A Review on Partial Replacement of Cement With waste paper sludge powder

Sumit Gaikwad¹, Sudhanshu Pathak², Mahesh Tatikonda³

¹ME Student, Department of Civil Engineering, D Y Patil College of Engineering, Akurdi, Pune 411045, India.
²,³Assistant Professor, Department of Civil Engineering, D Y Patil College of Engineering, Akurdi, Pune 411045, India.

Abstract — To make cement industry sustainable, the use of waste material in place of natural resources is one of the best approaches. This can not only help to reduce waste but also gives better option to utilization for betterment of cement industries. This review paper shows the investigation of utilization of waste paper sludge. The cement is replaced by Waste Paper Sludge (WPS) in the range of 5%, 10%, 15% and 20% by weight for Mix M40.

Keyword — WPS, Cement replacement

I. INTRODUCTION

In India, the cement sector is one of the lead contributors to conventional as well as GHG emissions. Over 3.3 billion tons of cement was consumed globally in 2010 based on a survey of world coal association and also cement production emits CO₂ into the atmosphere which is harmful to nature. The energy performs an important role in the growth of developing countries like India. In the environment 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 neglected. Industrial wastes produced by chemical and agricultural process in India possess problems of disposal, health hazards, and aesthetic problem. If we can partially replace the cement with the material with desirable properties then we can save natural material and reduce the emission of CO₂ into the atmosphere. Paper sludge is formed as a waste by-product is purely a chemical waste and do not contain any bio-degradable element.

II. LITERATURE REVIEW

Paper sludge is the buildup left finished from the paper reusing process. Waste from mash and paper factories are fundamentally cellulose filaments created toward the finish of the pulping procedure before entering the paper machines. Presently all the strong misuse of mash and paper starting point is being land filled. Because of the substantial volume of sludge, preclusion of waste dumping in the sea, and the absence of appropriate land space, districts are swinging to burning. Around 10% of its unique volume can be diminished with the cremation forms. Notwithstanding, the volume of sludge powder to be discarded remains extensively high Because of the restricted landfill space accessible and stringent ecological controls, and the potential for ground-water pollution produced from landfill leach ate, numerous wastewater treatment plants utilizing sludge burning procedures to create choices for using fiery remains leftover. Elective employments of paper sludge were examined in light of the great sorbent and pH-controlling limit of this material. The sludge of the paper business can be isolated into a few classes: the waste paper sludge originating from the generation of virgin wood fiber, called essential sludge; the waste paper sludge created by expelling inks from post-
purchaser fiber, called de-inking paper sludge; the initiated sludge from the auxiliary frameworks, called optional sludge; and joined waste paper and actuated sludge, called consolidated sludge. The most astounding volume strong deposits produced by the paper industry are wastewater treatment residuals and powder (from consuming coal, wood/bark, and wastewater treatment residuals). During the time spent treating the wastewater Essential clarifier process is the principal phase of the wastewater treatment to evacuate the strong, called essential remaining. Essential elucidation is generally completed by sedimentation and now and then by broke up air buoyancy. Essential leftover comprises for the most part of cellulose filaments and papermaking fillers. Auxiliary treatment is typically a natural procedure in which smaller scale life forms change over the dissolvable natural issue to carbon dioxide and water while expending Oxygen. Cellulose decides the character of the fiber. Cellulose is a polymer of glucose and sugar of high atomic weight is a noteworthy constituent of wood substance (around 50 percent by weight). Level of polymerization estimations of local cellulose filaments and papermaking strands are around 3500 and 600-1500. Hemicelluloses, different polymers developed of units of at least one types of sugar, for example, glucose, galactic, xylems, and mannose-assigns materials other than cellulose and found in wood. The nature and extent of the hemicelluloses found in various woods fluctuate. They display a few degrees of introduction and crystalline, especially when they are in close relationship with cellulose, however, are to a great extent undefined. Crisp concrete or plastic cement is a naturally blended material which can be formed into any shape. The relative amounts of bond, totals, and water combined, control the properties of cement in the wet state and also in the solidified state. Water and the amount of water required for a synthetic blend with bond and to possess the Gel pores.

**Effective use of Paper Sludge (Hypo Sludge) in Concrete, Y.D. Shermale, M. B. Varma**
In this paper they Concluded that Replacement of cement is successfully done up to 20% for Mix M-20 grade concrete. Compressive Strength, Flexural Strength and Split Tensile Strength were studied and obtained satisfactory results.

**Experimental Investigation on Self Compaction Concrete by partial replacement of cement with Waste Paper Sludge Powder and Fly Ash, I. Aneendra Kumar, N. Chenna Kesava Rao**
In this paper Author using M-25 Mix proportion. Cement replace with waste paper in various percentages i.e.. 10%, 20%, 30% and 40%. He obtained optimum value 30% i.e. the highest strength is obtained at 30% and after that it will be decreasing.

**Experimental Study On Behaviour Of Paper Sludge Concrete, G.L. Abishek**
Author conclude that Replacement of cement with waste paper sludge (hypo sludge) can be used as a cement replacement because it enhanced compressive strength, flexural strength and split tensile strength. He is replaced cement with 10%, 20%, 30% and 40%. He found that at 40% replacement compressive strength and split tensile is higher.

**Study of Concrete Involving Use of Waste Paper Sludge Ash as Partial Replacement of Cement, Sajad Ahmad, M. Iqbal Malik, Muzaffar Bashir Wani, Rafiq Ahmad**
Initially he replaced cement with 5%, 10%, 15% and 20% and he found that 5% by weight replacement is possible because after that strength will be decreasing. He is using M-25 mix proportion.
III. MATERIAL AND METHODS

1. Cement  
2. Sand  
3. Coarse Aggregate  
4. Water  
5. Admixture  
6. Waste Paper Sludge (WPS)

Ordinary Portland Cement of Birla super brand of 53 grade was used in this study. Special care was taken to ensure that the cement is from the latest batch of packing. Specific gravity of cement was obtained as 3.13. Those fractions from 4.75 mm to 150 microns are termed as fine aggregate. In this investigation locally available River sand is used as fine aggregate. Coarse aggregate includes natural aggregates. Locally available crushed stone of 10mm and 20 mm sizes have been used as coarse aggregate. The physical properties of coarse aggregate like specific gravity, fineness modulus were tested. Water is an important ingredient of concrete as it actually participates in the chemical reaction with cement. Here potable water was used for the mixing and curing. Conplast SP500 is used for High performance water reducing and super plasticizing admixture. Waste material Obtained from Paper Industries named as Ballarpur Industries Limited (BILT), Chandrapur. The nature of WPS is shown in following Image.

![Waste Paper Sludge (WPS)](image)

Fig -1: Waste Paper Sludge (WPS)

IV. METHODOLOGY

- MATERIAL PROCUREMENT
- RAW MATERIAL TESTING
- MIX PROPORTION
- CASTING OF SPECIMEN
- CURING
- TESTING
- RESULTS
V. CONCLUSION

It is concluded that the Paper process lime powder can be utilized for financial feasibility. We can utilize this material for the administration ventures for impermanent sanctuary for the individuals who influence by tidal wave, E.Q., and for the E.W.S. (Economically weaker area) Group individuals and so forth. Utilization of Lime sludge in cement can spare the transfer expenses of the paper business waste and deliver greener cement for development. The unsafe Environmental impacts of paper modern waste can be lessened. Likewise, the measure of concrete assembling can be lessened up to some degree. A superior measure by a New Construction Material is framed out through this undertaking.

REFERENCES

I. Bureau of Indian standards IS 516: 1959, “Methods of tests for Strength of concrete, New Delhi, India.”
II. Bureau of Indian standards IS 5816: 1999, “Splitting tensile strength of concrete - method of test, New Delhi, India.”
III. Indian. Standard Institution, (1983), “Indian Standard, Recommended guidelines for concrete mix design”, IS 10262-1982, 1983, Indian. Standard Institution, New Delhi, India. Invention, Vol.2, Issue 5, pp 07-11
IV. IS: 454-2000, (2000), “Code of practice for plain and reinforced concrete” (fourth edition), 2000, Bureau of Indian Standards, New Delhi.
V. Naik et al. (2004), “Use of Pulp and Paper Mill Residual Solids in Production of Cellucrete”, Cement and Concrete Research, Volume 34, Issue 7, July 2004, Pages 12291234.
VI. M. Etxeberria, C. Pacheco, J.M. Meneses, I. Berridi, (2010). “Properties of concrete using metallurgical industrial by-products as aggregates.” Construction and Building Material, 24, 1594–600.
VII. E. M. R. Fairbairn, B. B. Americano, G. C. Cordeiro, T. P. Paula, R. D. T. Filho and M. M. Silvoso, “Cement replacement by sugar cane bagasse ash: CO2 emissions reduction and potential for carbon credits,” Journal of Environmental Management Vol. 91 (9), pp. 1864-1871, 2010.
VIII. Mamta B. Rajgor and Jayesh Kumar Piroda, “A Study on Paper Industry Waste: Opportunity for Development of Low-Cost Concrete in Indian Contest”, IJSR 2013 pp. 90-92. Rafat Siddique, Geert De. Schutter and Albert Noumowe, “Effect of Used Foundry Sand on the Mechanical Properties of Concrete”, Construction of Building Materials 2008 pp. 976-980.
IX. IS: 12269-1987 (Second Revision) [Reaffirmed in 1999], Specifications for Ordinary Portland Cement 53 grade, Bureau of Indian Standards, New Delhi.
X. IS: 383-1970 specification for coarse and fine aggregate from natural source for concrete.
XI. Y.D. Shermale, M. B. Varma, “Effective use of Paper Sludge (Hypo Sludge) in Concrete”
XII. I. Aneendra Kumar, N. Chenna Kesava Rao, “Experimental Investigation on Self Compaction Concrete by partial replacement of cement with Waste Paper Sludge Powder and Fly Ash”
XIII. G.L. Abishek, “Experimental Study On Behaviour Of Paper Sludge Concrete”
XIV. Sajad Ahmad, M. Iqbal Malik, Muzaffar Bashir Wani, Rafiq Ahmad, “Study of Concrete Involving Use of Waste Paper Sludge Ash as Partial Replacement of Cement”