

PARTIAL REPLACEMENT OF FLY ASH WITH M-SAND RESIDUE IN FLY ASH BRICK

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ABSTRACT

As we all know that the waste from the industries is very harmful for the environment as well as to our health, if not disposed in proper manner. The residue of manufactured sand (M-sand) after washing are present in enormous quantity. The M-sand residue however used to fill the basement, major quantity of the material is still disposed into the water bodies as waste. The aim of this research is to avoid the wastage of M-sand and to partially replace the content of fly ash with the various % of residue obtained from the m-sand in the fly ash brick and also to determine the optimum % of residue for better results. After the full manufacturing process the bricks are tested in the laboratory and results are analyzed regarding the water absorption and compressive strength. The objective of this research is to make economical and to reduce the fly ash content in bricks to maintain environmental balance and avoid problem of waste disposal. It was also expected that bricks must be lighter in weight, energy efficient and meet compressive strength requirements of IS 1077:199

Key Words: Bricks, fly ash, manufactured sand, residue.

INTRODUCTION

There is a strong demand for environmentally safe reuse and effective disposal method for M-sand residue due to the increasing amount of sludge generated by the various industries or plant in India. Landfills are commonly used for disposal of sludge in India, rapid urbanization has made it increasingly difficult to find suitable landfill sites. Therefore, incineration has become one of the few alternatives available for disposal of sludge. The ultimate disposal of M-sand residue can be accomplished by using it an engineering construction materials. One possible solution for the management of this sludge is to re-use it as a building material namely, to incorporate this M-sand residue into fly ash bricks. The fly ash brick is one of the most common and abundant masonry building materials and remain popular for its many characteristic properties. As such,

the recycling of waste materials by incorporating them into bricks has been a popular topic of investigation over the last century, with varying degrees of success across a wide range of waste material. The current study investigates the potential for reusing the M-sand residue by using it as a partial replacement material in fly ash bricks. Due to limited availability of natural resources and rapid urbanization, there is a shortfall of conventional building construction materials. For fly ash, the manufacturers has to totally depend on the thermal power station. On the other hand, energy consumed for the production of conventional building construction materials pollutes the air, water and land. Accumulation of unmanaged waste, especially from the developing countries, has an increased environmental concern. Therefore, development of new technologies to recycle and convert waste materials into reusable materials is

MATERIALS USED

FLY ASH

Fly ash is a residue obtained from the thermal power stations. Normally the fly ash is used in the production of bricks as an alternative to clay bricks.

M-SAND RESIDUE

Many researchers have used the m-sand (manufacture sand) only as a replacement to the river sand. A small amount of something is present after the main part of the m-sand were taken for use. It is considered as the residue obtained from the m-sand.

QUARRY DUST

Quarry dust is a waste product produced during the crushing process which is used to extract stone. It is rock particles. When huge rocks brake in too small parts for the construction in quarries. It is like sand but mostly grey in color.

LIME

Lime is a calcium containing inorganic material in which carbonates, oxides and hydroxides predominate. In the strict sense of the term lime is calcium oxide or calcium hydroxide. It is also the name of the natural CaO.



Flyash
 Crusher powder



COMPOSITION OF BRICK

MATERIAL	COMPOSITION
Fly ash	1.25kg
Crusher dust	1.5kg

Cement	0.3kg
Lime	0.1kg
Gypsum	0.1kg

*The above mentioned composition is for one brick.

METHODOLOGY

First of all survey is being carried out to study the availability of the fly ash and M-sand residue in India. Two M-sand residues from different places have been taken into consideration and the tests are done. Then the materials which we have to be used is selected and the properties of those materials are studied. Then after selection the binding property of these materials are tested whether the materials are forming a bond or not. After testing binding property the required proportions of the materials are selected and then it is mixed together to mould a brick in definite shape. The kneading process is very carefully done. After molding the brick is removed from the mould and it is remained at the same stage for drying for 2 days. The drying must be done carefully at room temperature firstly for one day and then sun drying is done for another day so that the required strength can be attained.

The replacement is done on the basis of 5%, 10%, 15% and 20% from the total weight of the fly ash with the both M-sand residues obtained from two different places.

Firstly the most important test i.e compressive strength test is performed using a compression testing machine. The loading is applied to the bricks until they failed and the maximum loading rate is recorded. The compressive strength is taken as the average result from a set of three test for each respective percentage of replacement. After which the

Water absorption test and the efflorescence test is performed.

Experimental Investigation

A. Compression Test

The brick specimens are allowed to curing for a total period of 21 days. The frog of the brick is filled with 1:3 cement mortars and the specimen are tested in 3, 7 and 21 days. The specimen is placed in compression testing machine with 6 mm plywood on top and bottom of it to get uniform load on the specimen. Then load is applied axially at a uniform rate of 14 N/mm². The crushing load is noted. Then the crushing load is tabulated as follows.

SAMPLE 1

	Control mix	5 %	10 %	15 %	20 %
7 th day	4.4	4.5	4.7	4.8	3.6
14 th day	8	6.1	5.8	7.9	5.2
21 st day	11	8.1	7	11.1	6.6

SAMPLE 2

	Control mix	5%	10 %	15%	20 %
7 th day	4.7	6.1	4.4	4.6	3.7
14 th day	8.2	7.8	5.7	8.4	5.4
21 st day	11.2	10.2	6.9	11.7	6.4

*All values are in N/mm².

Compressive Testing Machine



B. Water absorption test

The bricks specimens are dried completely in an oven at 100+/-5°C and then weigh it as W1 .Then immersed the brick in water for 24 hours and wipe out the water from the bricks and again weigh it as W2.

$$\text{Water absorption} = (W2 - W1) / W1 \times 100$$

SAMPLE 1

	Control mix	5%	10%	15%	20%
W1	3.8	3.7	3.6	3.6	3.7
W2	4.2	3.9	4.0	4.1	4.2
%	9.7	5.4	11.1	13.8	13.5

*All values are in Kg.

SAMPLE 2

	Control mix	5%	10 %	15 %	20 %
W1	3.7	3.7	3.6	3.8	3.7
W2	4.1	4.2	3.9	4.2	4.0
%	10.8	13.5	8.3	10.5	8.1

*All values are in Kg.

C. Fineness of M-sand residue- Dry sieving

Weigh 100 grams of M-sand residue and place it on a standard 90 micron sieve. Breakdown any air-set lumps in the residue sample with fingers. Sieve the sample by holding in both hands with a gentle wrist motion for a period of 15 minutes. Weigh the residue. The value should not exceed 10% as specified in IS 8112-1976.

$$\text{Fineness} = (\text{Weight of residue} / \text{Weight of sample}) \times 100$$

SAMPLE 1

$$\begin{aligned} \text{Fineness} &= (9/100) \times 100 \\ &= 9 \text{ grams} \end{aligned}$$

SAMPLE 2

$$\begin{aligned} \text{Fineness} &= (9.5/100) \times 100 \\ &= 9.5 \text{ grams} \end{aligned}$$

The results show that both samples are suitable for usage as the fineness doesnot exceeds 10 %.

RESULTS AND DISCUSSION

The experimental investigation gives the following conclusions

- 15% replacement of fly ash by M-sand residue showed increase in compressive strength at 21 days and equal strength at 7 and 14 days while comparing to the normal brick.
- Fly ash can be replaced by the M-sand residue by 15% showing increase in strength and in 20% results decrease in the compressive strength..
- With increase in M-sand residue content, percentage of water absorption remains unchanged.

CONCLUSION

- The M-sand residue may be used for partial replacement of fly ash in Fly ash Brick.
- The optimum % of M-Sand residue found to be 15 % for better engineering results like compressive strength, etc.
- It seems to be one of the effective method for disposal of M-Sand residue.

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