

## Experimental Evaluation of Incorporating Dry Sludge in Cement Concrete

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**Abstract:** *The prime motive of this assignment is to extract an alternative solution for the disposal of hefty volume of sludge generated from the waste water treatment plants. This bulk volume of is detrimental to the land area which is even scarce and incessantly mounting population epitomizes the sludge problem around the globe. Numerous investigators worldwide have been trying to explore suitable solutions to decipher sludge problem. One track of this solution is to employ sewage sludge in construction field. The contemporary study presents the uses of dry sewage sludge in the concrete mixtures and in manufacturing block samples. The employment of this waste material in bricks usually has positive effect on the properties such as light weight brick. The bonding strength can be further enhanced by controlling operation conditions. The study recommended that more researchers are needed to evaluate the durability of sludge concrete and the behavior of reinforced sludge concrete. The civil engineers have been challenged to convert waste to useful building and construction material, as a part of which this has proven a significant step towards prevention of environment from getting degraded due to such un-disposable pollutants. Performing numerous tests on sludge incorporated concrete it has been observed that adding 20% of dry sludge gives satisfactory results.*

**Keywords:** *Redundant, attribute, Discovery, Dependency, Integrity, constraints, Normalization*

### I. INTRODUCTION

Sludge is generated in the sewage treatment plant of corporation area. Most of the treatment, sludge is used as land filling. In India, there are many effluent treatment plants resulting in an increasing of sludge which in turn increasing problems in disposal. The final destination of effluent treatment sludge affects the environment. Since land is limited, alternative technologies to dispose of effluent treatment sludge are essential. Incineration may be a profitable alternative technology of disposal but the final disposal of a huge quantity of effluent treatment sludge would pose another problem. Therefore this study was conducted to investigate the feasibility of using the common effluent treatment waste sludge for producing concrete bricks.

In sewerage systems, sewage sludge is inevitably generated through wastewater transportation and treatment. Appropriate treatment and disposal of generated sludge, as well as water quality control of treated wastewater, is essentially important for rational maintenance and operation of sewerage systems.

The amount of generated sludge in urban area has increased year by year in proportion to growing severed population rate. In future, the amount will undoubtedly increase with further promotion of sewage works and implementation of advanced wastewater treatment.

On the contrary, the available capacity of sanitary landfills for sludge disposal is insufficient because of increasing amount of wastes with the progress of social economy and difficulties to secure and construct new dump yards.

Recently, the Basic Law for Establishing a Recycling-Based Society in which cyclical use of resources and principals of proper disposal of wastes are stated, has been established, and Waste Disposal Law has been revised to strengthen the Responsibility of polluter and prevent insufficient treatment of Waste.

To deal with the shortage of sanitary landfills area and follow the above-mentioned laws, continuous efforts to establish and promote the Recycling-Based Society are needed in the field of sewage works. Especially, sludge utilization for construction works as cement ingredient has been progressed. Also, sludge utilization for construction works like melted slag utilization as sub base course material etc. has increased. The amount of sludge utilization for agriculture and green area has been almost constant

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- **Primary sludge**

Primary sludge is a sludge generated from primary treatment. The primary treatment process consists of physical or chemical treatments process to remove suspension solids. The most common physical treatment is a removal of suspended solids by sedimentation due to gravity setting.

- **Secondary sludge**

Secondary or surplus activated sludge is a sludge generated due to break down of the remaining organic materials (dissolved organic materials) in wastewater after primary treatment by using active agents. The active agents are micro-organisms, in the most are bacteria. These types of bacteria need organic material to grow and to still live. The breaking down process is followed by a sedimentation process.

- **Sludge components**

The wastewater in sewage plants is a collection of households, industries and storm water. These components treated together, not separated. This means that there are large amounts of pollutants in the influent wastewater which will also be in sludge. The sludge has two main components, liquid and solid. Liquid part, include water and dissolved substances. The dissolved substances contain organic and inorganic substances. The organic dissolved substance such as carbohydrates and fatty acid and the inorganic dissolved salts such as ammonium. The solid part of sludge contains organic and inorganic solid matter. The organic matter involves living organisms and their decomposition product. The inorganic solid matter is founded in the form of metals and nutrients. The sludge components are not constant and varying according to the local circumstances and the applying treatment methods. The sludge components can be analyzed as following:

- **Sludge treatment**

The resulted sludge from wastewater treatment plants has a large volume. This volume is consisting of high water content. Removal of this water from sludge will improve efficiency of subsequent treatment process, reduce storage volume and so decrease operation and transportation costs. After reduction of sludge water content, another treatment process is needed to stabilize the sludge and killing pathogenic organisms. Several treatment processes are carried out to reduce sludge water content including conditioning, thickening, dewatering and stabilization.

Other treatment process aims to kill organisms by subjecting sludge to high temperatures or high pH. This process is a sanitation process of sludge done by number of treatments such as anaerobic digestion, pasteurization, and composting and lime stabilization. There are different treatments processes can be applied on sewage sludge, depending on the following step which will a disposal or recycling

- **Conditioning**

Conditioning of sludge involves modification of sludge solid structure to facilitate water releasing in dewatering process. Conditioning process is necessary to give the economical factor to dewatering process. Conditioning process is take place by chemical process by use mineral agents such as salts or lime or polymers. Also conditioning may take place by thermal process during heating the sludge to 150-200 °C for 30-60minutes.

- **Thickening**

Thickenings of sludge aim to reduce the sludge volume by reduce the water content of sludge. There is a different thickening methods varying according to the sludge nature and the purpose used to remove some of its free water. A thickening of sludge using a flotation technique is suitable for chemical and biological sludge. Another thickening method is a thickening by various gravity (sedimentation) techniques. This technique is suitable for primary sludge.

## II. CASTING AND ANALYSIS



Fig.1. Flow Chart of Sludge Block Making

The block making consist of one Concrete Block Making mould and the Pan Mixer. The above discussed Mix is mixed well in the Pan Mixer, this Mixer is a sturdily constructed machine with heavy rollers to grind and mix the material thoroughly which is driven through quality worm reducing gear box and is an easy bottom loading mechanism with rap pinion door arrangement. In short the mixture is well mixed and grinded in this Pan Mixer. Mould is filled manually which is over the pallet. The mix is pressed and vibrated on both sides simultaneously, resulting in voids free, high density blocks with excellent texture and finish. The blocks thus formed are voids free and increases its strength. Demould and Formed blocks are dragged away from the mould and handled manually. And tests conducted on this are compression test, tensile test, and Having known the sludge effects on concrete mixes in fresh and hardened states, the optimum sludge/cement ratio was used to make interlock samples, as example of non-reinforced element. The influence of sludge on interlock block compressive strength, density and absorption were studied and compared with those of the control interlock blocks.



Fig. no. 2 Mould filled concrete specimen

The following tests were performed:

1. Tensile test
2. Compression test
3. Flexural test



Fig. no.3 Compression testing machine



Fig. no.4 Flexural testing machine

### III. RESULTS AND DISCUSSIONS

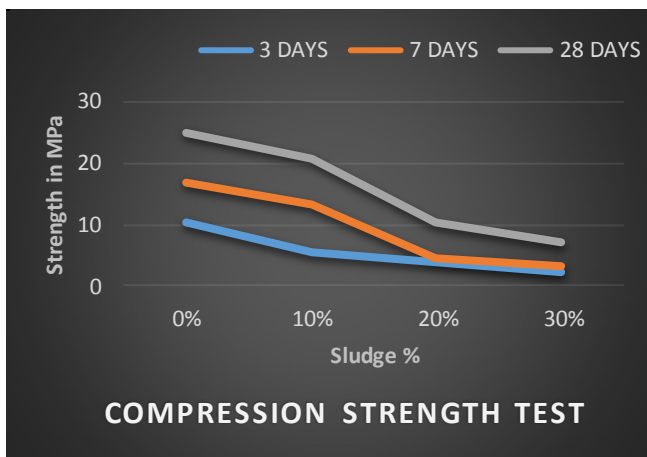


Fig. no.5 Compression Strength Test Result

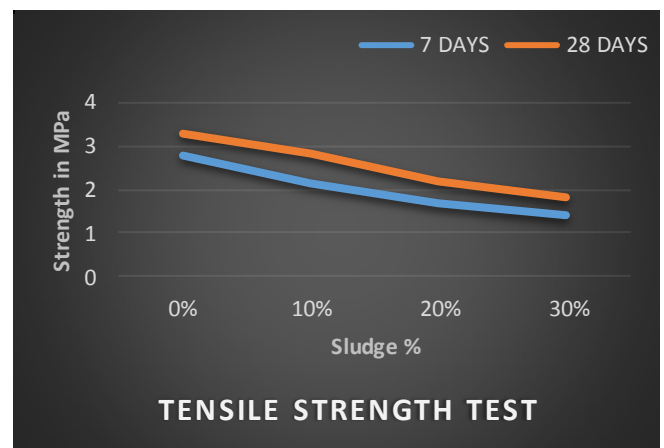


Fig. no.6 Tensile Strength Test Result

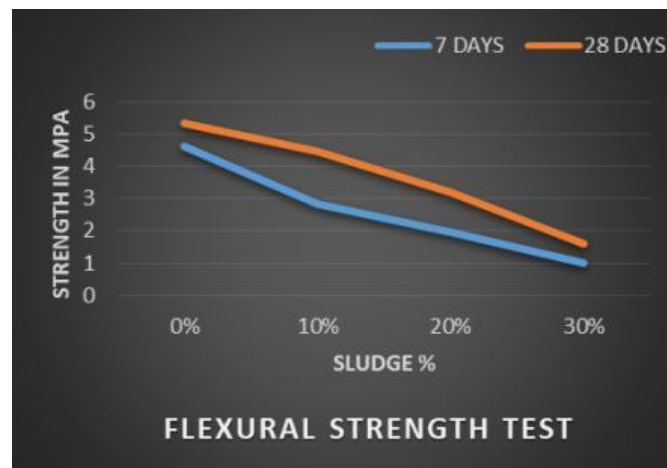


Fig. no.7 Flexural Strength Test Result

#### DISCUSSIONS

- From the above experiment it has been observed that the experimental result for zero percentage sludge are as per the IS M25 grade of concrete.
- In Graph no. one after adding ten, twenty, thirty percentage of sludge in concrete the compressive strength of concrete is decrease by twenty, fifty, and sixty five percentage.
- In Graph no. two after adding ten, twenty, thirty percentage of sludge in concrete the tensile strength of concrete is decrease by fifteen, thirty four, and forty six percentage.
- In Graph no. three after adding ten, twenty, thirty percentage of sludge in concrete the flexural strength of concrete is decrease by sixteen, forty, and seventy percentage.
- All the above results are decrease due to reduce in self-weight of concrete and various properties of sludge.

#### CONCLUSION

- The study shows that water absorption of the sludge blocks are less water absorption as compare to concrete blocks.
- The study of comparison for weight, the weight of sludge concrete block is less than concrete block.
- The cost of block comparison that the sludge concrete block cost is less than cost of concrete block.
- From the preliminary testing result we came to know that adding 20% of sludge of the total weight of sand gives satisfactory Results.
- Increase in the percentage of sludge reduces the strength of the block and also increases the water absorption which gives idea that they cannot be used for the construction purpose.

- These blocks can be used in the Construction Industry, in the cases such as partition walls, compound walls etc.
- The Incorporation of sludge reduces deposition on agricultural lands and so saves ecosystems and environment.
- The Incorporation of sludge wastes in building blocks production has proven to be safe for health and environmentally friendly.
- The above study gives us the idea, if the proper proportion sludge is added it will give required compressive strength and water absorption.

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