International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 8 Issue 02, February-2019

Experimental Study on Strength of Brick using ETP Sludge and Cement

M. Gunavel
Department of Civil Engineering
Vivekanandha College of Technology for Women
Erode, India

M. Lubaba Shahathiya
Department of Civil Engineering
Vivekanandha College of Technology for Women
Erode, India

***Abstract*— The production of sludge in textile industry is about to increase every year and most of the sludge was directly disposed to the landfill. A study is done to describe the reuse of textile mill sludge (ETP sludge) by incorporating then for making sludge bricks. The physical and chemical properties of the sludge are analysed in the laboratory. The quantity of sludge used is varied in volume as 1.5 and 1.7. The amount of cement added to the brick manufacturing is kept constant as 0.75 by volume. Thus, the ratios used are 0.75:1.5 and 0.75:1.7 as Cement: Sludge. The parameters such as compressive strength, efflorescence, water absorption are studied as per BIS procedures and are compared with fly ash bricks. Thus, the ETP sludge can be used effectively at 0.75:1.7 ratio to make brick as it gives compressive strength above 10 N/mm^2, low water absorption and nil efflorescence.**

Keywords*— *ETP Sludge, Cement, Compressive Strength, Efflorescence, Water Absorption.

I. INTRODUCTION

Effluent Treatment Plant sludge (ETPs) is classified as solid waste generated during the primary treatment of textile effluents. Due to rapid Industrialization and Urbanization serious environmental problems are created. One of the major concerns amongst these is safe and sound disposal of solid wastes. Textile mills are one of the largest and oldest sectors in India. In Maharashtra (India) cities like Sholapur and Ichalkaranji are famous for textile exports. Every year textile exports generates large amount of revenues for Indian economy. Textile mill uses large amount of fresh water for wet operations such as Resizing, Blending, and Dyeing etc. The wastewater generated from this process is treated in ETP by adding chemicals to remove traces of cotton and dyes. During this process sludge gets accumulated in primary and secondary clarifiers, which is further dried in sludge drying beds. Sludge generated in ETPs is not only problem for the industry but also affects the environment adversely. Many textile mills dispose these materials in Land filling. So, there is a need to look for various reuse options of waste materials for sustainable development. ETP bricks are cost effective and energy efficient alternative materials to the normal burnt clay bricks used for construction of buildings. ETP bricks are used for load bearing masonry as well as non-load bearing masonry. The paper focuses the study of various characteristics of ETP bricks using suitable sludge samples through an experimental investigation.

II. MATERIALS AND METHODS

A. Materials

Dried textile mill sludge is collected from SIPCOT industry, Perundurai, Erode District, Tamil Nadu State, India. The collected sludge material is packed and stored in polythene bags for further usage. The cement used is PPC 53 grade for making of the brick. Water is added to get the desired mix proportion.

B. Methodology

Providing detailed technical and economic information on the production of compressed stabilized bricks by assessing the potential of local materials i.e. type of cement and a sludge sample are selected and prepared. To this effect the following test programs are followed. The mix proportions are made based on literature recommendations.

The mix proportions of bricks (0.75:1.5 & 0.75:1.7) are prepared to compare the difference in compressive strength values with age, rate of strength development of the block produced using different mix ratio and water-cement ratio is 0.3.

III. EXPERIMENTS

A. Compressive Strength Test

The compressive strength is one of the most important tests for assuring engineering quality of building material. In this strength of brick was determined by using Compression Testing Machine (CTM). The three number of whole bricks from sample collected should be taken the dimensions should be measured to the nearest 1mm. Remove unevenness observed the bed faces to provide two smooth parallel faces by grinding. Immerse in water at room temperature for 24 hours. Remove the specimen and drain out any surplus moisture at room temperature. Place the specimen of bricks with flat faces horizontal and mortar filled face facing upwards between plates of the testing machine. Apply load axially at a uniform rate per minute till failure occurs and note maximum load at which the specimen fails to produce any further increase in the indicator reading on the testing machine.

TABLE I. COMPRESSIVE STRENGTH TEST

S. No	Compressive Strength (N/mm^2)			
	Types of brick	*Sample 1*	*Sample 2*	*Average*
1	Fly ash brick	9.5	10.5	10
2	Sludge brick (0.75:1.5)	9.72	10.82	10.27
3	Sludge brick (0.75:1.7)	10.24	12.02	11.13

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 8 Issue 02, February-2019

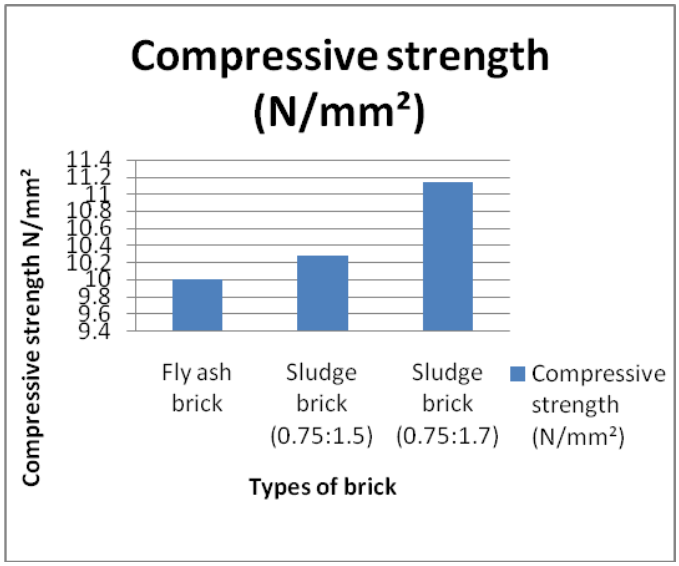

Fig. 1. Compressive strength test

B. *Water Absorption Test*

Before the compression test, a total brick of 4 bricks were to water absorption test. First, the brick specimen was weighed (W_1), then it is immersed in water at room temperature for 24 hours, and finally it was removed from the water tank and patted dry with a lint-free cloth. After their removal from the water, these specimens were weighed again (W_2).

Water Absorption = [$W_2 - W_1 / W_1$] x 100%

TABLE II. WATER ABSORPTION TEST

S. No	Water Absorption (%)			
	Types of brick	*Sample 1*	*Sample 2*	*Average*
1	Fly ash brick	12.62	12.2	12.43
2	Sludge brick (0.75:1.5)	7.24	7.56	7.4
3	Sludge brick (0.75:1.7)	9.13	9.63	9.38

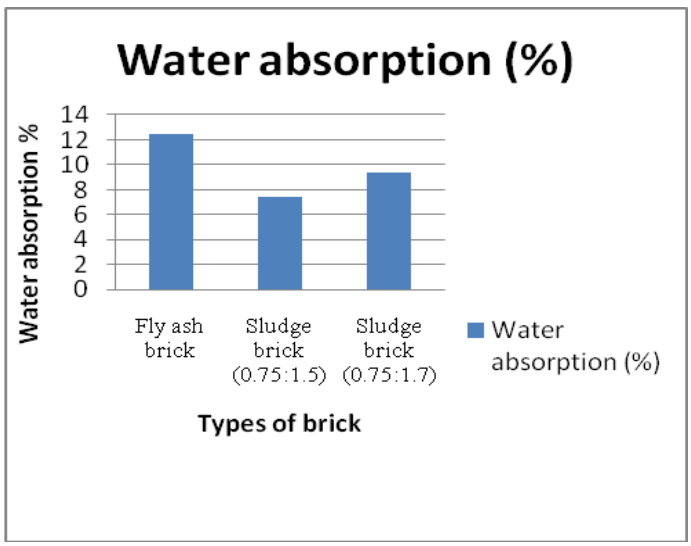

Fig. 2. Water absorption test

C. *Efflorescence Test*

The presence of salts in brick is not desirable because they form patches of grey powder by absorbing moisture. The brick specimen is placed in a tray containing distilled water to a depth of 25mm in a well ventilated room. After all the water was absorbed again add water for a depth of 25mm. After second evaporation observe the bricks for white/grey patches.

TABLE III. EFFLORESCENCE TEST

S. No	Efflorescence Test		
	Types of brick	*Sample 1*	*Sample 2*
1	Fly ash brick	Nil	Nil
2	Sludge brick (0.75:1.5)	Nil	Nil
3	Sludge brick (0.75:1.7)	Nil	Mild (<10%)

IV. RESULT AND DISCUSSION

TABLE IV. TEST RESULTS ON COMPARISON OF BRICKS

S. No	*Tests*	*Fly ash brick*	*ETP brick*
1	Efflorescence	Nil	Nil
2	Metallic sound	Yes	Yes
3	Drop from 1m height	Not broken	Not broken
4	Colour of brick	Grey color	Greenish grey color
5	Weight of brick (kgs)	3.01 to 3.09	2.90 to 3.03

V. CONCLUSION

Research on the usage of waste materials is very important as the quantity of waste materials is gradually increasing due to increase in population and also increase in urban development. The non-dissolving composite of mix 0.75:1.7 was manufacture successfully. The bricks were found to be economical and the compressive strength of bricks was similar to fly ash brick.

The strength obtained from the compressive strength test, water absorption test and also efflorescence test has found to possess high strength when compared to the fly ash bricks. Use of ETP Sludge in making bricks is recommended and it will increase the usage of sludge in building bricks, thus eliminating the problem of land filling. From this study, the ETP sludge brick possess high strength when compared to fly ash bricks.

ACKNOWLEDGMENT

This research was conducted as a UG project in Civil Engineering. I thank my guide Mr. M.Gunavel for his help and guidance in data collection and conducting this research.

REFERENCES

[1] Aeslina Binti Abdul Kadir, Ahmad Shayuti Bin Abdul Rahim,"An overview of sludge utilization into fired clay brick"- International Journal of Environmental, Ecological, Geological and Marine Engineering Vol:8 No:8, 2014.

[2] Balasubramanian J., et all., (2005), "Reuse of textile effluent treatment plant sludge in building materials", Elsevier Ltd,. Online paper, 11 January 2005, pp. 1.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 8 Issue 02, February-2019

[3] Farhad reza.p "Use of recycled brick in aggregates" Research Project, Volume 3, Issue 2, November 2011.

[4] G. Murali, K. Karthikeyan "Utilization of Textile Effluent Treatment Plant Sludge in Construction Materials" (ISSN 2347-1697 Volume 2, Issue 6, February 2015).

[5] *Hilary Nath (2006), "Sludge-Bricks Development", Reach Journal, brandix inspired solutions, Issue 3, pp. 6.*

[6] IS-3495 (part – 2)-1976 –"Determination of Water Absorption Test, Methods of test of burnt clay bricks", Bureau of Indian Standards, New Delhi.

[7] IS-3495 (part – 3)-1976 –"Determination of Efflorescence Test, Methods of test of burnt clay bricks", Bureau of Indian Standards, New Delhi

[8] J.Alleman, T. Stumm, Sludge amended brick production: Applicability for metal-laden residues, J Water Sci Technol, 22(12), 1990, 309-317.

[9] Jahagirdar SS, Shrihari S, Manu B. Utilisation of Textile Mill Sludge in Burnt Clay Bricks, International Journal of Environmental Protection 2013; 3(5): 6-13.

[10] Muhammad Ikhlasul Rahman, "Utilization of Blended Waste Materials in Bricks"- Technologies 2018, 6, 20.

[11] Ravikrishnan.S, Dr.S.Senthil Selvan -" Novel Green Bricks manufactured from Textile ETP Sludge" International Journal of Scientific & Engineering Research, Volume 5, Issue 6, June-2014 76 ISSN 2229-5518.

[12] T.Ragunathan, P.Gopalsamy, R.Elangovan "Study on Strength of Brick with ETP Sludge from Dyeing Industry"- International Journal of Civil and Structural Engineering (ISSN 0976 – 4399 Volume 1, No 3, 2010).

[13] V Palanisamy, "Utilization of Textile Effluent Waste Sludge in Brick Production"- International Journal of Sciences: Basic and Applied Research (IJSBAR), ISSN 2307-4531, Volume 4, No 1, pp 1-10, 2011.