm were casting using M25 grade concrete. Specimen with OPC and OPC replaced by hypo sludge at 10%, 20%, 30%, 40%, 50%, replacement levels were cast. During moldings, the cylinders were mechanically vibrated using a table vibrator. After 24 hours, the specimens were removed from the mould and subjected to water curing for 28 days. After curing, the specimens were tested for compressive strength using a calibrated compression testing machine of 2000kN capacity.

Table 3: Compressive Strength on Cubes at 28 Days (hypo sludge)

Replacement of cement in %	Number of Specimen	Initial Crack Load(kN)	Ultimate Load(kN)	Ultimate Compressive Strength (N/mm^2)
0	**3**	**627.100**	**827.652**	**36.78**
10	**3**	**756.300**	**902.365**	**40.10**
20	**3**	**920.250**	**1219.250**	**54.18**
30	**3**	**881.950**	**1250.228**	**55.56**
40	**3**	**700.00**	**820.875**	**36.48**
50	**3**	**298.350**	**360.241**	**16.01**

Table 4: Split Tensile Strength of Cylinder at 28- Days (hypo sludge)

Partial Replacement in %	Number of Specimen	Ultimate Load(kN)	Split tensile Strength (N/mm^2)
0	**3**	**130.061**	**1.84**
10	**3**	**110.269**	**1.56**
20	**3**	**104.615**	**1.48**
30	**3**	**100.373**	**1.42**
40	**3**	**98.253**	**1.39**
50	**3**	**97.546**	**1.38**

ECONOMIC FEASIBILITY

Cost analysis is carried out for the optimum proportion of percentage of hypo sludge in concrete. This project was carried out in our college campus. The cost is compared to the conventional concrete.

COST OF MATERIALS

Cost of cement per bag = Rs.250.00
Cost of sand per m3 = Rs.867.20
Cost of hypo sludge per kg = Rs.0.50

Cost of Granite powder per kg = Rs.0.50 (All the rates are include with lead charges)
Cost of coarse of aggregate per m3 = Rs.561.40

Table 9: Cost of material of normal concrete/ m^3

Description	***Quantity kg/m^3***	***Cost(Rs.)***	***Cost of material(Rs.)***
Cement	547.42	5/kg	2737.10
Hypo sludge	-	0.50/kg	-
Granite powder	-	0.50/kg	-
Sand	456.96	867.20/m^3	247.67
Coarse aggregate	1255.475	561.40/m^3	320.37
Total cost			**3305.14**

Table 10: Cost of material of 10% partially replaced concrete/m^3

Description	***Quantity kg/m^3***	***Cost(Rs.)***	***Cost of material(Rs.)***
Cement	492.678	5/kg	2463.39
Hypo sludge/granite powder	54.742	0.50/kg	27.37
Sand	456.96	867.20/m3	247.67
Coarse aggregate	1255.475	561.40/m3	320.37
Total cost			**3058.801**

Table 11: Cost of material of 30% partially replaced concrete/m^3

Description	***Quantity kg/m^3***	***Cost(Rs.)***	***Cost of material(Rs.)***
Cement	383.194	5/kg	1915.97
Hypo sludge/granite powder	164.226	0.50/kg	82.11
Sand	456.96	867.20/m^3	247.67
Coarse aggregate	1255.475	561.40/m^3	320.37
Total cost			**2566.12**

Table 12: Cost of material of 50% partially replaced concrete/m^3

Description	***Quantity kg/m^3***	***Cost(Rs.)***	***Cost of material(Rs.)***
Cement	273.71	5/kg	1368.55
Hypo sludge and granite powder	273.71	0.50/kg	136.855
Sand	456.96	867.20/m^3	247.67
Coarse aggregate	1255.475	561.40/m^3	320.37
Total cost			**2073.445**

CONCLUSION

Based on limited experimental investigation on the compressive and split tensile strength of concrete, the following observations are made regarding the resistance of partially replaced hypo sludge.

- Compressive strength of the concrete, should be increased the percentage of replacement is increased up to 50% and replacement increased compressive strength become reduced.
- The split tensile strength should be decreased for the percentage of the replacement is increased.
- Form this level, replacement of cement with this waste of hypo- sludgeand granite powder provides maximum compressive strength at 50% replacement.
- Environment effects from wastes and maximum amount of cement manufacturing is reduced through this project,
  A better measure by a NEW CONSTRUCTION MATERIAL is formed out through this project.

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