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Experimental Study on Strength of Brick Using ETP Sludge and Cement

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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 use disvaried 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,theratios used are 0.75:1.5 and 0.75:1.7 asCement:Sludge.Theparameters such as compressive strength, efflorescence, water absorption are studied as per BIS procedures andarecomparedwithconventional and fly ash bricks. Thus, the ETP sludge can beusedeffectivelya 0.75:1.7 ratio to make brick as it gives compressive strength above 10 N/mm ^{2}, low water absorption and nil efflorescence.

1. 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 environmetalproblemsarecreated.On of them ajorconcerns amongs tthese is safe and sound disposal of solid wastes. Textile mills are one of the largest an doldest sectors in India. In Maharashtra (India) cities like Solapurand 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 forwet operations such as Desizing, Blending, Dyeing etc.

Thewaste water generated from these process is treated 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. The generated sludge The effluents generated are treated an effluent treatment plants. ETP bricks is cost effective an energy efficient alternative materials to the normal burnt clay bricks used for construction of buildings. ETP bricksareused 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.

2. Materials and Methods

The properties of material used for making brick are determined in laboratory as per relevant codes of practice. Different materials used in present study were cement, ETP Sludge, in addition to fire brick. The aim of studying of various properties of materials is used to check the appearance with codal requirements and to enable an engineer to design a bricks for a particular strength.

2.1 Cement

Cement is building material which act as a binding agent of material. It is used as a binding material in which binding together various building material such as sludge, brick and stone etc.

2.2 ETP Sludge

The ETP Sludge used in this investigation wasbrought from SIPCOT Industry in Perundurai area. It was found out with different sizes and deleterious substances. It was then pulverized and sieved to the appropriate size. The physical properties and chemical compositions of the sludge are determined.

Table:1 Properties of ETP Sludge

Property	Value
Colour	Brown
Appearance	Agglomerated fine solids
Average Particle size	0.295 mm
Cadmium	5.6 mg/kg
Copper	119 mg/kg
Chromium	358 mg/kg
Zinc	190 mg/kg
Calcium	28.4 %
Iron	9.1 %
Silicon	7.1%
Aluminium	0.698 %

Fig:1

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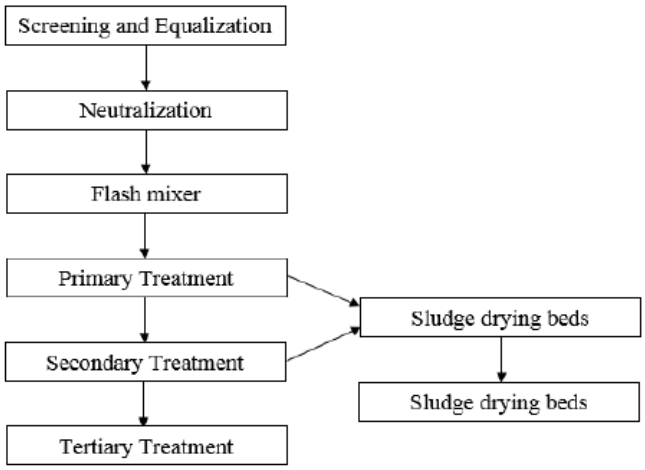
ETP Sludge before and after Pulverization

Properties and Analysis of Sludge for Sludge Cement Bricks



Process sequence of ETP Sludge in SIPCOT Industry

2.3 Water

Water is an important ingredient of bricks as it actively participates in the chemical reaction with cement. Since it help to form the strength giving cement gel.

2.4 Admixture

Polycarboxylate Ether Superplasticizer

Brick consists of Sludge, cement, and water. Anything other than these if added in brick either before or during mixing to alter the properties to our desired requirement are termed as admixtures. The use of admixtures offers certain beneficial effects to brick like improved workability, Strength, setting time, reduce water cement ratio.

2.5 Brick

Brick is used as a building material for bearing structure. The brick consists of header and stretcher faces. The brick consists of frog at the top surface which is used to bind the mortar and bricks in brick masonry.

2.6 Test Results and Discussions

2.6.1 Test on Sludge

Table.2 Specific Gravity of Sludge

S.No	Description	Trail-1	Trail-2	Trail-3
1.	Weight of pycnometer (W1) kg	0.615	0.615	0.615
2.	Weight of pycnometer + Weight of ETP Sludge(W2) kg	0.850	0.848	0.852
3.	Weight of pycnometer + weight of ETP sludge + weight of water (W3) kg	1.59	1.58	1.57
4.	Weight of pycnometer + Weight of water (W4) kg	1.45	1.44	1.46
5.	Average	2.28	2.35	2.31

Specific Gravity of ETP Sludge is 2.32

2.6.2 Mix Proportion

The materials for manufacturing the interlocking brick consists of cement and sludge with ratio of 1:1.5 & 1:1.7(Cement: Sludge) by volume. The use of volume rather than weight is due to simplicity of the manufacturing. Sludge and Cement were mixed together in the manual mixer. Water was gradually added in mixer. Until having right consistency which ready for moulding.

The mix proportions of bricks (1:1.5 & 1:1.7) 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.

2.6.3 Test on Bricks

1. Compressive strength test
2. Water absorption test
3. Efflorescence test
4. Soundness test
5. Shape & Size
6. Hardness test

Table:3 Compressive strength test

S. No	Name of Brick	Compressive Strength of Bricks(7 Days) N/mm^2		
		1	2	Average
1	Conventional Brick	4.6	5.2	4.9
2	Sludge Brick (1:1.5)	7.6	8.2	7.9
3	Sludge Brick (1:1.7)	6.9	7.2	7.06

Tabl:4 Compressive Strength Results for 28 Days Test

S. No	Name of Brick	Compressive Strength of Bricks(28 Days) N/mm^2		
		1	2	Average
1	Conventional Brick	9.5	10.5	10
2	Sludge Brick (1:1.5)	9.72	10.82	10.27
3	Sludge Brick (1:1.7)	10.24	12.02	11.13

Table:5 Water Absorption Test Results

S. No	Name of Brick	Water Absorption Test of Bricks (%)		
		1	2	Average
1	Conventional Brick	12.35	13.29	12.82
2	Sludge Brick (1:1.7)	9.13	9.63	9.38
3	Sludge Brick (1:1.5)	7.24	7.56	7.4

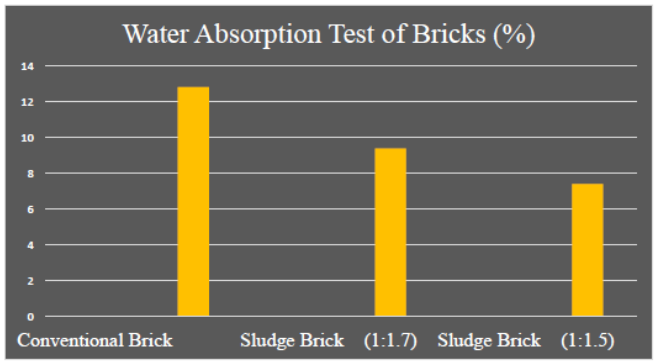


Table:6 Test Results on Comparison of Bricks

S.No	Test	Conventional Brick	ETP Brick
1.	Efflorescence	Nil	Nil
2.	Metallic sound	Yes	Yes
3.	Drop from 1m height	Broken/ Not Broken	Not Broken
4.	Colour of Brick	Copper colour	Light Brown colour
5.	Weight of Brick	3.32 to 3.60Kgs	2.90 to 3.03Kgs

2.7 Conclusions

Research on the usage of waste materials is very important as the quantity of waste materials is gradually increasing as a result of increase in population and increase in urban development. The non-dissolving composite of mix 1:1.7 was manufacture successfully. The bricks were found to be economical and the compressive strength of bricks was similar to first class bricks.

The strength attained from the compressive strength test, water absorption test has found to be possess high strength and compare to the normal burnt clay 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 landfilling. From this study, the ETP sludge brick masonry wall possess high strength when compared to normal burnt clay brick masonry wall.

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