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FEASIBILITY STUDY ON ADDITION OF HYPOSLUDGE IN CONCRETE

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ABSTRACT

Utilization or effectual disposal of waste materials from the industries or from the other sources plays a vital role in global level to reduce the environmental pollution as per the environment policies of the respective countries. Reuse of process finished materials leads in the reduction of unnecessary land filling / dumping. Hypo sludge is an industrial preliminary waste generated from the caustic soda process of paper making and other specific manufacturing industries. In this investigation, preliminary steps have been executed so as to confirm the doable utilization of hypo sludge as an ancillary cementitious material in suitable proportions. In this study, a preliminary outcome has been arrived by observing the strength and basic durability parameters of mortar cubes by adding hyposludge with weight of cement taken and the results were interpreted. Based on the outcomes it was concluded that 10% addition of hypo sludge with cement reveals reasonable outcome with respect to the strength and durability aspects

KEYWORDS: Hypo sludge, Sludge management, Waste utilization

I. INTRODUCTION

Infrastructure development is the main criteria for any developing country. The key factor for infrastructure development is waste management in an efficient way. Environment conservation is also taken into consideration for this development. Control in CO_2 emission and recycling of waste materials need to be carried out to achieve a healthy and sfae environment. Also, concrete plays a vital role in the infrastructure development. Cement and fine aggregate are some of the main ingredients for concrete. Production of cement emits large amount of CO_2 into the atmosphere. Moreover, hypo sludge is a waste generated from caustic soda process in various manufacturing and processing industries.

Hypo sludge contains silica, calcium oxide, magnesium oxide, iron oxide and aluminium oxide etc. Hypo sludge acts as supplementary cementitious materials when added in concrete to enhance the properties of concrete. The concrete is a brittle material which is strong in compression but very weak in tension. This weakness in concrete makes it to crack small loads at tensile end of member and finally the member breaks. The formation of cracks in concrete may occur due to drying shrinkage also. These cracks are basically micro cracks. These cracks increase in size and magnitude as the time elapses and finally makes concrete to fail. Addition of hypo sludge in concrete leads to fill the pores in concrete and can support to an extent to enhance the properties in its fresh and hardened stage. Also, it leads to an effective solution for its disposal.

Jayeshkumar Pitroda et.al (2013) concentrated on producing low cost concrete by blending various ratios of cement with hypo sludge and the innovative use of hypo sludge in concrete formulations as a supplementary cementitious material (SCM) were tested as an alternative to traditional concrete. The cement has been replaced by hypo sludge according in the range of 0% , 10 %, 20 %, 30 % & 40 % by weight of cement. The concrete mixes were cast, tested and compared compressive strength up to 28 days and split tensile strength for 56 days are found out and the conclusion was made that the compressive strength reduces when cement is replaced by

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hypo sludge at higher replacement percentages. The cost analysis indicates that the percentage cement reduction decreases cost of concrete but at the same time strength also decreases.

B.Pradeep et.al (2015) had investigated about the replacement of cement with hypo sludge and recommended that the use of hypo sludge can be explored for structural and non structural applications.

P.Velumani et.al had concluded that the fly ash bricks manufactured with hypo sludge and textile sludge satisfied the norms of BIS standards. Figure 1. shows the scanning electron image of the hypo sludge.

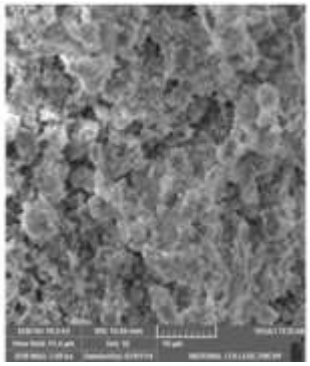

Figure 1. SEM image of Hypo Sludge

It was concluded from the literatures that usage of these by product improves performance of concrete. Hardened concrete properties were determined by compressive strength. In this investigation, different proportions of hypo sludge with the increments of 10% with that of cement were added, proportioned and cast. The outcomes were discussed.

II. MATERIALS AND METHODS

Cement

Portland Pozzolona cement confirming to the standards of IS: 1489-1991 was used for the entire study. The specific gravity was found to be 2.88, fineness of cement was observed as 6%, initial setting time was found to be 31 min and consistency of cement was 37%.

Hypo Sludge (Hs)

Hypo sludge was collected from Chemplast Industries, Mettur, Salem District. The sludge was initially dried at room temperature for about 48 hours, grinded and sieved then. It was sieved using 150 micron sieve. The specific gravity of the sludge was found to be 1.4. Figure 2 and Table 1 shows the physical appearance and properties of hypo sludge.

Figure 2. Hypo Sludge

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Table 1 Properties of HS

Parameter	Composition (%)
Silica (SiO_2)	10.42
Calcium oxide (CaO)	43.25
Magnesium oxide (MgO)	1.98
Iron oxide (Fe_2O_3)	0.10
Aluminium oxide (Al_2O_3)	0.17

Fine Aggregate (FA)
Manufactured sand (M-Sand) was used as fine aggregate. The specific gravity of fine aggregate was found to be 2.41 and bulk density of fully and loosely compacted were found to be 1560.27 and 1493.84 kg/m³ respectively.

Coarse Aggregate (CA)
Locally available crushed aggregate of 20mm size were used as coarse aggregate. The specific gravity of coarse aggregate was found to be 2.75.

Mix Proportion
The mix proportion for the mortar with added hypo sludge was designated and shown in Table 2.

Table 2. Mix Proportions

S.No	Specimen ID	Mix proportions	Cement Required(g)	Hypo Sludge(g)	Water content(ml)
1	MC	0% hypo sludge, 100% PPC	500	-	185
2	MC_1	10 % hypo sludge , 100 % PPC	500	50	187
3	MC_2	20 % hypo sludge , 100 % PPC	500	100	204

Compressive Strength
The determination of compressive strength has received a large amount of attention because the concrete is primarily meant to withstand compressive stresses. Generally cubes are used to determine the compressive strength of the binder. The mortar cubes used are usually of size 70.6x70.6x70.6mm. In the compressive strength test, the mortar cube was cleaned to wipe of the surface water, is placed with the cast faces not in contact with the plates of the testing machine (i.e.) the position of the cubes when tested is at right angles to that as cast.

Universal testing machine (UTM) of capacity1000kN was used for conducting compression test. The plates are cleaned; oil level is checked and kept ready in all respects for testing. Placing the specimen on bearing surface, it is brought in contact with the top plate by rotating the handling. The maximum load to failure at which the specimen breaks and the pointer starts moving back is noted. The mean value strength was recorded by conducting experiment for the three specimens. Figure 3.shows the comparison of compressive strength of the mortar cubes at 28 days.

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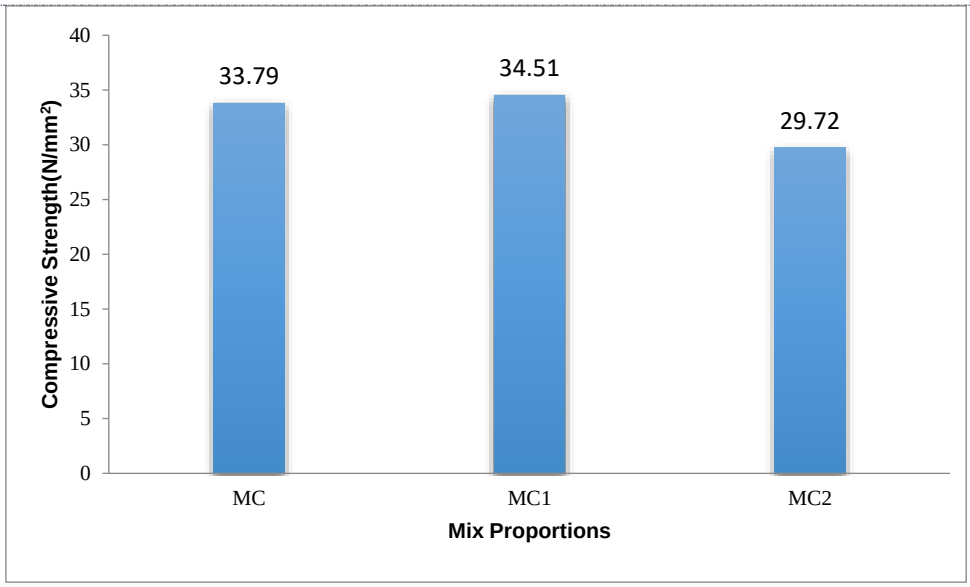

Figure 3. Compressive Strength

Water Absorption

The cast mortar specimens were cured for 28 days with water and the specimen is oven dried for 24 hours and the dry weight is noted as (W1) and after that the specimen is kept in water for 24 hours and the weight is noted as (W2). Figure 4 shows the water absorption of the mix proportions at 28 days.

Percentage of Water Absorption = ((W2 - W1) / W1) x 100

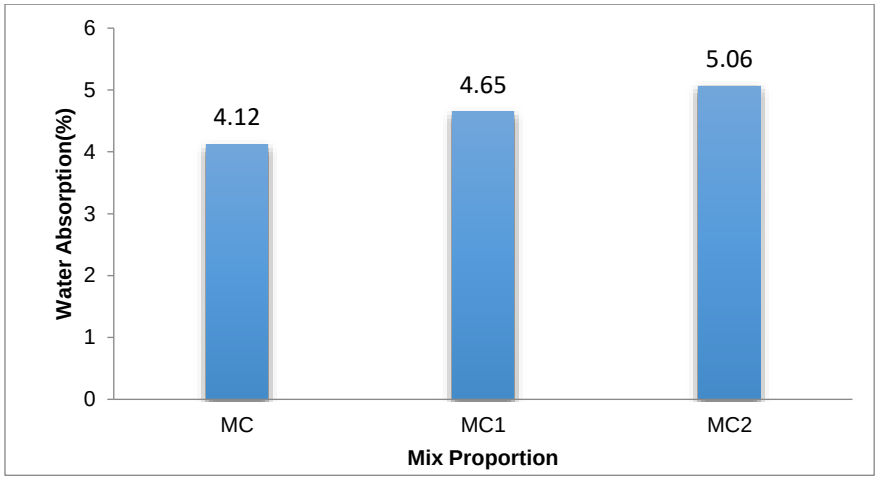

Figure 4. Water Absorption

Block Density

Block density of a cube justifies any material as light weight, medium weight or a heavy weight material. Table 3 shows the block density the mix proportions MC, MC1 and MC2.

Table 3. Block Density

Specimen Details	Average Block Density (kg/m^3)
MC	2310.61
MC1	2575.76
MC2	2684.10

III. SUMMARY AND CONCLUSION

The hardened mortar blocks were evaluated for the parameters like compressive strength, water absorption and block density.. The compressive strength in sludge-cement blocks after 28 days of curing were tabulated and compared for 10, 20 % sludge addition with cement. The control gave the strength of 33.79 after 28 days of water curing. It was observed that the strength for mortar cubes at 10 % of replacement was increased. The replacement up to 10% of sludge gives satisfactory strength requirement as per IS 1489-1991. Water absorption of mortar increases as the percentage of addition of hypo sludge increases and ranges from 4.12 % to 5.06 %. Moreover the water absorption for all the combinations does not exceed around 5%.As far as block density was concerned, it varies from 2300 t0 2700 kg/m^3. Therefore, all the solidified combinations were fulfilling the building blocks requirements to different types of applications. The presence of heavy metal concentrations must be investigated experimentally for the leaching characteristics.

From the preliminary investigations, the test results indicate that the hypo sludge can be further explored for its applications in concrete and other construction resources. Moreover, it also finds a path for a enhanced solidification method for the solid waste generated in industries.

IV. REFERENCES

[1] Jayeshkumar Pitroda, Dr L.B. Zala & Dr F.S. Umrigar (2013) 'Innovative use of paper industry waste (hypo sludge) in design mix concrete' International Journal of Advanced Engineering Technology, Volume.4, no 1, pp. 31-35.
[2] B.Pradeep, P.Velumani & Dr S.Senthilkumar (2015) 'An Endeavour for accomplishing hypo sludge as a construction material' International Journal of Applied Engineering Research (IJAER), volume 10, no 19, pp.14276-14279.
[3] P.Velumani, S.Senthilkumar & P.V.Premalatha (2016) 'An Innovative approach to evaluate the performance of sludge incorporated fly ash bricks' Journal of Testing and Evaluation, volume 44, no 06, pp.2155-2163.
[4] IS 383 - 1970 "Specifications for Coarse and Fine Aggregates from Natural Sources for Concrete", Bureau of Indian Standards, New Delhi.
[5] IS 456 - 2000 "Code of Practices for Plain and Reiinforced Concrete", Bureau of Indian Standards, New Delhi.
[6] IS 1489 - 1991 "Specifications for portland pozzolana cement", Bureau of Indian Standards, New Delhi.
[7] M.S.Shetty "Concrete Technology Theory and Practices" S.Chand & Company, New Delhi

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