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A PARTIAL REPLACEMENT OF CEMENT AND SAND BY USING LIME SLUDGE IN CONCRETE

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Abstract : The cement and sand requirements for construction activities increased proportionally but, all the materials required for producing concrete are obtained from the earth's crust only. Hence, the natural resources are exploited in an extremely high manner and resulted in depletion of the same and creating environmental strain. The sugar and paper industries are generating a huge quantity of lime sludge as waste, this waste may create ecological problems because of its dumping in open places causing environmental pollution. A proper utilization of lime sludge from sugar industry is to be used in concrete. This experimental study is aimed to utilize such lime sludge as a partial replacement material for sand in concrete and to study the suitability of this waste material for sand replacement. M25 grade of concrete is taken for investigation. The cement and sand is replaced by lime sludge of 5%, 10%, 15% and 20%. The concrete mix design is done as per IS10262-2009. The properties are studied including the workability characteristics of fresh concrete such as slump, compaction factor and strength properties of hardened concrete including Compressive strength, Split tensile strength and Flexural strength for various percentage of replacement of cement and sand by lime sludge.

Key Words: Lime Sludge, Calcium Carbonate, High Strength Concrete, Lime.

I. INTRODUCTION

India being an agricultural based country, a lot of Agro Industries as come up. The lime sludge is generated from paper, acetylene, sugar, fertilizer, sodium chromate and soda ash industries. To date, these by-products used in other industrial branches and in the field of Civil Engineering constructions. Now a days the concrete is most used manmade material in the world. The extent of quality control is often uneconomical compromise and depends on the size and type of job now a days engineers and scientists are trying to increase the strength of concrete by adding the some other cheap and waste material as a partial replacement of cement and sand or as a admixture fly ash, micro silica, steel slag, lime sludge etc. The sludge are disposed of wet in the form of slurry/filter cake into lagoons/settling tanks and are considered potential health and environmental hazards. So research is being conducted to improve the strength of concrete by the addition of various admixtures to the concrete. In this work, it has been planned to use it in concrete with the partial replacement by using lime sludge added as an additional ingredient in different proportions to enhance the binding properties of concrete.

Lime concrete, produced by this mix, makes a good base for load bearing walls, columns, or laying under floors because it has a degree of flexibility that regular concrete does not. It also has a certain waterproof property to it that prevents subsoil dampness in floors and walls. Additionally, lime concrete can be made easily and cheaply while still providing a durable material that resists weathering and wear and tear.

OBJECTIVES

The main objectives of the project is to replace cement and fine aggregate with Lime Sludge

1. To determine the Compressive Strength of concrete with 5%, 10%, 15%, 20% replacement of cement and fine aggregate with Lime Sludge.
2. To determine the Flexural Strength of concrete with 5%, 10%, 15%, 20% replacement of cement and fine aggregate with Lime Sludge.
3. To determine the Split Tensile Strength of concrete with 5%, 10%, 15%, 20% replacement of cement and fine aggregate with lime sludge.

II. LITERATURE REVIEW

GENERAL

In this chapter, an elaborate discussion is made regarding works done so far in this area as literature review. The lime sludge is one placement with the fine aggregate to get the lime sludge concrete have been examined and behavior were studied.

REVIEWS REGARDS LIME SLUDGE

Archaneshwar Kumar. K, [1] et al., (2016) This research work presents an investigation of compressive strength of cement mortar by adding Lime sludge and Fly ash as a partial replacement of cement in various

percentages. In this work cement has been replaced by four proportions of Fly ash & Lime sludge.

Sahu. V [2] (2013) study the use of fly ash and lime sludge as partial replacement of cement in mortar .The fly ash and ordinary Portland cement was sieved and portion retained on 90 micron was used.

Sajad Ahmad [3] et.al ., (2013) carried out the study of concrete involving use of waste paper sludge ash as partial replacement of cement The search for suitable for local materials to manufacture pozzolana cement was therefore intensified. Most of the increase in cement demand could be met by the use of supplementary cementing materials, in order to reduce the green gas emission (Bentur, 2002).

Sarika G.Javiya and Zalak P.Shah [4] studied Hypo sludge utilization in mortar by replacing cement by hypo sludge towards compressive strength, water absorption and sorptivity with different time lapses. .In the reference paper, Aman jatale et al, carried out investigation on effect of fly ash on mechanical properties of the concrete like workability, setting time, density, air content, compressive strength by replacing the cement with 20%,40% and 60% of fly ash. M15, M20 & M25.

Vaishali Sahu and V.Gayathri., [5] (2014) study the use of fly ash and lime sludge as partial replacement of cement mortar. The fly ash and ordinary Portland cement was sieved and portion retained on 90 micron was used.

Marimuthu .A., Jose Ravindra Raj .B, [6] et. Al., said that reinforced concrete is the most extensively used material for construction worldwide. A particle substitution of cement by an industrial waste such as fly ash is not only economical but also improves the properties on fresh and hardened concrete and enhances the durability characteristics and improvements effected in properties of new concretes.

Chandak N. R., Amit Babu [7] Lime stabilization is one of the oldest process of improving the engineering properties of soils and can be used for stabilizing both base and sub base materials It was concluded that the soft soil can be successfully stabilized by the combined action of lime and natural pozzolana. The effect of lime on the compaction and strength behaviour of the red earth treated with mine tailings shows that the compressive strength of red earth had increased due to the long term pozzolanic reaction of the calcium oxide present in the mine tailings.

Sarika G.Javiya [8] et. al., studied Hypo sludge utilization in mortar by replacing cement by hypo sludge towards compressive strength, water absorption and with different time lapses. .

Siddique, [9] 2003 carried out experimental investigation to evaluate mechanical properties of concrete mixes in which fine aggregate (sand) was partially replaced with class F Lime. The tests on flexural strength and modulus of elasticity also showed improvement in the results as compared to control concrete.

Namagg & Atadero, [10] 2009 described early stages project to study the use of large volumes of high lime in concrete. Authors used Lime for partial replacement of cement and fine aggregates. They concluded that this was due to the pozzolanic action of high Lime.

Nancy L Holland [12] et.al,. The use of cementitious materials, such as hydrated lime and volcanic cements, predates the use of Roman and Portland cements by several millennia. There has been a significant body of research on concrete made with Portland cement, though relatively little information related to the effects of hydrated lime as a partial replacement for Portland cement. Barbhuiya, et al., found that lime can be added to fly ash based concrete to increase the early strength so that forms can be stripped more quickly. This use has been studied in the last few decades, both in concrete and mortar use. A report by the Portland Cement Association noted that emphasis needed to be placed on less than five percent crushed limestone replacement of the Portland cement. A traditional cost analysis looks only at the first or construction cost, without considering the long term cost to mitigate for the increased global warming emissions resulting from the manufacturing process of Portland cement.

III. MATERIALS TO BE USED

CEMENT

Cement is a binding material which possess very good adhesive and cohesive properties which makes it possible to bond with other materials to form compact mass of concrete. Cement used it our project is ordinary Portland cement 53 grades. Its specific gravity is 3.13.

FINE AGGREGATE

Sand is either round or angular grains and is found mixed in various gradation of fineness. A concrete can be made from sand consisting of rounded grains are good as from that in which the grains are angular. River or pit sand should be used and not sea sand as it contains salts and other impurities which affect the structure.

In this project work, M-sand has been used as fine aggregate. The specific gravity of sand is 2.65 by the experiment conducted using pycnometer. The sieve analysis of fine aggregate is conducted using the sieve shaker

COARSE AGGREGATE

Coarse aggregate used for concrete should be clean and free from only, loam, vegetable and other organic materials. Aggregate for lad bearing concrete must be hard, strong, non-porous and elongated particles .The maximum size of the aggregate depends upon the type of concrete here the aggregate is being obtained from the crushers in government approved granite quarry. The specific gravity of coarse aggregate is 2.62.

WATER

Water is an important ingredient of concrete as it actively participates in chemical reactions with cement to form the hydration product, calcium-silicate- hydrate (C-S-H) gel. The strength of the cement concrete depends mainly from the binding action of the hydrate cement paste gel. A higher water binder (w/b) ratio will decrease the strength, durability, water tightness and other related properties of concrete. The water used for making concrete should be from desirable salts that may react with cement. Silts and suspended particles are undesirable as they interfere with setting, hardening and bond characteristics. Algae in mixing water may cause marked reduction in strength of concrete either by combining with cement to reduce the bond or by causing large amount of air entrainment in concrete.

LIME SLUDGE

Limestone is the most widely used mineral in the chemical industry and generally one of the by-products/wastes from these chemical industries is a lime bearing sludge. Lime sludge is generated from paper, acetylene, sugar, fertilizer, sodium chromate and soda ash industries. All the lime sludge other than carbide sludge contains lime as calcium carbonate. The carbide sludge from acetylene industry mainly contains lime as calcium hydroxide. This sludge essentially contains lime as major constituent. However, their chemical compositions vary considerably depending upon the composition of limestone used in the parent process. The particle size distribution and mineralogical composition of India lime sludge. All sludge contain some deleterious constituents/ contaminants, which come from the process through which they are generated, e.g. the phospho-chalk from fertilizer industry contains 5- 9% SO3, 1.5% P2O5 and 2% fluoride as major contaminants. Similarly, paper, sugar and chromium sludge contain free alkalies up to 2%.COIR FIBRE

LIME-USED IN CONCRETE

From the ancient period, human is using lime as a binding material. Due to its binding property, it is also known as natural cement. Egyptian and roman used this material in ancient period very effectively. If we talk about the ancient period of India many engineering structures i.e. Quila, Raj palace, Bridges, Temples and other structures are in very good condition that were build in Indian ancient time.

1) Lime is very useful in comparison of cement which is because:

2) Lime is to cheaper than cement.

3) Workability and plasticity of lime is good as compare to cement.

4) Shrinkage of lime is less with respect to cement on hardened state.

5) Lime is generally available locally.

6) Due to calcinations of limestone, the moisture and carbon dioxide are removed from it.

IV. WORK TO BE CONTINUED

- The basic properties of cement, fine aggregate, coarse aggregate and fibre should be found out.
- The workability test for concrete such as Slump test, Flow test, Vee Bee apparatus test, Compaction factor test should be found out with and without lime sludge.
- Further, the results of mechanical properties of concrete should be done and compared with conventional concrete.

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