Utilization of Industrial Sludge for Preparation of Bricks*

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Abstract **-** This study involves the usage of sludge, construction and demolition waste as an essential ingredient. Bricks were prepared and was checked for its physical characterization such as bulk density, compressive strength, impact test etc. and chemical properties such as water absorption percentage, pH test for the commercial purpose. The study was performed by using ratio as 2:3:3:2 of fly ash, demolished mortar, sludge and demolished brick respectively for making brick samples.

Keywords-*Construction and demolition waste, kiln, environment, sludge.*

I. INTRODUCTION

In this project we try dry sludge to replace as a soil in brick. Construction and demolition wastes need to be disposed of properly, so that the aesthetics of the place is maintained properly. Landfill method is not the most suitable method for the disposal, as expensive land is used up as landfill site and with the growing demand, landfill sites have become more difficult to manage. Development of a substitute method for the disposal is required so that these waste can be utilized as construction materials, therefore lowering the cost of construction and making low cost housing possible.

A. *.Importance of sludge*

1) Bricks manufactured from dried sludge collected from an industrial wastewater treatment plant were investigated.

2) Increasing the sludge content results in a decrease of brick shrinkage, water absorption.

3) The use of sludge in brick manufacturing is considered to be the most economic and environmentally sound option.

4) The large amount of organic matter present in sludge results in high shrinkage of the bricks during fire.

B. Aim and objectives

1) To suggest alternative to conventional brick.
2) To achieve strength and feasibility.
3) To examine the effect of dry sludge in brick Properties.
4) Conservation of natural resources.
5) Economical design and light weight brick.
6) Reduce in construction cost.

II. LITERATURE REVIEW

For this project following research papers are studied:

Aeslina Abdul Kadir et al. (2012)

This paper reviews the recycling of different wastes into fired clay bricks. A wide range of successfully recycled materials and their effects on the physical and mechanical properties of bricks have been discussed. Most manufactured bricks with different types of waste have shown positive effects by producing lightweight brick, increased porosity and improved the thermal conductivities of fired clay bricks.

Akash V.A et al. (March 2018)

This study is focused on the reuse of sludge in clay-brick production as the chemical composition of sludge is similar to that of brick clay. In this study different series of clay and sludge proportioning ratios were studied which included the addition of sludge with ratios 5,10,15,20 and 25 percent of total weight of sludge clay mixture.

Alaa.A.Shakir et al. (2013)

In the review of utilization of those waste, this paper reviewed recycling various waste material in bricks production. The effects of those wastes on the bricks properties as physical, mechanical properties will be reviewed and recommendations for future research as out comings of this review will be given. This reviewed approach on bricks making from waste is useful to provide potential and sustainable solution.

Avinash More et al. (March 2018)

This study involves the usage of sludge, construction and demolition waste as an essential ingredient. The study was performed by using different ratios as 3:2:2:3, 3:2:3:2, 2:3:2:3 of fly ash, cement, sludge and demolition waste respectively for making brick samples.

.R.sumathi (dec 2016)

A study was carried out to determine the potential reuse of construction debris as a brick making material. The study investigates the potential for reusing construction debris as a replacement for sand. The brick characteristics, both strength and aesthetic tests such as water absorption test, compressive strength test and efflorescence are to be conducted on bricks made using construction debris and normal bricks which are to be compared.

III. MATERIAL USED

The component material used for preparation of brick are as follows:

A. Clay is replaced by sludge

Fig. 1 Sludge

B. Sand is replaced by demolished mortar

Fig. 2 Demolished mortar

C. lDemolition bricks

Fig.3 Demolition brick

D. Fly ash

Fig.4 fly ash

IV. METHODOLOGY

The study aims at comparing the performance of bricks made of waste materials like, sludge (industrial sewage), Fly ash and Demolition waste with respect to bricks designed using soft clays. The performance of our prepared Brick is compared with conventional brick.The component material used for preparation of brick are mentioned above in material used.

A. Collection and preparation of sample

1) *Collection of Sludge:* Waste sludge is collected in sludge drying bed which is generated from STP. There are drying bed which holds the waste sludge. Sludge is brought from these holding tank and then left over the bed for drying.
2) *Drying of Sludge:* The waste sludge which is left on bed for drying is allowed to dry for 7 to 10 days. The drying method is totally natural. Natural solar energy is used for the drying of sludge. Water present in sludge is evaporated in atmosphere by the heat of sun.
3) *Collection of construction and demolition waste:* Construction and demolition waste is collected from a selected construction site.
4) *Crushing and sieving:* The demolition waste such as demolished mortar and bricks are crushed using hammer and then it is sieved through a sieve of 1.75 mm size.
5) *Selection of proportion:* Selection of proper suitable proportion of different kind of material for achieving good strength is very important. After selection of proper proportion for brick the dry homogenous mixture is prepared. With adding the appropriate water wet homogenous mixture is formed and finally the mixture is ready for moulding. A particular ratio of the elements are taken as 2:3:3:2 for fly ash, demolished mortar, and sludge & demolished brick respectively.

B. Casting of brick

The process is as follows.

A particular ratio of the elements are taken of 2:3:3:2 for fly ash, demolished mortar, and sludge & demolished brick. The sludge is then dried at atmospheric temperature for 7 to 10 days. Now the demolition waste such as bricks and mortar is crushed using hammer and then sieved through a sieve size of 1.75 mm. The mixture is then added thoroughly and it is

placed in the mould, compacted and is left to dry in atmospheric condition. When the sample is dried enough, it is taken out of the mould by the help of oil and grease. The sample is now ready to fire.

C. Testing of brick

After the casting of brick specimen following test is to be carried out:

1) Compressive strength test

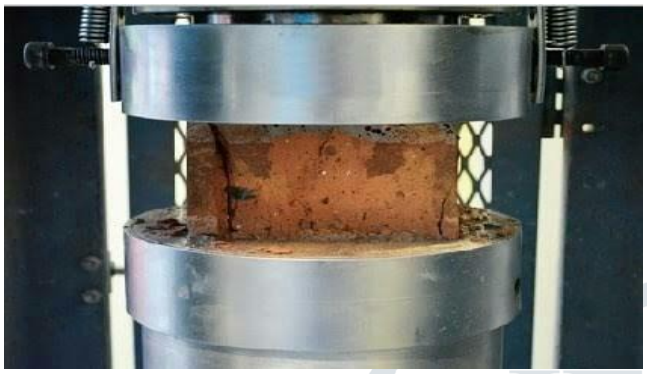

Fig. 5 Compressive strength test taken on CTM

2) Soundness test

Fig. 7 Soundness test conducted by using two bricks

3) Water absorption

Fig. 6 Water Absorption test on brick

4) Efflorescence test
5) Bulk density
6) Hardness test
7) Resistance to erosion by water

Comparative study of conventional brick and brick made by using industrial sludge and demolished mortar and brick and fly ash was carried out.

V . Result and Discussion

The results obtained from designed brick after carryingout some tests:

A. Compressive strength

Compressive strength test on bricks are carried out to determine the load carryingcapacity of bricks under compression. This test is carried out with the help of compression testing machine and the Results are as follows:

TABLE I
COMPRESSIVE STRENGTH BASED ON PERCENTAGE OF SLUDGE

No. Of BrIck	% of sludge	Compressive Strength (N/Mm2)
1	10	3.42
2	20	3.0
3	30	2.8

B. Water absorption

Water Absorption test is conducted on brick to find out the amount of moisture content absorbed by brick and the results are as follows:

TABLE II
WATER ABSORPTION BASED ON PERCENTAGE OF SLUDGE

No. Of Brick	% of sludge	Weight before test(kg)	Weight after Test(kg)	% of Water Absorption
1	10	4.2	4.83	15%
2	20	4	4.33	8.25%
3	30	3.9	4.28	9.74%

IV Conclusion

The brick prepared using the ratio of 2:3:3:2 containing fly ash, demolished mortar, sludge and demolished brick, respectively was found to be the better suitable ratio in manufacturing brick and is Comparatively economical and also has a potential to be used instead of normal bricks.

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