

## EFFECT OF LIME SLUDGE ON STRENGTH OF CONVENTIONAL CONCRETE

Md. Mujtaba <sup>1</sup>, Maqsoodalimalik <sup>2</sup>, KushagraTiwari <sup>3</sup>, MahtabAlam <sup>4</sup>

(<sup>1,2,3,4</sup>Civil Engineering, NIET, Greater Noida, Uttar Pradesh, India)

### ABSTRACT

*Conventional concrete is the mixture of cement , sand , aggregates and water which is used for various construction purposes. Production of constituents of . Conventional concrete causes high carbon emission in atmosphere .so we will partially replace its constituents with lime sludge In this experiment we will be testing strength of conventional*

*concretecube by replacing cement and sand with lime sludge at different percentage of replacement . We will betesting flexuralas well as compressive strength of concrete cube after curing it with H<sub>2</sub>SO<sub>4</sub> and HCL individually for 28 daysBy carrying different tests and comparing the results , we will find the optimal replacement percentage which will give better strength results than conventional concrete cube , percentage at which flexural strength , compressive strength and durability is maximum*

**keywords :** *compressive strength,concrete, flexural strength,lime sludge*

### I.INTRODUCTION

Lime sludge is the residual waste obtained from sugarcane, acetylene, soda ash industries. Around 4.5 million tons of

lime sludge is generated from these industries which causes serious disposal issues .Open disposal of lime sludge also promotes environmental pollution . These residual waste could be beneficially used for various purposes like stabilization of soil and improving strength of concrete by partial replacement of sand .Lime sludge behave like cement because of silica and magnesium properties, which improves the setting of concrete. So it could be used as partial replacement of sand in concrete. In context of low availability of non renewable energy resources coupled with the requirement of large amount of energy for building material , the importance of using industrial waste cannot be underestimated. It will cut down carbon emission and also will save energy. The lime sludge obtained from sugar factory normally contains calcium carbonate and small amount of free lime. Hence lime sludge can be utilized in concrete and in construction industry. In this work, it has been planned to use it in concrete with the partial replacement of sand by using lime sludge added as an additional ingredient in different proportions to enhance the binding property of concrete

The experimental studies are conducted for durability characteristics of concrete and flexural strength of hardened concrete with lime sludge. From the results the optimum replacement of lime sludge is determined.

## **2. MATERIALS USED**

### **Cement**

cement is a binding material in concrete which is used in all building elements. Generally ordinary Portland cement is used

### **Sand**

sand is either round or angular grains and often found in various gradation of fineness. Specific gravity of sand is 2.64. It constitutes about 26% of total volume

### **Course Aggregate**

These are inert or chemically inactive materials which form the bulk of cement concrete. The aggregates are bound together by means of cement. It constitutes about 41% of cost of concrete

### **Water**

Portable water is used for this work. Excess of acidity or alkalinity in water is to be avoided. It should be free from oils, acids, organic and inorganic impurities

### **Lime sludge**

Solid residue is obtained from various industries. Free lime is being added in sugar processing for cleaning the juice. The residue obtained along with some soil and cane pith is called lime sludge. It contains small percentage of free lime which has binding property

## **3. SCOPE OF PRESENT INVESTIGATION**

One of the major challenges of our present society is the protection of environment. Due to growing structures cement and natural aggregates availability is relatively reduced. Some of important elements in this respect are the reduction of consumption of energy and natural raw materials. These topics are getting considerable attention under sustainable development nowadays

Recently good attempts have been made for successful utilization of various industrial by products like lime sludge, fly ash in concrete

In addition to this, an alternative source of potential replacement of natural aggregates in natural concrete has gained good attention due to reduction in sources. As a result there is increased need to identify substitute materials to aggregates and cement in the production of concrete

The work is mainly focused on finding the effect of lime sludge on strength of conventional concrete as partial replacement of cement and fine aggregates which helps to reduce some percentage of environmental effects and reduce the impact of waste materials on environment

## **4. OBJECTIVES**

- ❖ To find out the percentage use of admixture feasible for construction
- ❖ To compare the results of various tests conducted on concrete at different proportions by using lime sludge
- ❖ To find out how much percentage of lime sludge is partially replaced by cement and sand in concrete for

safe construction

- ❖ To study the influence of hardened properties of concrete such as compressive strength and quality and grading of concrete when lime sludge is used in the concrete mixes to reduce the cost of concrete production

Sl. No	Description	Avg Flexural strength N/mm <sup>2</sup>
1	Normal concrete 0%	3.18
2	5 % lime sludge replacement	3.26
3	10%lime sludge replacement	3.28
4	15%lime sludge replacement	3.48
5	20%lime sludge replacement	2.88
6	25%lime sludge replacement	2.97
7	30%lime sludge replacement	2.82

## 5. PREVIOUS WORKS AND THEIR RESULTS

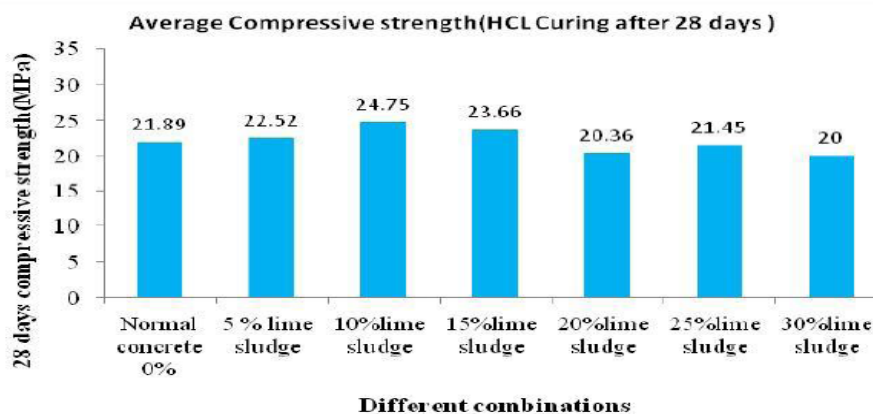
### 5.1.Detailed investigation on concrete using lime sludge from sugar industry

By Marimuthu and Jose Ravindra Raj

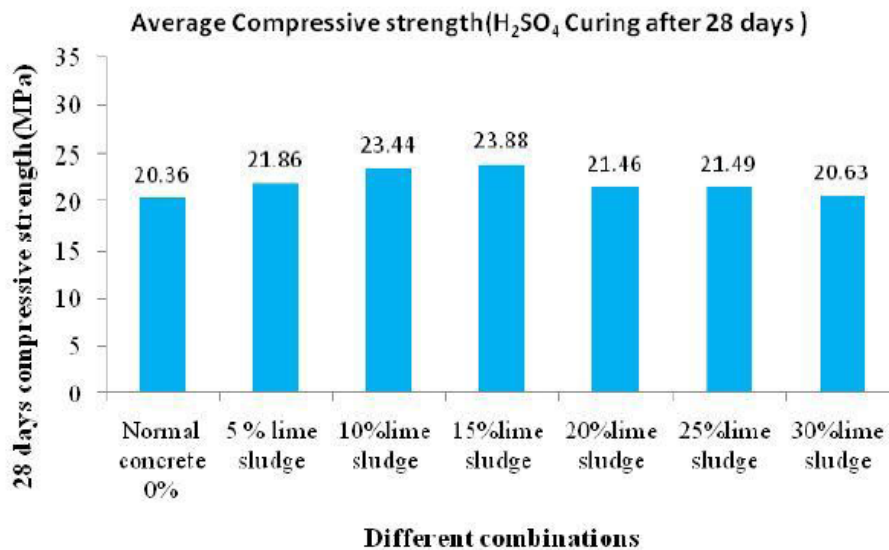
They used M20 grade of concrete with mix ratio 1:1.5:3 . The sand is replaced by 0% to 30% with an increment of 5% The properties studied included durability test such as acid resistance and flexural strength for various percent of replacement of sand by lime sludge For flexural strength test prism of standard size was casted and cured for 28 days

and test is done as per IS 516: 1956 specifications and results obtained are shown in table below

Table 5.1.1( average flexural strength at different percent replacement )



Graph 5.1.1 Average compressive strength at different combinations by curing with HCL for 28 days



Graph 5.1.2 Average compressive strength of concrete different % replacement of cement with lime sludge (H<sub>2</sub>SO<sub>4</sub> curing)

5.2 study of effect of lime sludge and silica fume on strength of concrete

By vijay pal and Er. R P Mahla, OITMhissar, Haryana, India

They studied effect of lime sludge and silica fume at different % replacement on strength of conventional concrete. The quantity of different ingredients was determined by making 6 cubes so that 3 cubes are tested after 7 days and 3 cubes were tested after 28 days. First of all, cubes with ingredients determined above were casted and then sand was partially replaced by lime sludge. First 10 percent of lime sludge was added as partial replacement of fine aggregate and then 20 percent of sludge was added as partial replacement of fine aggregate. In order to study the compressive strength when lime sludge and silica fume were partially added as a replacement of fine aggregate and silica fume respectively, the cubes containing different quantities of lime sludge and silica fume were casted and kept for curing for 7 and 28 days. The test was conducted on UTM (Universal Testing Machine) and following results were obtained.

Table 5.2.1 Compressive strength at different % silica fume and lime sludge after 7 and 28 days

Sr. No.	% age of lime sludge	% age of silica fume	Compressive strength after 7 days (N/mm <sup>2</sup> )	Compressive Strength after 28 days (N/mm <sup>2</sup> )
1.	0	0	29.06	31.67
2.	10	0	23.51	26.38
3.	20	0	17.36	19.89
4.	20	10	20.29	23.10
5.	20	20	23.16	29.74

**5.3 Durability and strength character of concrete using lime sludge and fly ash as partial replacement of fine aggregate**

By S. Sudha, Sree Rama Engineering College, Tirupathi, Andhrapradesh

In this study, concrete cubes have been cast by replacing fine aggregate (0% and 5%) with fly ash and cement with (0%, 5%, 10% and 15%) lime sludge. The method adopted in this investigation was as per the IS code specifications. Compressive strength of these cubes is tested after 3, 7 and 28 days and following results were obtained

**Table 5.3.1 compressive strength of cube for 3,7 and 28 days**

Percentages %	3 days MPa	7 days MPa	28 days MPa	Slump value mm	Compaction factor
Normal concrete	15.06	17.10	22.79	75	0.89
Lime sludge 5% + Fly ash 5%	14.67	15.59	21.20	60	0.86
Lime sludge 10% + Fly ash 5%	13.90	14.28	18.62	68	0.80
Lime sludge 15% + Fly ash 5%	11.57	12.72	16.22	90	0.76

**6. CONCLUSION**

From these experiments, following conclusion could be drawn

- ❖ Using waste materials like lime sludge saves non renewable energies as well as reduces carbon emissions
- ❖ It also solves disposal problems of lime sludge in open land which causes pollution

**6.1 Optimal replacement for lime sludge in concrete shows following results**

- ❖ Flexural behavior of 15% replacement is found to be good
- ❖ Durability property is good at 5%, 10%, 15%
- ❖ Higher replacement are found to be poor in acid curing

- ❖ Compressive strength is found to be maximum at 15% lime sludge replacement when cured with  $H_2SO_4$
- ❖ Compressive strength is found to be maximum at 10% lime sludge replacement when cured with HCL

6.2 Optimal replacement when replaced by silica fume and lime sludge

- ❖ Compressive strength is maximum in conventional concrete but it decreases as lime sludge and silica fume is added
- ❖ It again increases nearer to its maximum value at 20 % lime sludge and 20 % silica fume

6.3 Optimal replacement when replaced by fly ash and lime sludge

- ❖ Compressive strength is maximum at 0% fly ash and 0% lime sludge
- ❖ Compressive strength is nearer to its maximum value at 5% lime sludge and 5% fly ash replacement
- ❖ Further addition or replacement reduces its compressive strength

## REFERENCES

- [1]. S. Sudha "Durability and strength character of concrete using lime sludge and fly ash as partial replacement of fine aggregate" *International Research Journal Of Engineering and Technology (IR-JET)* Volume 03 issue:07 ( july 2016) e-ISSN: 2395 p-ISSN: 2395-0072
- [2]. Marimuthu and Jose Ravindra Raj ."Detailed investigation on concrete using lime sludge from sugar industry" *International Journal of Engineering and Management Research*, page number :253-256 , Volume 07, issue :2 (march – april 2017) ISSN (ONLINE): 2250-0758, ISSN (PRINT): 2394-6962
- [3] Vijay Pal1 ,Er. R.P. Mahla2." Study of Effect of Lime Sludge and Silica Fume on Strength of Concrete" *International Journal of Technical Research (IJTR)* Volume 05, issue :2 (july –august 2016)ISSN 2278-5787
- [4]. G.Shivanath, EArumugam and V.Murugesan "utilization of industrial effluent treatment plant sludge as partial replacement for cement in concrete" *Journal of industrial pollution control* ISSN (0970-2083)
- [5] Nafsalkhaleel, T Ramasamy "the use of lime sludge and cement for the production of green brick" *International Journal on Application in Civil and Environmental Engineering* Volume 01 issue :1 (january 2015 )
- [6] [www.essay.uk.com/free-essay/engineering/low-cost-concrete.php](http://www.essay.uk.com/free-essay/engineering/low-cost-concrete.php)