International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 07 | July 2020 www.irjet.net p-ISSN: 2395-0072

INVESTIGATION AND EXPERIMENTAL STUDY ON CONVENTIONAL BRICKS AND INDUSTRIAL SLUDGE BRICKS

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Abstract –

For thousands of years, bricks have been made from clay. Industrial sludge is very synonymous to the raw material of brick formation. So, the sludge can be a good alternative to the clay. This sludge gets produced in industries because of various manufacturing processes as a by -product .This sludge has to be disposed in appropriate manner so that the balance of the environment should not get disturbed because of their ingredients. If the sludge is organic in nature then it should be disposed in a peace of manner because of susceptibility to the decomposition the sludge is inorganic and non-reactive to the surrounding, then it can be used for the various productions of other products. Gypsum sludge is also supposed to be very useful in the manufacture of other materials such as bricks, paving blocks, etc.

1.INTRODUCTION

Brick is the oldest manufactured building material, and much of its history is lost in antiquity. The oldest burnt or fired bricks have been found on the sites of the ancient cities of Babylonia, some of which are estimated to be about 6000-8000 years.

Brick fundamentals of brick manufacturing have not changed over time. However, technological advancements have made contemporary brick plants substantially more efficient and have improved the overall quality of the products. A more complete knowledge of raw materials and their properties, better control of firing, improved kiln designs and more advanced mechanization have all contributed to advancing the brick industry. is the simplest and most ancient of all building materials. Few other fabricated building units have enjoyed such widespread and continuous popularity. This enduring public acceptance is based on the unique combination of the properties offered by brick to the owner and builder.

2. Literature survey

Sp Raut, RV Ralegaonkar, SA Mandavgane-

Development of sustainable construction material using industrial waste:

Accumulation of unmanaged industrial waste especially in developing countries has resulted in an increased environmental concern. Recycling of such wastes as a sustainable construction material appears to be viable solution not only to pollution problem but also an economical option to design of green buildings

Hanifi *et al*., 2005 –

Presented an earthquake-resistant material with high compressive strength. He elaborated the compressive strength of fiber reinforced mud bricks made out of clay, cement, basaltic pumice, lime and gypsum using plastic fiber, straw, polystyrene fabric as fibrous ingredients, each at a time. It was demonstrated that the fiber

reinforced mud brick fulfil the compressive strength requirement of Turkish codes, whereby reducing the weight and material handling cost for housing. Furthermore, it can store more elastic energy compare to the other type of mud brick which renders it more resistance to earthquake

In the year 2013 Zhang(29) presented an extensive review-

In an environmental sustainability context one of the innovation lines in the sector is to incorporate domestic, industrial and agricultural waste in the production of bricks. Eco-friendly bricks do not only reduce waste. But also try to improve their properties or manufacture process. Reducing the depletion of clay raw resources and the energy consumption during fire

3. METHODOLOGY

3.1 MATERIALS USED

- **Gypsum sludge**
- **Clay**
- **Water**

Gypsum sludge: *Basically these types of sludge produce in chemical industries which are manufacturing chemicals, fertilizers, etc. Gypsum sludge is nothing but a by-product of these manufacturing processes. This sludge is then treated primarily and then transported for their use in other processes and remaining is stored in-situ.*

Clay: *Clay is one of the most abundant natural mineral materials on earth. For brick manufacturing, clay must possess some specific properties and characteristics. Clay is finely grained natural rock or soil material that combines one or more clay minerals with possible traces of quartz, metal oxides and organic matter.*

Water: *The water use for mixing of bricks and should be potable drinking water having PH 6 to 8.*

3.2COLLECTION OF MATERIAL:

When any certain chemical get processed in any chemical industry, then there will be various by-products which get produced in that process. This by-product then expelled from the main manufactured product and will be stored in storage bins or open ground storage systems which are adopted for the storage purposes.

3.2.1Crushing and Grinding:

The collected raw materials were then checked according to the requirements of the manufacturing process that, are they in a state to use them as it is for further processes. But after the checking, we found that the raw material was in a state of heavy solid masses with presence of water and moisture. This moisture has to be expelled out and they should be in pulverized form.

3.2.2Gypsum proportioning:

The main aim of the project is to find out the alternative material for clay in brick manufacturing with best results possible associated with its strength, water absorption, weight, etc. Therefore this step was most important apart from all the steps involved in the whole manufacturing process. The project was completed on the trial and error basis of practical considerations. Therefore we decided to work out every possible proportion.

3.2.3Blending:

The process followed by the proportioning is the process of blending. Blending is nothing but the mixing of all the ingredients which concludes the final mixture in which all the ingredients got completely mixed with each other.

3.3MANUFACTURING PROCESS OF INDUSTRIAL SLUDGE BRICKS

By considering the above aspects of choosing raw material, we selected Gypsum and Iron Oxide as alternative materials for the traditional clay. Konkan areas under the Raigad and Ratnagiri region including some part of the Sindhudurg district consists of Laterite rocks and weathered soil components which cannot be used as manufacturing material for manufacturing of bricks. Therefore we decided to go with the by-products (wastes) coming out from industries situated in MIDC, Mahad. The above specified Gypsum sludge is collected from Sudarshan chemicals, MIDC, Mahad.

3.3.1Moulding

Blending is the pre-requisite to the moulding. Moulding is immediate, because the blended material containing mixture with water has some possibilities to segregate, reduction in amount of water, that's why to prevent the adverse effects the moulding gets initiation.

*The moulds used in this process were 22*10*7 cm in size. The blended material was used to make heavy solid balls of size referring to the size of moulds. The moulding process started with wetting the moulds by application of water. Then normal ash was used to apply on the walls of moulds.*

3.3.2Drying of industrial sludge Bricks:

The process involving passive phase of the work concludes drying of the bricks. Bricks are allowed to dry as soon as the moulding completes. The filled moulds were emptied in such an area where the sunrays are about to fall directly on wet green bricks. The main purpose of this process is making removal of water used in the blending process.

The main purpose of using water in the previous steps was to create cohesion between particles of mixture. The water will be the adhesive agent in the respective process.

3.3.3Firing of Bricks:

Firing is defined as the process in which bricks were allowed to burn under controlled conditions by means of fuel. This process was another most important process in manufacturing. The main characteristics of bricks can be achieved through this step only. This process will define actual texture of the bricks, its appearance, etc.

3.4MATERIAL TESTING:

These abilities of bricks will be checked by conducting following tests on it.

1. *Shape and size test*
2. *Water absorption test*
3. *Efflorescence test*
4. *Crushing strength test*

4 RESULTS AND DISCUSSION:

4.1.1 Water absorption test for conventional bricks observation:

- *CONVENTIONAL BRICK WEIGHT: 1.8-2 Kg*
- *WATER ABSORPTION : 25-30%*
- *CALCULATION FORMULA FOR WATER ABSORPTION :*

$$W = \frac{M2 - M1}{M1} \times 100$$

$$W = \frac{2.27 - 1.8}{1.8} \times 100$$

$$W = 26.11\%$$

4.1.2Water absorption test for industrial sludge bricks observation

Sr. No.	Proportion (S:C)	Weight (kg)				Average increase (%)
		Before		After		
		I	II	I	II	
1.	30:70	1.7	1.835	2.23	2.25	28
2.	40:60	1.68	1.5	2.27	2.1	35
3.	50:50	1.645	1.63	2.39	2.39	45
4.	60:40	1.5	1.44	2.18	2.12	46
5.	70:30	1.36	1.49	2.14	2.32	56
6.	80:20	1.38	1.36	2.2	2.1	57
7.	90:10	1.43	1.395	2.27	2.28	60

2 CTM Results

Sr. No.	Proportion	Load (KN)	Area (mm^2)	Strength (Mpa)
1	30	33.3	20140	1.65
2	40	32.5	20140	1.61
3	60	29.5	20140	1.46
4	70	20.7	20140	1.02
5	80	30.5	20140	1.51
6	90	28.8	20140	1.43

Conventional bricks results:

Test	Result
Raw material is collected	By digging earth
Temp requirement	1000-1200°C
Weight:	3-3.5kg
Water Absorption	25-30%
Crushing strength	3Mpa

Industrial sludge bricks results:

Test	Result
Raw material is collected	From chemical industries
Temp requirement	1400-1500°C
Weight:	1.5-2.5kg
Water Absorption	30-60%
Crushing strength	1.2-2Mpa

5.0 CONCLUSIONS:

- *The industrial sludge bricks are a good alternative in case of deficiency of traditional clay bricks.*
- *Gypsum is found to be an economic and efficient alternative material for clay.*
- *It should be noted that limited alteration to clay up to certain percentages of raw material results in bricks formation having sufficient strength, well-finished surfaces, and economy in manufacturing.*

- *From the above project work, it is concluded that the proportion 80:20 (Sludge: Clay) provides best results from all the aspects like strength, water absorption, efflorescence and weight.*
- *Therefore, increasing amount of sludge by reducing clay percentages gives efficient product, which can be used as used as alternative material for clay in those areas where availability of clay is less and very costly.*

6.0 ACKNOWLEDGEMENT:

*We hereby express our intense sense of gratitude to our respect and beloved **Asst.Prof. Mali.V.M** without whom we could not be able to present this project with such great confidence and determination. he has always been a great force of inspiration for all the team.*

We are also thankful to all our lectures in civil engineering department who guided us in completion of this project.

*We are obliged to our principal **Dr. D. N. Jaiswal** and our head of department **Asst.Prof. Galinde Y.R**. and to all the staff members of civil engineering department for their equal encouragement during the completion of this project.*

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