

AN ART OF THE STATE OF LITERATURE OF HYPO-SLUDGE BLOCKS WITH SISAL FIBRE AND STEEL FIBRE

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ABSTRACT

Large amounts of waste are produced annually by the paper mill companies and are thrown in the surrounding areas, which is quite distracting. The society would greatly benefit if these wastes were handled and put to use by finding some other uses. Technically referred to as Hypo Sludge Ash, paper sludge ash is one such waste generated by the paper mill industry. Hypo sludge is also known as paper industry waste. Paper making generally produces a large amount of solid waste. This paper mill sludge consumes a large percentage of local landfill space for each and every year. To reduce disposal and pollution problems emanating from these industrial wastes, it is most essential to develop profitable building materials from them. The quantity of sludge varies from mill to mill. This hypo sludge contains low calcium and maximum calcium chloride and minimum amount of silica. Hypo sludge behaves like cement because of silica and magnesium properties. So Hypo sludge may be used as partially replacement of cement. So we can use Hypo sludge as a partial replacement of cement in pervious concrete. In place of cement, Hypo Sludge Ash (HSA), a waste product of the paper mill industry, is discussed in this study. When applied in different ratios, such as 0%, 5%, 10%, 15%, or 20%, Hypo Sludge Ash can replace cement and produce highly convincing effects. Grade concrete is utilized in accordance with requirements, and mix designs are created accordingly.

KEYWORDS: *Hypo Sludge*

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INTRODUCTION

In order for any nation to succeed, industrialization is essential. It contributes to the economic sector's strengthening, which advances national development. But in order to fully realize this success, the nation must also be capable of overcoming its fallout. The primary issue with industrialization is the difficult task of disposing of the waste generated by industries. The environment is significantly contaminated by rapid industrialization, which also seriously degrades the atmosphere and hydrosphere. The waste that is produced when industrial water is used introduces heavy metals and other toxins into soil and water supplies, posing a risk to the environment.



Figure 1: Hypo Sludge Ash.

Concrete is strength and tough material but it is porous material also which interacts with the surrounding environment. The durability of concrete depends largely on the movement of water and gas enters and moves through it. To produce low-cost concrete by blending various ratios of cement with hypo sludge & to reducedisposal and pollution problems due to hypo sludge it is most essential to develop profitable building materials from hypo sludge. To make good quality paper limited number of times recycled Paper fibres can be used which produces a large amount of solid waste. The innovative use of hypo sludge in concrete formulations as a supplementary cementations' material was tested as an alternative to traditional concrete.

Pervious concrete is a unique and effective solution to reduce the runoff from paved areas and recharging the ground water. Pervious concrete can uproot storm water more rapidly than conventional concrete. It is directly recharging the ground water so it eliminates the need of retention pond, swales and storm water management devices. It is also eliminating costly storm water detention vaults and piping systems. Thus, reduce construction expenses, safety issues and maintenance cost. The waste management problem has already become severe in the world. The problem is compounded by the rapidly increasing amounts of industrial wastes of a complex nature and composition. Energy plays a crucial role in the growth of developing countries like India. In the context 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 underestimated. Many research organizations are doing extensive work on waste materials concerning the viability and environmental suitability. Therefore, the main objective of this research study is to use hypo sludge materials to develop a pervious concrete mixture proportion and to improve the compressive strength and flexural strength of pervious concrete.

As enlisted above, numerous kinds of wastes are produced from various sources. So now it is need of the hour to over come effect of waste on human health and environment. As stich in time saves nine, so everyone should think of appropriate measures to overcome its effects. Disposal of waste should now be done in smarter ways. The waste instead of disposing in environment which again is hazardous, we should use them where they can be used as raw material. Hypo-sludge is one such industrial waste obtained from paper industries, amount of waste produced is in enormous quantityand proper disposal is prime duty so the replacement of sludge with different variation of cement could be done because of the cementitious property of sludge with is obtained on incineration of this sludge ash.

Properties

Properties of waste paper sludge ash also called as Hypo Sludge Ash may vary depending upon the quality of paper produced in that particular paper industry. Quality of sludge finally depends upon the number of times the materials are being recycled to produce paper and different industries may have different standards to achieve the end products, but still some common properties that Hypo Sludge Ash contains in an average are as shown in table no-1.

Table 1: Properties of Hypo Sludge Ash

Sl. NO.	Chemical Properties	Hypo-sludge Ash (% by mass)
1	<i>Silicon Dioxide</i>	5.28%
2	<i>Calcium Oxide</i>	47.84%
3	<i>Magnesium Oxide</i>	6.41%
4	<i>Sulphur Trioxide</i>	0.19%
5	<i>Aluminium Oxide</i>	0.09%
6	<i>Ferric Oxide</i>	0.73%

Applications

- Hypo Sludge Ash can be used as a alternative material for production of concrete of different grades.
- Waste Paper Sludge ash can also be used for making of bricks.
- Hypo Sludge Ash can be used as a alternative material for plastering work and other minor repair works.
- It can also be used for temporary construction work where strength is not the major parameter.

LITERATURE REVIEW

Some information has been published on uses for hypo sludge. There is a lack of information on the engineering properties of the material.

Experimental investigations in developing low-cost concrete from paper industry waste R. Srinivasan,*K. Sathiya and M. Palanisamy, 2010 - 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 wastes like phosphonyls, fluor gypsum and red mud contain obnoxious impurities which adversely affect the strength and other properties of building materials based on them [1]

Utilization of waste paper pulp by partial replacement of cement in concrete Sumit ABalwaik; S P Raut, ISSN: 2248-9622 - The use of paper-mill pulp in concrete formulations was investigated 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 for M-20 and M-30 mix. By using adequate amount of the waste paper pulp and water, concrete mixtures were produced and compared in terms of slump and strength with the conventional concrete [2]

Investigation was carried out to determine the pozzolanic properties by establishing optimal conditions for transforming paper de-inking sludge into pozzolanic. They dry hypo sludge was burnt in an electric laboratory furnace from 6000C to 8000C for 2 and 5 hours. [3] The resulting products were grounded and sieved to a particle size of under 45. The mineralogical composition by X-ray diffraction was detected where XRD patterns were accomplished in SIEMENS D-5000 diffractometer using a wolfram cathode and copper plate as anode. The semi-quantitative mineralogical components were accomplished using the method of the reflectant powders and compared with results from conventional mathematical

program the areas of peaks where each mineral as quantified were determined through the Gaussian adjustment and subtraction of the base line.[4] To observe and compare the pozzolanic activity of calcined sludge commercial metakaolin was used as a reference. An accelerated method by using a saturated lime solution at 400C for 1, 7, 28, 90 days was used. CaO concentration in the solution was analysed at the end of each period [5]. The combined lime (mmol/L) was obtained by the difference between the concentration in the control saturated lime solution and CaO present in the solution in contact with the sample. The analysis indicates that dry industrial waste is formed mainly of calcium oxide, silicates and alumina. The presence of chloride ions (0.04%) and loss on ignition (47.62%) was detected.

In 2013, Jayraj et al done experimental investigation on strength of concrete and optimum percentage of the partial replacement by preparing a mix M20 grade was designed as per Indian Standard method and the same was used to prepare the test samples. In the test performed, the optimum compressive stress obtained by utilizing paper waste was at 30% replacement. The compared values of cost show gradual decrement in total cost of per cubic meter concrete. When government implement the projects for temporary shelters for who those affected by natural disaster, this material can be used for economic feasibility.[6]

In 2013, Jayesh kumar Pitroda et al focused on investigation of strength of concrete and optimum percentage of the partial replacement by replacing cement via 10%, 20%, 30%, and 40% of Hypo Sludge. Keeping all this view, the aim of investigation is the behavior of concrete while adding of waste with different proportions of Hypo sludge in concrete by using tests like compression strength and split strength.[7]

In 2013, Rushabh shahet al present dissertation work is directed towards developing low-cost concrete from paper industry waste. Dissertation work is carried out with M20 & M30 grade concrete with W/c ratio Effective use of Paper Sludge (Hypo Sludge) in Concrete (IJSRD/Vol. 3/Issue 08/2015/071) All rights reserved by www.ijssrd.com 288 of 0.55 & 0.45 respectively as a control specimen and hypo sludge is replaced in different percentages such as 10%, 20%, and 30% by weight of cement. Test was conducted to study the mechanical properties of concrete, such as compressive strength, split tensile strength and flexural strength. The curing period should be 3, 7 and 28 days.[8]

Eco-Friendly Concrete is a concept of thoughtful environs into concrete considering every aspect from raw materials manufacture over mixture design to structural design, construction, and service life [9]. Eco-Friendly Concrete is very often also cheap to produce, because, for example, waste products are used as a partial substitute for cement, charges for the disposal of waste are avoided, energy consumption in production is lower, and durability is greater [10]. Sustainable construction materials are composed of renewable, rather than non-renewable resources. Sustainable materials are environmentally responsible because impacts are considered over the life of the product. Depending upon project specific goals, green materials may involve an evaluation of one or more of the following criteria: Locally available, Salvaged, re-furnished or re-manufactured, Reusable or recyclable, Resource and Energy efficiency, Indoor air quality, Water conservation. Concrete basically has porous structure. This porous nature of the concrete allows the penetration of the gases or fluid through it. If see microstructure of concrete; it consists aggregates, cement paste entrapped air voids. The cement paste may have the micro-cracks due to the volumetric changes in it.[11]

If these cracks are getting interconnected, then they allow the water to penetrate through it. The phenomenon that governs the rate of flow of a fluid into a porous concrete is said to be its permeability. The permeability of concrete thus depends up on the pore structure. The porousness of concrete is directly related to the porosity. Thus, if perviousness of the concrete can be control, its durability can be increase. Hence, there is a need to study the parameters responsible for

perviousness of concrete how the perviousness can be control. Sorptivity is a measure of the capacity of concrete to absorb water under capillary forces. Table 1 shows the acceptance Criteria for durability indexes.[12]

Sajad Ahmad, M. Iqbal Malik, Muzaffar Bashir Wani, and Rafiq Ahmad in “Study of Concrete Involving Use of Waste Paper Sludge Ash as Partial Replacement of Cement” presented that, waste produced from cement manufacturing industries are growing day by day so we have come to the peak period to find out such a sources that help to produce greener concrete. It is found that cement industries are the major sources that produce greenhouse gases leading to its emissions into environment. Sothey found out one such material called Waste paper sludge ash which is used as replacement to cement to produce concrete. [13] Mix Design for M-25 grade concrete is used in project work. Concrete cubes were prepared and compression tests was carried out and concrete beams were prepared for testing flexural test along with that water absorption and dry density tests were also carried for checking out the weight reduction and water absorption. It was found that concrete strength increased at 5%replacement of cement with waste paper sludge ash and along with this water absorption was also found to be increased.[14]

Saveria Monosi, Daniela Sani and Maria Letizia Ruello in “Reuse of Paper Mill Ash in Plaster Blends” presented that as paper mill ash is a waste and is light weight, it can be used in manufacturing of plaster bends. This waste if used with Portland cement, limestone powder, natural sand with a maximum diameter of 2mm, and a silane-based hydrophobic powder can be used in manufacturing of cement mortar which can be used in the production of dry-cast concrete products such as masonry blocks and paving stones, wet-cast precast products, structural-grade concrete.[15]

As different paper mills produce different quality of paper there properties may vary in nature. Paper ash used were provided by Burgo Group" paper mills (Mantova, Italy). Mechanical strength found ranged from 4 to 10MPa with specific gravity between 1150 and 1350 Kg/m³. Paper ash being light weight in nature can be used in various field applications such as filling of temporary joints and other minor repair work. Sumit A Balwaik and S. P. Raut in “Utilization of Waste Paper Pulp by Partial Replacement of Cement in Concrete” presented that waste produced out of paper mill industries are in large amount and can be used in production of concrete production. [16] Two types of design mix were used for concrete production M-20 and M-30. Tests like compression test, splitting tensile strength, flexural strength were carried for curing of 14 and 28 days and it was found that the end results showed convincing results. Increase in strength by 10 % was found for replacement upto 5%.[17]

However, after 5% replacement there was continues decrease in strength. The waste that was utilized were first tested for Elemental, Proximate and Ultimate analysis for finding the constituents of Paper mill ash and actual detailing was made to match with the properties of cement and finding out better replacement alternatives. Different sets of tests were performed on fresh and hardened concrete and finding out slump values for different replacement ranging from 5% to 20%. Slump found to be decreased beyond 5 % replacement Also by using waste paper ash disposal cost and land which is used for disposal can well managed if they are used in various building construction techniques.[18] Apurva Kulkarni, Samruddha Raje, Juned Peerzada and Mamata Rajgor in “A Miniscule Endeavour for Accomplishing Hypo Sludge Fly Ash Brick in Indian Context” presented that as the waste produced out of paper industries can be recycled only alimited number of times so these low-quality fibres which are treated as a waste can be used for construction work [19]

This waste contains a large amount of lime so they used this Hypo sludge ash for production of Fly Ash Bricks. They replaced lime with different proportions such as 5, 10, 15, 20% with HSA. They found good results at 5 % replacement for production of Fly Ash Bricks. Dr. L.B. Zala and Dr. F. S. Umrigar in “Utilization of Hypo Sludge by Eco-

Efficient Development of Rigid Pavement in Rural Roads” presented that Hypo Sludge Ash can be used for rigid pavement construction in rural areas [20] By using this waste road construction may become cost efficient and at the same time best utilization of waste could also be made. They found good results for the replacement. Gabriele Fava, Maria Letizia Ruello and Valeria Corinaldesi in “Paper Mill Sludge Ash as Supplementary Cementitious Material” presented that, as the waste produced out of paper industries are on large scale now-a-days so gainful utilization should be made, so they targeted to use this waste material as a supplementary cementitious material. Material properties of this paper mill ash were tested and they used it for preparation of mortars and other concrete manufacturing. They found excellent results at 10% replacement of cement with paper mill sludge ash [21].

CONCLUSIONS

- Strength found to be increased for initial replacement of cement with Hypo sludge Ash for instance up to 10% replacement.
- By using Hypo sludge Ash greener concrete can be produced.
- Utilization of waste and disposal cost are reduced.
- Low-cost houses can be constructed using waste paper ash by reducing the cement content.
- By using suitable admixture such as super plasticizers, the problem of water absorption can be reduced.
- Weight of concrete member can be reduced by using paper mill sludge ash which ultimately helps in reducing the dead load of the structure.

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