

# Application of Paper Pulp in Concrete

Jawahar Singh<sup>1</sup> Premit Kumar Patil<sup>2</sup>

<sup>1</sup>Resident Engineer <sup>2</sup>Assistant Professor

<sup>1</sup>LNMIPPL <sup>2</sup>UIT-RGPV, Bhopal

**Abstract**— Environmental problems are growing due to release of CO<sub>2</sub> in the construction process of cement, it is producing harmful effects on environment. And also shortage of conventional construction materials such as cement, gravels and sand is increasing, because of the higher growth in construction work. Hence alternates are strongly required for these materials. An ordinary Portland cement is caused to five to seven percent of total greenhouse gases emission, so alternative of cement is required for construction of concrete. 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 shown that the paper pulp is also useful for construction of concrete as a fine aggregate. Paper pulp contains low calcium and minimum amount of silica, because of this silica and magnesium paper pulp can be used like cement, paper pulp reduces cost of concrete and also it improves the strength of concrete. This study explains the application of paper pulp as a substitute for binding material in concrete. This paper reviews the performance properties of paper pulp in concrete. Paper pulp can be used as an effective building material.

**Key words:** Paper Pulp, Cement, Concrete

## I. INTRODUCTION

At the present time there is a huge growth in construction work. Too many road networks are developing and also infrastructures for residential projects and commercial projects are developing, due to this high development of construction projects demand of construction material is also increased, and it leads to shortage of conventional construction material like cement, sand and aggregates. So alternates are required for these conventional materials to fulfill the demand of this huge growth in construction work. Researchers indicated that industrial waste and agriculture waste can be used as construction material. These types of some materials are blast furnace slag, fly ash, waste from coconut, hypo sludge, etc. Paper pulp is also such type of material. Paper pulp can be used as a binding material in concrete, as a substitute of cement. Application of paper pulp in concrete can be reduces the use of cement in concrete, so shortage of conventional construction material can be overcome. Use of paper pulp in concrete is economically and also reduces the hazardous effect of construction process of cement by replacing it from concrete.

## II. REVIEW OF LITERATURE

N. P. Rajamane et al (2009), Reported that Producing one ton of cement requires about 2 tons of raw materials (shale and limestone) and releases 0.87 ton of CO<sub>2</sub>, about 3 kg of Nitrogen Oxide (NO<sub>x</sub>), an air contaminant that contributes to ground level smog and 0.4 kg of PM<sub>10</sub> (particulate matter of size 10 μm), an air borne particulate matter that is harmful to the respiratory tract when inhaled. The global

release of CO<sub>2</sub> from all sources is estimated at 23 billion tons a year and the Portland cement production accounts for about 7% of total CO<sub>2</sub> emissions.

Hence production process of cement releases elements which are hazardous for environment, then it is necessary to search an alternate for cement with supportive to environment and also good in strength.

Seyyedeh Fatemeh Seyyedalipour et al, reported that concrete were produced by mixing adequate amount of the waste paper pulp and water, and then they compared slump value (it is used to check workability of concrete) and strength with the conventional concrete. The slump decreased when a higher amount of paper pulp content was added in concrete. But when a higher amount of paper pulp was added in the mixture, it required more water to achieve a given slump. The slump increased up to 5% replacement of cement, above 5% the slump decreased as the paper pulp content in the concrete mixtures was increased. The workability of concrete containing paper-mill residual was improved by the addition of excessive water instead of admixtures as they have to achieve economy. Many factors are responsible for adverse effects on the workability of paper pulp concrete such as amount of paper pulp replacement, paper pulp physical properties of paper pulp, and the carbon content of the paper pulp would be the main reasons for the reduction of concrete workability. They observed compressive, splitting tensile and flexural strength increased up to 10% addition of waste paper pulp and further increased in waste paper pulp reduces the strengths gradually. So the most suitable mix proportion is the 5 to 10% replacement of waste paper pulp to cement.

Sumit A Balwaik and S. P. Raut, studied the use of paper pulp in concrete construction as an substitute to cement. Paper pulp behaves like cement because of silica and magnesium properties which improve the setting of the concrete. They studied 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). The slump increased up to 5% replacement of cement, above 5% the slump decreased as the paper pulp content in the concrete mixtures was increased. Generally, the compressive, splitting tensile and flexural strength increased up to 10% addition of waste paper pulp and further increased in waste paper pulp reduces the strengths gradually. The most suitable mix proportion is the 5 to 10 % replacement of waste paper pulp to cement. There was an increase in water absorption of the concrete mixes as the content of the paper pulp increased. Use of waste paper pulp in concrete can save the pulp and paper industry disposal costs and produce an environment supportive concrete for construction.

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 ( $2\text{CaO}\cdot\text{Al}_2\text{O}_3\text{SiO}_2$ ) and melilite ( $8\text{CaO}_3\text{Al}_2\text{O}_3\text{MgO}_5\text{SiO}_2$ ); 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.

### III. CONCLUSIONS

The ground-breaking use of paper material represents a way of work out some trouble of solid waste management. Paper pulp could be worthwhile materials as replacement resources for building and construction and other applications. It is noticed that huge amount of cement or aggregate replacement in concrete with this paper pulp will be advantageous from the point of cost, strength efficiency, and friendly for environment. Environmental issues related with the CO<sub>2</sub> emissions from the production process of cement, are reduced with the use of paper pulp. The cost analysis of various researchers gave data that percent cement replacement reduces economic worth of concrete. The flexure strength and tensile strength of concrete has risen with 10% replacement of paper pulp with cement as compare to conventional concrete. Hence it can conclude that paper pulp can be a good alternate for conventional binding material in concrete and also it reduces the harmful effect from cement Industries. Use of paper pulp is also worthwhile for solid waste management. So it is concluded that compressive, splitting tensile and flexural strength increased up to 10% addition of waste paper pulp and further increased in waste paper pulp reduces the strengths gradually. So the most suitable mix proportion is the 5 to 10% replacement of waste paper pulp to cement.

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