

COMPARISON OF MUD BRICK, SAND MUD BRICK AND PLASTIC SAND MUD BRICK

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Abstract - In present scenario the Disposal of plastic product (polythene, bottles, plastic carry bags etc.) is a great challenge to our environment because plastic product is non-degradable in nature. As we know that we can not decompose biologically to the plastic hence the plastic waste is increasing in our surrounding in large amount. There are many of the research are going on to use the plastic waste in various types of construction work. In this research work the plastic sand bricks is made by adding plastic waste (bottle, polythene, plastic carry bags etc) in melted form. Plastic waste is melted up to 200°C. This technique of Plastic sand bricks will help to reuse the plastic waste as an additional material of bricks and will get fruitful result in the disposal of plastic waste. The specimen of brick are made of melted plastic which contain varying percentages of plastic which was later tested for the compressive strength. After testing, It shows an considerable improvement in performance of that bricks which can be achieved by melted plastic waste into bricks. In accordance of sustainable use of plastic waste as a construction material or to short out the problem of disposing the plastic waste or to make the environment safe against plastic waste, in this study, standard size bricks of different compositions as 5%, 10% and 15% plastic are produced which were mixed in raw material (clay+sand) to develop plastic sand bricks. After the casting of bricks, it were tested for compressive strength and for water absorption test. After testing recommendations are given according to the outcome of this study. In compression test, It was found that the compressive strength is going to be increased on increasing of plastic percentage but it can be raise more by addition of super plasticizer.

Key Words: Plastic Waste, Compressive Strength, mud brick, mud-sand brick, mud-sand-plastic brick, Environmental Issue

1. INTRODUCTION

Presently, Plastic is playing an important role in daily life of human being. By its importance it is a common material and world widely using by everybody. Due to its compact shape and light weight, it has various advantages. There are some of the Common plastic waste that are using in daily life are bags, containers, bottles, and food packages etc. the disposal of plastic waste is great problem now days. Plastic is made by polymer chemicals hence they are non bio degradable in nature. That means on buried, plastic will not decompose. Besides all of these disadvantages, the plastic is a useful material because of its various properties like flexible, rigid and robust but after use of plastic it become waste and make pollute the environment.

The material which is not biologically degrade, recycling is used. Recycling is the process by which a new product is made by waste material. Presently increase in the development of using eco-friendly, lightweight and low cost construction materials in civil engineering, the plastic waste is coming in light and need to explore how can be make plastic waste as eco-friendly. Resultly, To protect the atmosphere as well as to take the advantage of plastic waste, recycling procedure is used.

In this sequence, the bricks were made with the help of plastic waste to solve the problem of waste product and to optimize the cost of building materials. In this study, plastic waste as mentioned above various specimen were made and after then tested for compressive strength and there result is compared.

There are three type of specimen (brick) are made from clay. with varying percentage sand and plastic.

Plastic is a material which use is increasing daily but hazardous material. In municipal solid waste, the quantity of plastic waste is expanding in considerable amount. As per estimations, the rate of expansion of plastic waste is going to be double in every 10 years. Our environment is polluted much more by plastic is due to the development of urbanization, population growth and change in life style etc.

2. LITERATURE REVIEW

Rajarapu Bhushaiah et al (2019). has studied on "Study of plastic Bricks Made from Waste Plastic". They concluded in their research paper that they made a bricks from plastic waste using mix design of plastic. they made the mix design using variable plastic as 5 %, 10 %, 15%, 20% etc with cement, fly ash and sand. All quantities are in kg. then they burn the plastic waste first at temperature of 90-110 degree and than mix with other ingredients. after then they conducted test on plastic bricks as compressive strength test, water absorption, efflorescence test, soundness test. As per their results, they made the 3rd class bricks.

Lairenlakpam Billygraham Singh has studied on "Manufacturing bricks from sand and waste plastic" uses waste compact disc of plastic and waste water bottles and uses river sand from local supplier and prepare a specimen. they cleaned and dried properly the plastic waste and cut in to small pieces for easy heating. They uses a proportion of 1:1.5 (1 plastic : 1.5 sand) by weight and heated separately and 200 degree. after heating material are mix together to get a homogeneous mix and poured in a cube. after the cooling of cube specimen is taken out and make test on test specimen. test concluded are bulk density, water absorption, apparent porosity and compressive strength.

SitiAishah Wahid et al (2014) has worked on "Utilization of plastic bottle waste in sand bricks" used rejected bottles from factory were collected then put into crusher and get small pieces and sieved to get small uniform size and make plastic sand brick. in which he get the result after various test on sand plastic brick like compressive strength, water absorption test and efflorescence test.

Mr. N. Thirugnanasambantham et al. (2017) has worked on "Manufacturing and testing of plastic sand bricks" used cement, sand, water flyash and waste plastic for his study. they used a proportion of 1:2 to 1:6 of plastic and sand to get different results. they use a proper sequence for manufacturing of bricks as batching, mixing, moulding, curing and then testing. test was conducted as compressive strength test, water absorption test efflorescence test, hardness test, fire resistance test, soundness test etc and gave a special name to plastic sand brick as "Eco-Brick"

Bhushan V. Ghuge et al. (2019) has worked on "manufacturing of plastic sand bricks" his objective was to develop an efficient way to effectively utilize the waste plastics. he use poly ethylene terephthalate, high density polythene, low density polythene, poly propylene, urea formaldehyde, polyester resin as a plastic waste. in his research paper firstly he batch all ingredients, burning, mixing, moulding and then testing is done. in various tests compressive strength test, water absorption test, efflorescence test, hardness test, soundness test is included. They concluded that the strength of brick is increased when plastic ratio keep constant and increase the value of sand ratio.

there are the various researches are going on to find out safe and eco friendly disposals of plastics. Annually, India release 56 lakh tons plastic waste, where as Delhi accounting for generating 689.5 tons per day. Approximately, there are the 60% of total plastic waste in india is collected and recycled a day and remaining waste is uncollected. Besides all of these, concrete is also an important building material which is used in world on vast level for infrastructure. Both materials (plastic waste and concrete) consumptions are rapidly increasing. That means the conclusion is that we can also use plastic waste as an ingredient of concrete which is a better way to dispose it.[2]

3. TESTING ON NATURAL SOIL

- Natural water content test :This is the natural moisture content. It is the ratio of weight of water to weight of solid in a given mass of soil. It is expressed as in percentage. It is determined by oven dried test.
- Liquid limit test: Standard Liquid limit is the minimum water content of soil at which the both faces of groove of apparatus come to close at exactly 25 no. of blows in a Standard A.Casagrande's apparatus.
- Plastic limit test: It is minimum water content at which a soil just start to crumble when rolled into a thread of approximately 3 mm in diameter.
- Modified Proctor test:Proctor compaction test is used to find out the maximum Dry Density and optimum Moisture Content. Heavy compaction is done by 4.89 Kg hammer using 25 no. Of blows in each layer which is filled in proctor mould.
- CBR Test: California Bearing Ratio test is used for determine the bearing capacity of any soil. In this test mould of 2250 cubic centimeter volume is used and the soil is filled with 5 layers in addition of water at optimum moisture content 56 blows are given in every layer by 4.89 Kg hammer.
- Triaxial shear Test:this test is used to determine the shear strength parameters. Generally It is used for research and soil testing. Name of the strength parameters are cohesion (c) and the angle of internal friction (ϕ) are finding out by triaxial shear test.
- Free swelling index test:this is defined as the increase in volume of soil without any external rigidity on submergence in water

Swelling pressure Test:The main objective of this test is to determine the swelling pressure of expansive soil when it is not allowed to undergo any change in volume change.

4. Test Results and Discussions of natural soil

Table -1: Index and engineering properties of soils are:

Soils	Properties
Classification	OI (Organic clay with medium plasticity)
Natural moisture content	5.11%
Liquid Limit	34.56%
Plastic Limit	22.14%
Plasticity Index	12.42%
OMC	12%
MDD	1.88 g/cc
CBR Value (Soaked)	5.04%

5. MATERIALS AND METHODOLOGY

Table -2: type of bricks with there different ingredients and no. of specimen

Serial No.	Type of sample	No. of bricks
01.	Pure clay	3
02.	Clay+10% sand	3
03.	Clay+20% sand	3
04.	Clay+30% sand	3
05.	Clay+10% sand+5% plastic	3
06.	Clay+20% sand+10% plastic	3
07.	Clay+30% sand+15% plastic	3
Serial No.	Type of sample	No. of bricks

There are total 14 bricks were made of different composition.

6. PREPARATION OF BRICKS

The main aim of this research is to develop an appreciable way to use the plastic waste which is mostly responsible for the ecological unbalance. The plastic waste is melted on approximately 200°C and sand and clay were mixed thoroughly. After mixing of ingredients of bricks, the mixture poured in the mould of brick of standard size 19x9x9 cm³.



Fig 1. STANDARD SIZE MUD BRICK PREPARED FOR DRYING

7. BRICKS TESTING

Two types of testing were conducted in this research work, which is compression test as per BS 5628: Part 1: 1992 and water absorption test as per IS 3495-1992 (Part-II).

7.1 Compression test (BS 5628: Part 1:1992)

This test is done to get the idea about compressive strength of brick. This strength is also called as crushing strength. There are 14 specimens of different proportion of ingredients of bricks are taken in laboratory for testing of compression test and then tested one by one. In this test, a single brick specimen is put in between two jaw of crushing machine and applied the pressure till it breaks. After then The ultimate pressure on which brick is crushed is noted. All 2-2 specimen of each combination are tested one by one and then the average value of two specimen is taken as compressive or crushing strength of bricks.



Fig. 2. compressive load testing on standard size mud brick of various ingredients

7.2 Water absorption test (IS 3495-1992 Part-I)

In this test, the weight of bricks were taken in dry condition and then immersed for 24 hours in fresh water. But during this period, the bricks were immersed in water and after 24 hours the wet weight of bricks were taken. If the water absorbed by brick is less then it shows its better quality. A brick of Good quality doesn't absorb water more than 20% of its own weight.

Table -3: water absorption values of different type of bricks

Type of bricks	% Water absorption	Compressive strength (kg/cm ²)
1 st class brick	Less then 15 %	Greater than 100
2 nd class brick	16% to 20 %	99 to 75
3 rd class brick	21 % to 25 %	74 to 35

Table -4: water absorption values of different type of bricks

Type of bricks	Weight before immersed in water (kg)	Weight after immersed in water (kg)	% water absorbed	Remark
01.Pure clay	3.2	3.92	22.5	3rd class brick
Clay+10% sand	3.4	3.85	13.23	1 st class brick
Clay+20% sand	3.3	3.65	10.6	1 st class brick
Clay+30% sand	3.5	3.80	8.57	1 st class brick
Clay+10% sand+5% plastic	3.1	3.40	9.67	1 st class brick
Clay+20% sand+10% plastic	3.3	3.60	9.09	1 st class brick
Clay+30% sand+15% plastic	3.2	3.40	6.25	1 st class brick

8. RESULTS AND DISCUSSION

Effect of Different Ratio of Plastic Waste on Compression Test

Table -5: Maximum load and the compressive strength of various ingredients of bricks

Sample	Weight (kg)	Density (kg/m ³)	Max load at crushing (KN)			Compressive strength (N/mm ²)	Remark
			Brick - 1	Brick - 2	Average		
Pure clay	3.2	2079.27	72.0	73.35	145.35	8.5	2 nd class brick
Clay+10% sand	3.4	2209.22	81.225	81.225	162.45	9.5	2 nd class brick
Clay+20% sand	3.3	2144.25	82.0	82.18	164.160	9.6	2 nd class brick
Clay+30% sand	3.5	2274.20	83.0	84.58	167.58	9.8	2 nd class brick
Clay+10% sand+5% plastic	3.1	2014.29	85.0	86	171	10	1 st class brick
Clay+20% sand+10% plastic	3.3	2144.25	89.775	89.775	179.55	10.5	1 st class brick
Clay+30% sand+15% plastic	3.2	2079.27	94.1	94.0	188.100	11	1 st class brick

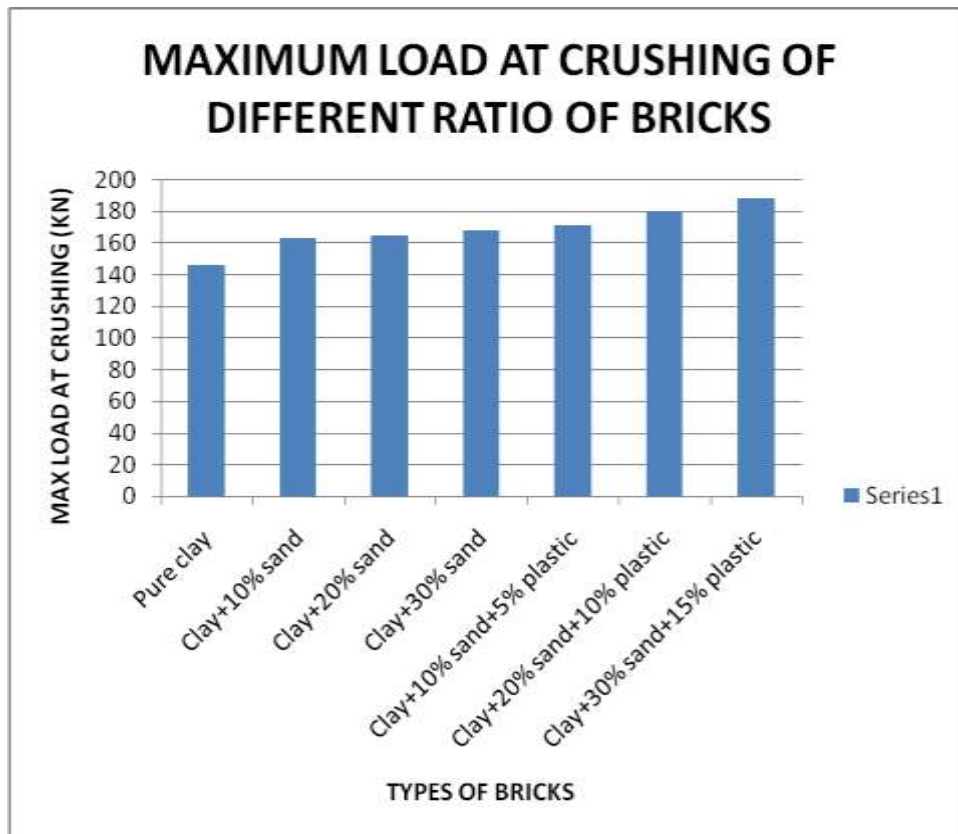


Chart -1: load v/s type of bricks

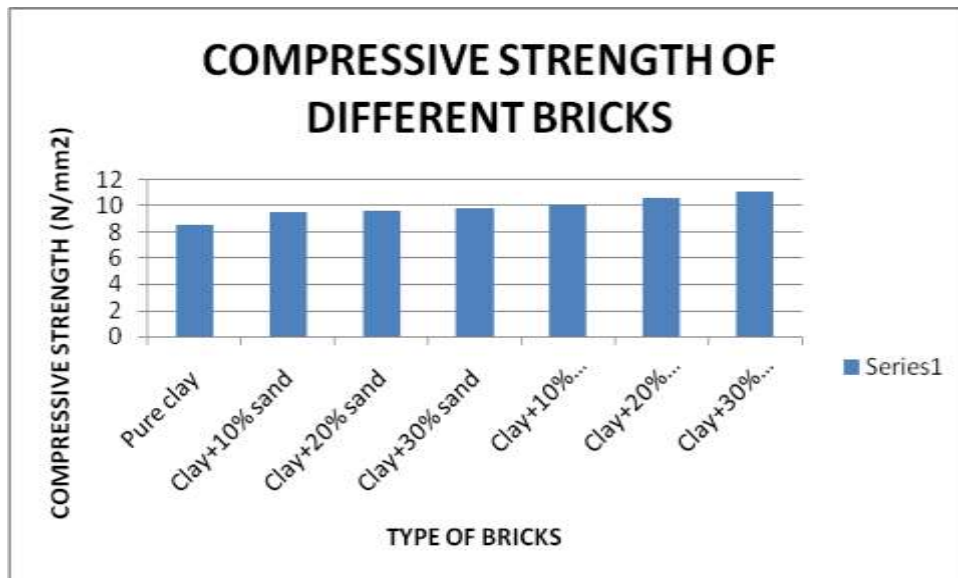


Chart -2: compressive strength v/s type of bricks

CONCLUSION

From the results of compression test, it is clear that the compressive strength of plastic bricks get increased when quantity of plastic get increased. The pure clay brick shows the highest compressive strength of 8.5 N/mm². When sand mixed by 10%, 20% and 30% then compressive strength are 9.5 N/mm², 9.6N/mm² and 9.8N/mm². But when plastic waste is mixed as 5%, 10% and 15% then the strength comes to be 10 N/mm², 10.5 N/mm² and 11N/mm². The values of compression test increased when plastic waste increase. plastic bind well in molten state with soil and hence the compressive strength get increased.

In order to Recommend for further study, brick will give best result in 10% amount of plastic waste when mix to get maximum packing density. When we add plasticizer it will give best results and our plastic waste become also dispose in huge amount.

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