

# Experimental Investigation on Utilization of Hypo Sludge and Sugarcane waste in Fly ash Brick.

B. Navaneetha<sup>1</sup>, S. Manjula<sup>2</sup>, R. Nandhini<sup>3</sup>, K. Gowrisankaran<sup>4</sup>, R. Stalin<sup>5</sup>

Asst professor<sup>1</sup>Dept of Civil Engineering, Sri Rangathar Institute of Engg and Tech, Coimbatore, Tamilnadu.  
UG Student<sup>2,3,4,5</sup> Dept of Civil Engineering, Sri Rangathar Institute of Engg and Tech, Coimbatore, Tamilnadu.

## ABSTRACT-

Fly ash is one of the major residues generated during combustion of coal in thermal power plants. Fly ash brick technology is the process of converting industrial waste materials into quality building material. Fly ash, lime, gypsum and crusher dust are used to manufacture the fly ash brick. In this study hypo sludge and sugarcane press mud is used as a replacement material for fly ash brick. The lime was replaced by the hypo sludge and sugarcane press mud in the various proportions. Four types of fly ash brick were casted. The prepared bricks are cured in water for 15 days and dried in regular temperature for 15 days. The Compression, Water Absorption, and Soundness of the brick are experimented as per IS code. The study was aimed to reduce the hypo sludge and sugarcane waste dumping in the earth to protect the environment from hazardous and also increment of low-cost brick towards the construction industry for the sustainable development.

**KEY WORDS:** Fly ash {class F}, Hypo sludge, Sugarcane Press mud, Waste reuses, Compression, Water Absorption, Soundness, Eco friendly Bricks.

## 1. INTRODUCTION

Production of paper all around world is 8.4 to 11.2 metric tons per annum. Hypo sludge in a large amount as by product of paper industry. It contains calcium and minimum amount of silica. Due to presence of silica & Magnesium it acts as a cement. In Sugar mills, sugar is produced through several processes & yields many solid wastes in the production.

For every 100 tons of crushed Sugarcane 3.3 tons of filter cake remain as a byproduct. The main chemical component of Press mud is CaO and can be used as filler material in bricks. Bricks are the major concern building material used for constructional purpose. In earlier days mud blocks were used & now a day's clay bricks are being used. In the manufacturing of clay bricks, the CO<sub>2</sub> emission is more since they are burned and the clay is also exhausting. Hypo sludge and sugarcane press mud are the waste materials which pollutes and harm to the environment. Many attempts have been made to overcome these problems. So, the industrial waste materials and the by products are used in the manufacturing of bricks. Here we have incorporated the

hypo sludge and the sugarcane press mud along with fly ash & lime to get the better binding and compressive strength. The bricks are made without burning so the CO<sub>2</sub> emission is controlled. The attempt made will be a better solution for this problem. The sludge, fly ash and press mud are basically a waste material which can be converted to useful constructional material with least amount of investment. It helps in providing the low-cost housing. Uses of Hypo sludge & Sugarcane waste can save the Industry disposal costs & produce Green Bricks for construction.

## 2. EXPERIMENTAL MATERIALS

S. No	Chemical Composition	Percentage
1	Silicon Dioxide (SiO <sub>2</sub> )	5.28%
2	Calcium Oxide (CaO)	47.84%
3	Magnesium Oxide (MgO)	6.41%
4	Sulphur Trioxide	0.19%
5	Aluminum Oxide (Al <sub>2</sub> O <sub>3</sub> )	0.09%
6	Ferric Oxide (Fe <sub>2</sub> O <sub>3</sub> )	0.73%
7	Loss on Ignition	38.26%

### Hypo sludge

Paper fibers can be recycled only a limited number of times before they become too short or weak to make high quality paper. It means that the broken, low-quality paper fibers are separated out to become waste sludge, this waste sludge is known as Hypo sludge. Hypo sludge in a large amount as by product of paper industry. It contains low calcium and minimum amount of silica and it can be used as a replacement of cement.

### Fly ash (Class F)

Fly ash is the ash produced from the combustion of coal or lignite. It is a pozzolanic material helps in gaining of strength with lime. The burning of harder, older anthracite and bituminous coal typically produces Class F fly ash. The fly ash is pozzolanic in nature, and contains less than 20% lime (CaO). Possessing pozzolanic properties, the glassy silica and alumina of class F fly ash requires a cementing agent, such as Portland cement, quick lime, or hydrated lime, with the presence of water in order to react and produce cementitious compounds.

### Sugarcane Press mud.

The major byproducts of the sugar industry are Bagasse, Molasses and Press mud/ Filter press cake. Press mud is also known as filter cake obtained from the clarification process of sugar. The disposal of these wastes into the environment causes the land pollution.

### Lime

Lime is used in the powdered form to get the better binding and strength. Pure calcium oxide is fused with coke in order to render highest in the manufacture of acetylene. The quality of the resultant carbide lime is a direct result of the excellent quality raw materials. Carbide lime is finer in particle size, and physically having a very finely divided particle size makes carbide better. A finer particle size means faster and more reactivity.

### P-Sand

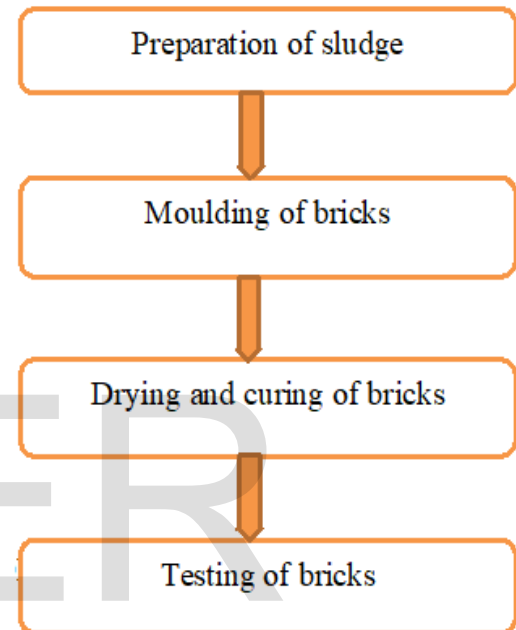
Sand is loose particles of hard broken rock, it comprises of grades from disintegrated rock. It is the substitute for River Sand, it is also known as fine aggregate which is manufactured by crushing either granite or basalt rock using 3 stage crushing process. This sand is manufactured in conformance to IS codes

and is an effective alternative to river sand also known popularly as P Sand.

### Water

Water is an important ingredient of bricks as it actually used for manufacturing of brick. Since it helps to bind all the raw materials for giving proper mix. Water used for making brick should be free from impurities.

## 3. METHODOLOGY



## 4. MIX PROPORTIONS

Percentage weight by proportion

Sample	Fly ash	Lime	Hypo sludge	Sugarcane press mud	P-Sand
STD	60	20	0	0	20
L1	60	15	2.5	2.5	20
L2	60	10	5	5	20
L3	60	15	7.5	7.5	20
L4	60	0	10	10	20

## 5. MAKING OF BRICKS

### 5.1 Sludge preparation

Sugarcane press mud is collected as sludge form and it is sun dried after drying under sun the sludge is

crushed and sieved with 2.36mm IS sieve and used as ingredients.

### 5.2 Moulding of bricks

Brick contains Fly ash, Lime, Water and P-sand. With the control brick, i.e. 5%, 10%, 15%, and 20% of the lime is replaced with Hypo sludge and Sugarcane press mud. Five bricks samples were cast and the mould having size of 230x110x70mm.

### 5.3 Drying and Curing of bricks

Bricks are allowed to dry under shadow in open air for 15 days and bricks are cured with water for 15 days.

## 6. TESTING OF BRICKS

The evaluation of Hypo sludge for use as a replacement of fly ash material begins with the brick testing. The data from hypo sludge and sugarcane press mud fly ash brick is compared with data from a standard fly ash brick. The tests are conducted based on the Indian Standard codes. The code books are

IS-3495 Part- 1:1992 (Compression test)

IS-3495 Part- 2:1992 (Water absorption test)

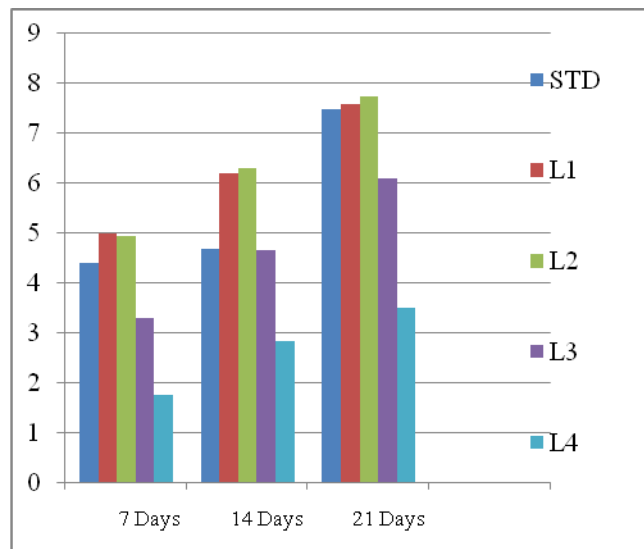
### 6.1 Compression Test

To determine the compressive strength of bricks. The compressive strength of bricks are obtained by placing the brick on the compression testing machine with 6mm plywood on top and bottom of it to get uniform rate of 14N/mm<sup>2</sup>. The axial load is applied at uniform rate until the bricks get failure.

The compressive strength of the brick is obtained by using the formula,

Compressive strength = Maximum load at failure / Area of the surface.

Sample	7 Days	14 Days	21 Days
STD	4.41	4.70	7.50
L1	5.00	6.20	7.60
L2	4.95	6.32	7.75
L3	3.30	4.67	6.10
L4	1.77	2.85	3.50

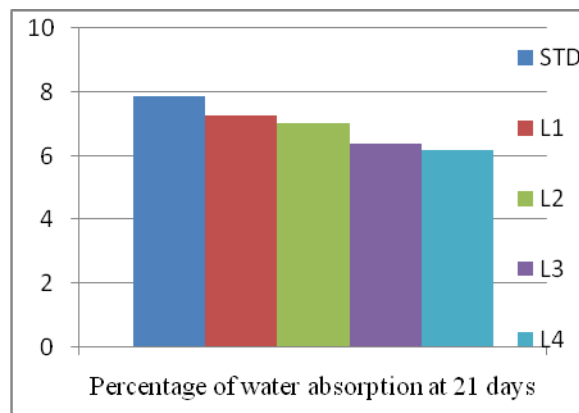


### 6.2 Water Absorption Test

Dry the brick in an oven at a temperature of 105-115°C, cool the brick to the room temperature and it is weighed ( $W_1$ ). Then immersed the dry brick in water completely at room temperature for 24hrs and remove the brick from the water and wipe out the traces of water with a cloth and the brick is weighed ( $W_2$ ).

$$\text{Water absorption} = (W_2 - W_1) / (W_1) \times 100.$$

The values of water absorption of the bricks 21 days are found out and tabulated.



### 6.3 Soundness Test

The two bricks are taken and made struck with each other. Brick of good quality should not break and produce a ringing sound. Bricks sufficiently passed soundness test.

## 7. CONCLUSION

The following conclusion can be drawn from the result obtained from the experimental investigations.

1. The compressive strength test carried out at 21 days the comparison made between the conventional fly ash brick with four proportion of sludge (5%,10%,15%,20%) as per IS code 3495Part1:1992.

2. It has been observed that in case of compression test, for 10% sludge, compressive strength comes to maximum.

3. Water absorption test carried out for 24 hours the comparison made between the conventional fly ash brick with four proportion of sludge (5%,10%,15%,20%) as per IS code 3495Part2:1992.

4. Study shows that water absorption values for the bricks is less than 4% so the brick required very ease amount of water for curing.

5. Environmental effects from wastes and disposal problems of waste can be reduced or controlled through this research.

6. Environment is protected from the emission of CO<sub>2</sub>

7. A better measure by an innovative Construction Material is formed through this project.

5. IJIRSET-Vol 5, Issue- 4, Apr-2016 Experimental Investigation of Fly Ash Brick with Addition of Waste Glass Powder & Copper Slag.

6. IS: 3495 Part 1 and 2:1992, Methods of tests of Burnt Clay Bricks- Specification, Bureau of Indian Standards, New Delhi.

7. IS: 1077:1992 Common Burnt Clay Building Bricks- Specification, Bureau of Indian Standards, New Delhi.

8. IS: 12894:2002 Pulverized Fuel Ash-Lime Bricks- Specification, Bureau of Indian Standards, New Delhi

## REFERENCES

1. IJETT-Vol 10, Number- 7, Apr- 2014-A Miniscule Endeavor for Accomplishing Hypo Sludge Fly Ash Brick in Indian Context.

2. IJRTER-Vol 4, Issue- 3, March- 2018-Experimental Investigation of Brick Manufactured by Incorporating Sludge & Sugarcane Waste.

3. Int J Adv Engg Tech-Vol 7, Issue- 2, April-June 2016 – Feasibility of Using Glass Powder in Fly ash Bricks.

4. IJIRSET-Vol 2, Issue- 3, Mar-2013 -Fly Ash Bricks Glass Fibre the Innovative Concept for Getting Higher Strength Brick.