



# EXPERIMENTAL STUDY ON STRENGTH OF CONCRETE BY USING HYPO SLUDGE, FLY-ASH & IRON OXIDE

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## ABSTRACT

*The worldwide concrete industry contributes around 9% of ozone depleting substance emanation to the world's environment and Industrial Wastes are being delivered by 420 million tons for each annum by compound process in India. To diminish concrete assembling and transfer issue of paper squander, there is a need to create elective fasteners in development field. Use of mechanical waste items as Supplementary Cementitious Material (SCM) in concrete is imperative perspective in perspective of conservative, natural and specialized reasons. In this Research, The mix has been replaced by Hypo Sludge accordingly in the range of 0% (without Hypo Sludge, fly ash, ferrous oxide), 10%, 20%, 30% and 40% by weight of cement for M-20 mix. Concrete mixtures were produced, tested and compared in terms of compressive strength, durability & life span to the conventional concrete. These tests were carried out to evaluate the mechanical properties. For the test results for compressive strength up to 56 days are taken. In the test performed, the optimum compressive stress obtained by utilizing paper waste was at 30% replacement. At the place where strength is not of more importance or rather structure is for temporary basis then design mix proportion up to 40% replacement can also be utilized. Test also point towards developing low cost concrete by varying design mix proportion from 10% replacement to 40% replacement. The compared values of cost show gradual decrement in total cost of per cubic meter concrete.*

**Key words:** Concrete, Hypo-Sludge, Fly-Ash, Iron Oxide, Sustainable Development.

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## 1. INTRODUCTION

The 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 paper 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. Objective of this experimental study was to find out the important parameters such as compressive strength, modulus of elasticity, strain at maximum load and ultimate strain of cement concrete in which hypo sludge replaced the cement by 10, 20, 30 and 40 percent for certain slump workability and to find out the optimum percentage of hypo sludge in M20 nominal mix concrete. 100 mm slump has been considered for different replacement levels of cement. Two decision variables that are strength and workability had been considered to optimize the replacement percentage.

## 2. SOURCE OF HYPOSLUDGE

The process of formation of paper from pulp includes the following processes during which the Hypo sludge is formed as waste by-product is purely a chemical wastes and do not contain any bio-degradable element. Most of the mills are using only woody raw material (bamboo, eucalyptus, casuarinas, poplar and other hardwood species), but some other mills are using bagasse in substantial quantity as raw material. Most of the paper mills in India prepare bleach liquor (calcium hypochlorite) using lime and elemental chlorine. Six mills among eight mill sare using ClO<sub>2</sub> as bleaching agent either as partial substitution of elemental chlorine or in final stage of bleaching to attain desired brightness level. These mills are producing ClO<sub>2</sub> with environmental friendly process. Three mills among eight mills are still using calcium hypo chlorite in final stage for bleaching. Solid wastes generated during calcium hypo chlorite generation are called hypo sludge.

Effect of fly ash and hypo sludge on concrete beams has a considerable amount of increase of the flexural strength characteristics [1]. The wastes like phosphogypsum, fluoro-gypsum and red mud contain obnoxious impurities which adversely affect the strength and other properties of building materials based on them [2]. The compressive increased up to 10% addition of hypo sludge and further increased in hypo sludge reduces the strengths gradually [3]. Replacements of hypo sludge have beneficial effects on the mechanical properties i.e tensile strength & Split tensile strength of concrete [4]. for the resistance of the concrete to the de-icing salt scaling, the mechanical properties and the durability of concrete made with this blended cement were superior to the concrete in which the un ground fly ash and the cement had been added separately at the mixer [5].

## 3. MIX PROPORTIONS

Conventional Concrete 1: 0.834 : 2.29

10% replacement 0.9: 0.834 : 2.29

20% replacement 0.80:0.834:2.29

30% replacement 0.70:0.834:2.29

40% replacement 0.60:0.834:2.29

**Table 1** Mix Proportions

<b>Kg/m<sup>3</sup></b>	<b>WATER</b>	<b>H S+F A</b>	<b>FINE AGGREGATE</b>	<b>COARSE AGGREGTE</b>
<b>BY WEIGHT(KG)</b>	<b>191.6</b>	<b>383</b>	<b>727</b>	<b>1103</b>

## 4. RESULTS AND DISCUSSIONS

**Table 2** Standard consistency Tests for different mixes

Name of the material	Standard consistency %
Hypo sludge	35
Fly ash	52
Hypo sludge and fly ash mix	46
Hypo sludge, fly ash and 10% of iron oxide	35

**Table 3** Setting Time of different Mixes

Sl.no	Name of material	Initial time in minutes	Final time in minutes
1	Hypo sludge	56	467
2	Fly ash	72	432
3	Hypo sludge and fly ash mix	63	459
4	Hypo sludge, fly ash and ferrous oxide 10% mix	78	470

**Table 4** Compressive strength concrete with 10% of Iron Oxide, Hypo sludge & Flyash

Sample no.	Water added in (ml)	Age in days	Load applied in (KN)	Comp strength (Mpa)	Avg. comp strength (Mpa)
1	1350	3	125	25.14	
2	1350	3	115	23.13	24.8
3	1350	3	130	26.15	
4	1350	7	150	30.17	
5	1350	7	135	27.16	30.17
6	1350	7	165	33.19	
7	1350	28	260	52.31	
8	1350	28	225	45.26	48.28
9	1350	28	235	47.28	
10	1350	56	280	62.13	
11	1350	56	295	75.54	71.96
12	1350	56	315	78.23	

## 5. CONCLUSIONS

From the above experiment the following conclusion has been drawn

- Up to 10% replacement of cement by hypo sludge and fly ash along with 10% iron oxide in M20 grade of concrete compressive strength is increased and 20% replacement of cement in M20 grade of concrete is lower than traditional concrete but similar to the required strength.
- Cement replaced by 40% by hypo sludge in M25 grade of concrete at 28 days and 90 days, % change in compressive strength in N/mm<sup>2</sup> increases from 40.39% and 43.90% and for M20 grade of concrete at 28 days and 90 days, % change in compressive strength in N/mm<sup>2</sup> decreases from 52.76% and 50.82%
- For M20 grade of concrete 20% hypo sludge replacement gives required compressive strength.

## REFERENCES

A reference list MUST be included using the following information as a guide. Only *cited* text references are included. Each reference is referred to in the text by a number enclosed in a square bracket (i.e., [3]). References must be numbered and ordered according to where they are first mentioned in the paper, NOT alphabetically.

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