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REPLACING THE FLY ASH BY STP DRY SLUDGE IN MANUFACTURING OF FLY ASH BRICKS

Govind Bikkad[1], Chetan Sontakke[2], Baliram Janwade[3], Gajendra Giri[4], Vaibhav Kalbhor[5], Rohini Khandelwal[6]

[1,2,3,4,5,6]*Savitribai Phule Pune University, D. Y. Patil College of Engineering, Akurdi, Pune, India.*

Abstract - *A common effluent treatment waste sludge being largest industry in India faces problem of sludge disposal. In this study an attempt is made to use of sludge. In this paper we experimentally describe the recycling of the waste products like STP Sludge and Fly ash by incorporating them into bricks. It is a practical solution for problems like cost expenditure on waste management and its effect on environment. This paper is based on the study and testing which includes the use of dry sludge collected from the waste water treatment plant in the manufacturing of fly ash brick. The replacement is done by the weigh batching method. We replace the sludge by 5%, 7.5%, 10% and 12% by Manufacturing of the bricks using the STP sludge. It is the alternate way to dispose of the sludge. Various tests are done on the dry sludge fly ash bricks and then the results were compared with the fly ash bricks.*

Key Words: Brick, STP sludge, Fly ash, Environment

1. INTRODUCTION

As the technology and population is increasing day by day, the consumption of natural resources increases by the same way. The use of natural resources beyond the limits causes various harmful effects to environment. We can save the Natural resources by recycling, reuse and replacing the waste materials. Sewage sludge is generated through wastewater transportation and treatment. Most of the treatment, sludge is used as land filling. 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. The main focus of this research is on beneficial utilization of sewage sludge in fly ash brick as partial replacement for fly ash. In this research an attempt has been made to carry out experimental study to find the effect of partial replacement of sewage dried sludge in various percentages on the fly ash bricks properties and compressive strength. Therefore this study was conducted to investigate the feasibility of using the common effluent treatment waste sludge for producing sludge-fly ash bricks.

Fig. 1 Wet sludge

Fig. 2 Dry sludge

1.1 Scope of research

- Use of sewage dried sludge in fly ash bricks, apart from energy saving and reducing environmental pollution and is also an alternate means of disposing the sludge.
- Using the sludge from the waste water treatment plants in useful manner.

1.2 Problem statement

- To check the feasibility of sewage sludge as ingredient in brick making.
- Conservation of natural resources like clay.
- To solve the problem of disposal of sewage sludge in urban region.
- To make eco-friendly low cost and durable construction material.

2. MATERIAL

A. Cement

The cement used was ordinary Portland cement of 43 grade, Ultratech cement. Confirming to IS 12269

B. Crush Sand

Fine aggregate used for project work is crushed sand from stone crusher plant. It should be taken as per the ASTM standard. It should be clean, strong, hard and free from organic impurities. Specific gravity of crushed sand is 2.6. It confirming to uniform grading passing from IS sieve 4.75 mm and retained on IS sieve 2.36 mm.

C. Fly ash

Fly ash is residue generated during combustion process of coal. It is industrial context comprises the fine particles that rise with flue gases. The specific gravity of fly ash is 2.7.

D. Sludge

Sewage sludge is a by-product. It is one of final products of wastewater treatment at sewage treatment plants. The wastewater treatment plants (WWTPs) equipment's concentrate impurities in wastewater into solid form and then separate these solid from liquid. The solid remain is known by sludge. The main sources of sludge are Primary sedimentation, secondary clarifiers and a small amount comes from screening, grinding and filtration device.

Table -1 Physical Properties of dry sludge

SR.NO	PROPERITES	RESULTS
1	Specific Gravity	1.34-1.45
2	Bulk Density	687 kg/m3
3	Clay And Sulphate Content	0.1-0.5 %
4	Grain Type Coefficient	1.1
5	Moisture Content	0.1-11.5 %
6	Softening Coefficient	0.96 %
7	Water Absorption	6 %

E. Water content

As the fly ash is used in bricks then water content is calculated. The water cement ratio is varies from 0.4 to 0.7. For finding the water content we had casted the bricks of different proportion of water, cement and fly-ash with standard size (190x90x90 mm) and tested in laboratory. After testing the brick of various water cement ratio we found the water cement ratio required for the sludge-fly ash brick 0.6.

3. METHOD

A. Material Proportioning

The proportioning will depend on the quality of the raw material and the class of brick required. As per the NTPC (National Thermal Power Corporation) guidelines for manufacturing quality fly ash brick the proportion of sludge-fly ash brick is taken. Following mix proportion is adopted for the preparation of standard fly ash brick. In standard fly ash brick the fly ash is replaced by the sludge with the percentage of weight of brick. The percentage replacement is 5%, 7.5%, 10% and 12.5% of the brick weight.

Fly ash 55-60%

Crush sand 25-35%

Cement 15-20%

Table no. 3.6. Material Proportion

Sr. No.	Sludge percentage	Cement content (gm)	Fly ash content (gm)	Crush sand content (gm)	Sludge content (gm)
1	5%	450	1050	1350	150
2	7.5 %	450	975	1350	225
3	10 %	450	900	1350	300
4	12.5 %	450	825	1350	375

B. BATCHING

In batching the various ingredients are taken as per the design mix.

C. MIXING

Mixing of ingredients is done either hand or by machine. For this research hand mixing is done. Mixing of ingredient in dry state is done firstly and water is then added gradually and mixed with help of trowel.

Fig.3. Mixing of Raw Ingredients

D. PLACING

Placing of ingredient is in the mould in layers. Layers of mixer is well compacted by tapping rod.

E. CURING

Curing of brick is done after demoulding for 28 days with help of gunny bags.

4. TEST

The following tests were performed:

1) Compression test
2) Water Absorption
3) Density
4) Hardness
5) Efflorescence

1. COMPRESSION TEST:

Remove the specimen from water after curing time and wipe out excess water from the surface. Take the dimensions of the specimen. Place the specimen in the machine in such a manner that the load shall be applied to the opposite sides of the cube cast. Align the specimen centrally on the base plate of the machine. Rotate the movable portion gently by hand so that it touches the top surface of the specimen. Apply the load gradually without shock and continuously at the rate of 6 KN/sec till the specimen fails. Record the maximum load at failure.

Fig.4. Compression test

2. WATER ABSORPTION:

Three full size bricks shall be completely immersed in clean water at room temperature for 24 hours. The bricks shall then be removed from the water and allowed to drain for one minute by placing them on a 10 mm or coarser wire mesh, visible surface water being removed with a damp cloth, the surface dry bricks immediately weighed. After weighing all bricks shall be dried in a ventilated oven at 100 to 1150 0C for not less than 24 hours and until two successive weighing at intervals of 2 hours show an increment of loss not greater than 0.2 per cent of the last previously determined mass of the specimen.

Absorption percent =(A-B)/B * 100

Where,

A = wet mass of unit in kg.

B = dry mass of unit in kg.

3. DENSITY:

In this research, the density of brick specimens is the theoretical density. The density is calculated by dividing the weight of each brick on the brick volume. The same brick specimens which used to determine compressive strength were used to determine the density in the same procedure.

Let

W = Weight of Brick in kg

V = Volume of Brick in m^3

ρ = Density of Brick kg/ m^3

ρ = W / V (Kg/m^3)

5. RESULT

Compressive strength of sludge-fly ash brick is obtained as.

Table no. compressive strength

Sample. No.	5 % sludge brick (N/mm2)	7.5 % sludge brick (N/mm2)	10 % sludge brick (N/mm2)	12.5 % sludge brick (N/mm2)
1	5.85	5.85	5.30	4.09
2	7.60	5.85	5.40	4.51
3	7.01	5.26	4.90	5.26
Average	7.01	5.65	5.20	4.62

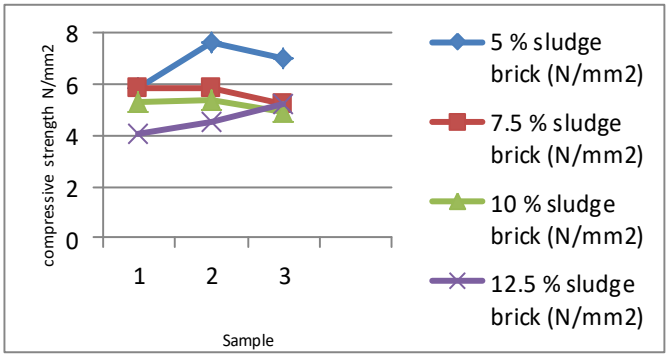

Chart 1 Compressive strength of bricks

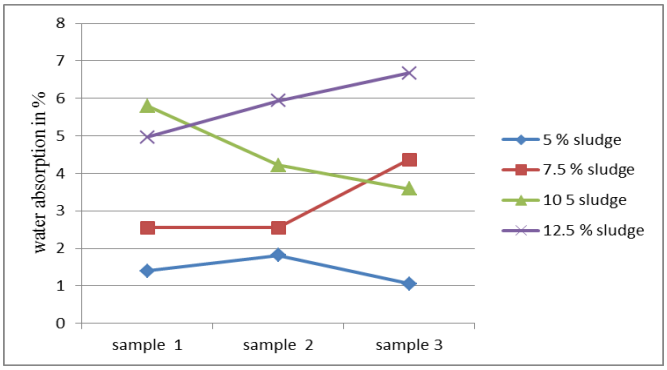

Chart 2 Graph showing water absorption

6. CONCLUSIONS

- From the above sample tests we got to know that adding 7.5% of sludge of the total weight of brick gives satisfactory Results.
- Increase in the percentage of sludge reduces the strength of the brick.
- The average strength of brick with 7.5 % sludge is 5.65 N/mm2.
- The density of 7.5% sludge sample brick is 2001.29 Kg/m3
- The water absorption of brick with 7.5% sludge is 3.15%of its dry weight.
- The cost for manufacturing of sludge brick is much less than the conventional brick.

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