

# Waste Paper Sludge as a Fine Aggregate in Concrete

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**Abstract**— The higher growth in construction work leads to shortage of conventional construction materials such as cement, gravels and sand. Hence alternates are strongly required for these materials. At the present time researchers searched some substitute for these materials such as fly ash, blast furnace slag, silica fume, rice husk ash, etc apart from this the recent studies research has show that the waste paper sludge (waste from paper industries) is also useful for construction of concrete as a fine aggregate. It contains low calcium and minimum amount of silica, because of this silica and magnesium waste paper sludge can be used like cement, they improve the setting of concrete. Waste paper sludge reduces cost of concrete and also it improves the strength of concrete. This study explains the use of waste paper sludge as a substitute of fine aggregate in concrete.

**Key words:** Paper Sludge, Portland Cement, Concrete, Silica

## I. INTRODUCTION

This study is aim to present the addition of wastepaper to concrete mix, to study the effect of wastepaper on the strength of concrete, Use of wastepaper in structural concrete could become an economical and environmental friendly which helps to reduce harmful effects of construction process. Construction process of cement emits large amount of harmful carbon dioxide gases. To produce one tons of ordinary Portland cements about 2 tons of raw materials (shale and limestone) are required and it releases 0.87 ton of CO<sub>2</sub> and about 3 kg of Nitrogen Oxide (NO<sub>x</sub>). Hence alternate is required for conventional source of cement which can reduce the harmful effects on environment, good in strength and also economical. Paper sludge is such a material, results of various researches indicate that as paper sludge percentage increases flexural strength and split tensile strength of concrete. Use of paper sludge in concrete can save the paper industry disposal costs and produces an eco friendly concrete for construction.

## II. REVIEW OF LITERATURE

Sumit A Balwaik and S. P. Raut, Over 300 million tons of industrial wastes are being produced per annum by chemical and agricultural process in India. These materials pose problems of disposal and health hazards. The waste like phosphogypsum, flurogypsum and red mud contain obnoxious impurities which adversely affect the strength and other properties of building material based on them. Out of several wastes being produced at present, the use of phosphor gypsum, flurogypsum, lime sludge, hypo sludge, red mud and mine tailing is of paramount significance to protect the environment. They studied the use of paper-mill pulp in concrete formulations as an alternative to landfill disposal. The cement has been replaced by waste paper sludge accordingly in the range of 5% to 20% by weight (Paper sludge behaves like cement because of silica and magnesium properties which improve the setting of the concrete).

B Ahmadi and W Al-Khaja, investigated the utilization of paper waste sludge obtained from a paper manufacturing industry, as a replacement to the mineral filler material in various concrete mixes. Concrete mixes containing various contents of the waste were prepared and basic strength characteristics, such as compressive strength, splitting, flexural, water absorption, and density were determined and compared with a control mix. Five concrete mixes containing various contents of the waste, 0 (control mix), 3, 5, 8 and 10%, as a replacement to the fine sand were prepared with ratios of 1:3:6 by weight of cement, sand and aggregate, respectively. The test results revealed that as the content of the waste increased the water to cement ratio for the mix was also increased, since the waste has a high degree of water absorption. Therefore, additional amount of water was required for cement hydration. The results obtained showed that as the amount of the waste increased the basic strengths, such as compressive strength were decreased. A maximum of 5% content of the waste as a replacement to the fine sand in concrete mix can be used successfully as construction materials, such as in concrete masonry construction with a compressive strength of 8 MPa, splitting strength of 1.3 MPa, water absorption of 11.9%, with a density of 20 KN/m<sup>3</sup>.

R. Srinivasan, K. Sathiyaa 2010, Reported that Waste paper sludge obtained from a paper factory in Trondheim, Norway, It has bulk density 460kg/m<sup>3</sup> specific gravity 2.6, ash content of 94% and a pH value of 11.4. The material is essentially composed of amorphous silicates and aluminates, mainly gehlenite (2CaO.Al<sub>2</sub>O<sub>3</sub>.SiO<sub>2</sub>) and melilite (8CaO<sub>3</sub>Al<sub>2</sub>O<sub>3</sub>MgO<sub>5</sub>SiO<sub>2</sub>); which are responsible for a pozzolanic reaction. Due to these elements paper sludge behaves like a cementitious material, and it can be used as a binding material in concrete.

Abdullah shahbaz khan et al 2014, Reported that split tensile strength, It is observed that in split tensile strength of M20 and M30 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 more or we can say it as equivalent but with 30% its start decreasing in strength. It is observed that in flexural strength of M20 and M30 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 more or we can say it as equivalent but with 30% its start decreasing in strength.

So the various literatures indicated that paper sludge is a excellent alternate for cement, which shows good strength and also not hazardous for environment.

## III. CONCLUSIONS

The innovative use of paper wastes material represents a way of solving some problems of solid waste management. Paper Wastes could be valuable materials as alternative

resources for building and construction and other applications.

It is observed that huge amount of cement or aggregate replacement in concrete with this paper waste will be advantageous from the point of economy, energy efficiency, and supportive for environment. Environmental issues related with the CO<sub>2</sub> emissions from the production of portland cement, resource conservation consideration, and economic impact due to the high cost of portland cement manufacturing plants demand that substitute cementing materials in general and wastes from paper industries in particular be used in increasing quantities to replace Portland cement in concrete. Researchers indicated that environmental effects from wastes and residual amount of cement manufacturing can be reduced through the use of paper waste. The cost analysis indicates that percent cement reduction decreases cost of concrete. The flexure strength and split tensile strength of concrete has increased with 10% replacement of hypo sludge with cement as compare to conventional concrete. Hence it can concluded that paper sludge can be a good alternate for fine aggregate in concrete and also it reduces the harmful effect from cement Industries.

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