

# A Suitability Analysis of Paper Waste Sludge in Cement Concrete

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**Abstract**— Portland cement is that the most vital ingredient of concrete and may be a versatile and comparatively high value material. massive scale use of cement is inflicting environmental issues on one hand and depletion of natural resources on different hand. This work examines the likelihood of victimization paper sludge (hypo sludge and brine sludge) to provide an occasional value concrete by mixing varied ratios of cement and fine combination (sand) with hypo sludge and brine sludge and to cut back land disposal issues thanks to paper sludge. The innovative use of hypo sludge and brine sludge in concrete as a supplementary building material and fine combination material was tested as another to concrete. during this study hypo sludge and brine sludge was partly replaced from 3%, 5%, 7%, 10% and 12% in cement to induce optimum for M30 and M40 grades of concrete.

**Keywords:** Concrete, Hypo Sludge, Brine Sludge, cement

## I. INTRODUCTION

In order to make concrete industry sustainable, the use of waste materials in place of natural resources is one of the best approaches because natural resources are not unlimited therefore, they must be carefully consumed. This will help not only to control degradation of environment but also conserve them 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. Recycling of waste product is a great way to dispose of industrial waste because the waste can be reused to make new product. Material such as glass and aluminum can be recycled and used in manufacturing other products. If there is industrial waste which can't be recycled in our planet, waste is seen everywhere. Therefore recycled is best way to make our planet green.

## II. LITERATURE REVIEW

After studying most the literature paper on the paper industry wastes, we investigate that there are various types of paper waste used in construction material such as hypo sludge, brine sludge, paper mill waste ash and lime sludge, but most commonly used paper mill waste was hypo sludge. The researcher were used these sludge as replacement of cement and fine aggregate in concrete at various percentage of replacement such as from 5%, 7.5%, 10% and up to 40% in nominal mix or low grade such as M20 and M25. The various strength properties were tested on the paper sludge concrete for fresh and hardened state such as slump cone test, compressive strength test on cubes and cylinders, flexural strength test on beams & cylinders and split tensile strength on beams. In most of the researches, it was concluded that the compressive strength, flexural strength and split tensile strength of the concrete cubes, cylinders and beams made by replacing cement and fine aggregate with these sludge increases to a certain extent then starts decreasing. So to produce the economical concrete used in construction work,

these sludge should be used smartly. After reading literature on the paper industry wastes it was clearly seen that most of the researches have been done on Hypo sludge and Brine sludge which was used as a replacement of Cement and Fine Aggregates at different percentages. Researchers concluded that the compressive strength of the concrete prepared by replacing cement with paper wastes increases to a certain extent. Research studies show that optimum percentage for replacing cement is 5% to 10% by total weight of cement and for replacing fine aggregate is 10% to 15% by total weight of fine aggregate. Researchers also concluded paper waste makes concrete economical and eco-friendly

## III. METHODOLOGY

In this research raw material used and their properties as per Indian standards code (IS: 383–1996) procedures. Mix design for concrete proportion has been developed as per IS: 10262–2009. The Casting, compaction and curing of the concrete specimens has been done as per Indian standards procedures. Grade of the concrete used for this research is M30 & M40. Slump cone test and compressive strength test is performed on concrete containing brine sludge and hypo sludge. The concrete mix design for M40 & M30 concrete with and without replacement is calculated using IS: 10262-2009 as shown in table below.

Cement	Hypo Sludge	Mix	Name
		M30	M40
100%	0%	CC30	CC40
97%	3%	HC30A	HC40A
95%	5%	HC30B	HC40B
93%	7%	HC30C	HC40C
90%	10%	HC30D	HC40D
88%	12%	HC30E	HC40E

Table 1: Mix Names when Cement replaced with hypo sludge

Cement	Brine Sludge	Mix	Name
		M30	M40
100%	0%	CC30	CC40
97%	3%	BC30A	BC40A
95%	5%	BC30B	BC40B
93%	7%	BC30C	BC40C
90%	10%	BC30D	BC40D
88%	12%	BC30E	BC40E

Table 2: Mix Names when Cement replaced with Brine Sludge

## IV. RESULT & DISCUSSION

Result of slump cone test shows that in both brine and hypo sludge slump value decreases with increase in the percentage of hypo sludge & brines sludge, but brine sludge posses higher slump value when compare to hypo sludge. Hypo Sludge at 12 % the compressive strength of concrete is 40.6 N/mm<sup>2</sup> which slightly less than that of conventional concrete i.e., 40.74 N/mm<sup>2</sup> which shows that the compressive strength

decreases at 12% replacement for M30 grade of Concrete. For M40 grade of concrete At 12 % the compressive strength of concrete is 51.70 N/mm<sup>2</sup> which was slightly less than that of conventional concrete i.e., 51.89 N/mm<sup>2</sup> which shows that strength will further decreased as cement was replaced. So, on comparing results it is clear that 10% replacement of cement with Hypo sludge is optimum for this study. For Brine Sludge the Compressive Strength of M30 Grade of concrete reached to 41.19 N/mm<sup>2</sup> at 7% cement replacement with Brine Sludge. At 10 % the compressive strength of concrete is 39.33 N/mm<sup>2</sup> which nearly same to that of conventional concrete i.e., 39.5 N/mm<sup>2</sup> the compressive strength decreases further when 12% cement was replaced. The Compressive Strength of M40 Grade of concrete reached to 50.23 N/mm<sup>2</sup> at 7% cement replacement with Brine Sludge. At 10 % the compressive strength of concrete is 48.91 N/mm<sup>2</sup> which nearly same to that of conventional concrete i.e., 49.1 N/mm<sup>2</sup> the compressive strength decreases further when 12% cement was replaced. So, on comparing results it is clear that 7% replacement of cement with brine sludge is optimum for this study.

#### V. CONCLUSION

The Compressive Strength of Concrete increased when the Cement is replaced by Hypo Sludge up to 10% by weight of Cement. The Compressive Strength of Concrete increases when the replacement of Cement with Brine Sludge up to 7% replacement by weight of Cement. Comparatively Hypo Sludge give more compressive strength till 10 % than Brine Sludge. Hypo Sludge and Brine Sludge are a better innovative supplementary cementitious construction material which is used in concrete, so it can save the paper industries waste disposal costs and produce a greener concrete for construction. This research concludes that hypo sludge and brine sludge can be innovative supplementary cementitious and fine aggregate Construction Material in Concrete up to certain extent.

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