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RESEARCH ARTICLE

BRICKS FROM WASTE PLASTIC.

Shikhar Shrimali.

Civil Engineering, Neotech Institute of Technology.

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Abstract

This project reviews one of the sustainable and effective ways of managing plastic waste in urban and rural parts of India in order to minimize their adverse environmental impacts. The requirement for such a research is validated as it is desirable to change the unsustainable arrangement of consumption, production and disposal associated with these materials. After studying the whole scenario, I developed an effective way of utilizing the soft plastic waste and recycling it into plastic bricks which are very light in weight and can withstand high amount of pressure as compared to standard modular bricks. However due to some physical and chemical properties of plastic which can be disadvantageous to the brick created from it, some changes in its design and manufacturing processes can be made.

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Introduction:-

Environmental engineering is the branch of engineering bothered with the application of scientific and engineering principles for conservation of human populations from the effects of adverse environmental factors; preservation of environments, both local and global, from the potentially destructive effects of natural and human activities; and improvement of environmental quality. Relating to this, environmental engineers also work upon the different strategies and effective ways of managing the waste created naturally and artificially within the environment. Among the different types of wastes generated, plastic waste is one of the most hazardous wastes which need to be treated in a proper systematic way.

Plastic Waste management is all the activities and actions required to manage plastic waste from its inception to its final disposal. This includes amongst other things, collection, transport, treatment and disposal of plastic waste together with monitoring and regulation. It also encircles the legal and regulatory framework that relates to plastic waste management enclosing guidance on recycling etc.

As more cities become industrialized, the surplus problem of plastic waste management comes along with it. Technological and economic advancement has made the types and kinds of plastic wastes very diverse and their management much more complex. The complex nature of disease outbreaks; cases of cholera as well as other diarrheal diseases in recent times authenticate this fact. Furthermore, the changing economic trends and rapid urbanization disarrange plastic waste management (PWM) in developing countries. Consequently, plastic waste is not only increasing in composition but also changing in quantity from a few kilograms to tonnage proportions.

The plastic brick is compressed by the two iron rods. Firstly the plastic waste is being collected in bulk amount. Then a modular brick mould is being taken and plastic waste such as crisp bags and polythene bags are filled in it.

Corresponding Author:- Shikhar Shrimali.

Address:- Civil Engineering, Neotech Institute of Technology.

Air tight amount of plastic waste has to be filled in the mould. After that the mould is closed with a metal plate on it and allowed to heat in a solar grill oven for 1 hour. Then the mould is taken out from the oven and cooled down immediately with a jet spray. After this with the help of mechanical means the plastic brick is being removed from the mould.

Literature Review:-

The need of creating this plastic waste brick is as mentioned.

Municipal control board emphasizes the current scenario of plastic waste in india.

The leading factor for plastics is its functional convenience and cost effectiveness. By upright economies of scale, plastics have disintegrated the traditional industries in india and have slowly conserved the throwaway culture in the indian society.

The bottled water, junk foods and pepsi coke culture in the country distributes to the increasing plastic waste generation in india. The problem becomes very vast when there is no effective end of life management to take care of the litter, and this creates an environmental, social as well as economic problems.

The increasing use of plastics as a packaging material has resulted in the landscapes of india being littered with non-biodegradable plastic bags and PET bottles, with plastic bags commanding the litter.

High amount of plastic waste has a value, and is constantly taken care of by the informal recycling sector.

Market executives guide the informal sector, and they contribute to the waste system excessively by collecting waste material that has a value, thereby taking over a part of the responsibilities on the municipalities.

Inspite the attempts from the formal and the informal sector, massive quantities of the plastic waste remain uncollected. Waste management is also embarrassed by the lack of public awareness and low municipal finances in the country.

Most municipalities are malnourished of finances and this blemish the system of waste collection and disposal in many cities in india. Even when budgets are consequent for collection, safe disposal remains a primary problem.

Taking in consideration, improper waste management leads to so many environmental problems. The situation is more immense in countries like india where economic growth as well as urbanization is quite frequent.

A total of 36.5 million tonnes per year that is 36.5 kg per individual of municipal solid waste is generated in the country. Considering the fact that the plastic consumption in the country is 4 million tonnes and 52% of the plastics is used for packaging, and then we could estimate that the plastic waste generated is at least 2 million tonnes and not more than 4 million tonnes.

In view of the limited resources and availability of land for disposal, especially in the mega cities, there is a great need for an effective effort to develop cost-effective and feasible policy options for overcoming the waste management problems.

Problem Definition:-

For effective plastic waste management, it is necessary to carry out the work in a systematic step by step manner. For this areas where waste management is required is studied out and then which techniques of waste collection and disposal will be the most suitable is being analyzed and carried out.

Plastic waste contains high amount of polythene bags and crisp bags which is further collected and used for manufacturing of newly designed plastic brick which proves to be cost effective and beneficial as it is used in a proper way rather than disposing or burning it in the atmosphere.

Also the waste disposing techniques of plastic waste such as pyrolysis, chemical decomposition of waste, land filling, incineration, composting are quiet time consuming techniques and does not offer to clear out large quantities

of waste in a short period of time. Hence this method of using soft plastic waste for a beneficial purpose of making out bricks which are very light in weight and gives high pressure handling capacity would prove to be very useful as it would minimize the plastic waste at a large extent.

Aim of the Project:-

The aim of the project is to study the plastic waste management strategies and provide an effective way to minimize it and use it for a beneficial purpose.

Further adding to this, the main project work also relates the following:-

- Compilation of data on plastic waste from rural and urban areas.
- Analysis and study of plastic waste to understand its utilization or disposal.
- To measure the willingness of help and co-operation provided by people for plastic waste management.
- To review the methods for waste collection, transportation and disposal as available for municipal solid waste.
- To provide an effective way of using plastic waste into a very beneficial way and giving a plastic brick as a final product by using plastic waste.
- The need of developing such a brick was to minimize the plastic waste by using it in the best possible way and replacing these bricks with raw mud as a constructing material for houses so that the major issue of houses getting washed away during floods and damaging during earthquakes can be minimized.

Design of brick:-

OVERVIEW:-

- ❖ In present times, in rural and coastal regions of India, there is no waste management system present to deal with the continuous increase of plastic waste that come into the villages everyday due to improper dumping by the localities.
- ❖ The villages due to lack of education and understanding about the importance of waste management, just burn away the waste in their stoves or in open places or may throw it in the nature, which creates problems such as foul smell around the region, blockage of drainage pipes, which are created to prevent flooding in the area, unhealthy environment for living and polluting the nearby river banks.

The Prototype:-

- A prototype of the block made from plastic waste has been made.
- This will give a basic idea of how the block can be used in real life.
- The block will be used as a kind of fundament for the houses, covered with clay, so they maintain the look as from today.
- After completion of the monsoon seasons, the house will still be existing with the roof on so there's no need to build up the house again from the scars as they need to do it today.

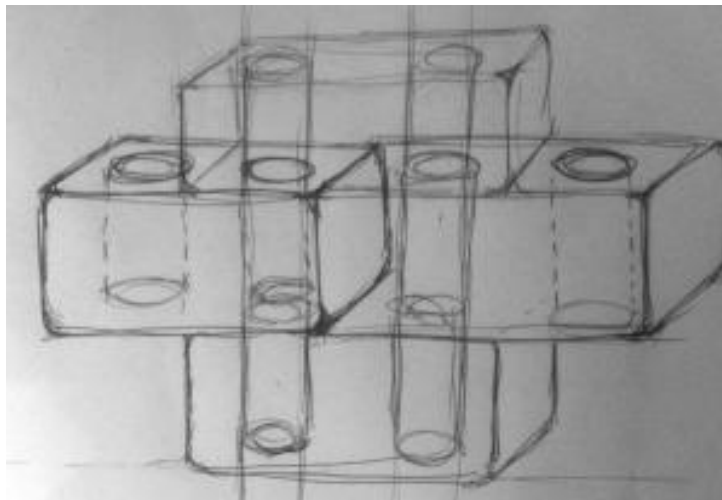


Fig 4.1:- Sketchmetric Diagram Of Brick

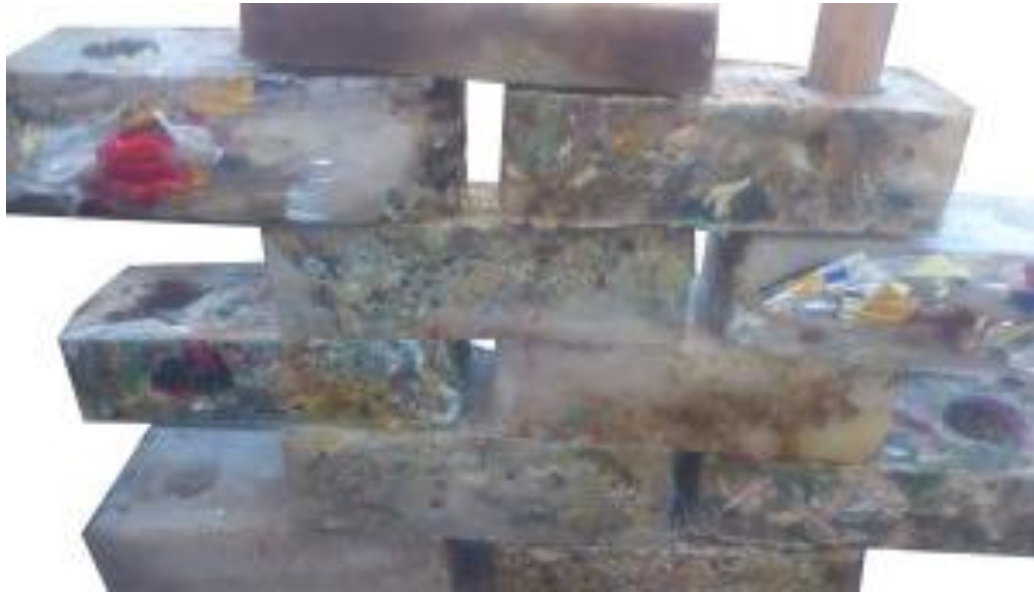


Fig 4.2:- Plastic Brick Arrangement.

Required Materials:-

- Plastic waste such as crisp bogs, polythene bags.
- Standard brick mould for preparing bricks of dimension 19*9*9 cms.
- A solar grill oven or an electric oven of heating capacity 100 to 500° C.
- A metal cover plate and a compressing/tamping rod.
- A water jet sprinkler.

Preparation Methodology:-

- At initial stage, waste soft plastic (polythene bags, crisp bags) of (approximate 4 to 5 kgs) is filled up in a brick mould of dimensions 19*9*9cms and then it is made air tight so as to prevent the leakage of viscous plastic.
- After filling the mould with plastic bags, it is compressed with a tamping rod until fully filled and then it is closed with a metal plate.
- The brick mould is now placed in a heating oven and heated at 175 to 200°C for one and a half to two hours.
- Further the mould is taken out from the oven with accurate precautive measures and for sudden cool down, a jet of water is sprayed on the mould.
- Finally with the help of mechanical means, the final product a plastic brick is obtained.

Result and Analysis:-

General:-

To analyze the compressive strength and the technical features of plastic brick, we will conduct the laboratory test and thus the brick sample will be taken to the laboratory.

Standard and nominal brick sizes in India:-

In India, according to recommendation of BIS, standard modular brick size is 190 mm x 90 mm x 90 mm.

With mortar thickness, the dimension of the brick becomes 200 mm x 100 mm x 100 mm which can be also called as the nominal size of the modular brick.

Compressive /Crushing Strength of Bricks:-

Compressive strength of bricks are very unsteady, and may vary from 30 kg/sq. cm to 150 kg/sq. cm for hand-made burnt bricks, while compressive strength of heavy duty bricks which are machine pressed may have compressive strength as high as 450 kg/sq. cm, and even 500 kg/sq. cm. The minimum compressive strengths of burnt bricks tested flat-wise described are:

1. Common building bricks—35 kg/sq. cm,
2. Second class bricks—70 kg/sq. cm,
3. First class bricks— 105 kg/sq. cm.
4. Compressive strength of bricks, not less than 140 kg/sq. cm are graded as AA class.

The strength of brick decreases by about 25 percent when drowned in water.

Strength of sun-dried bricks is from 15 to 25 kg/sq.cm

Water absorption of bricks after 24 hours is shown as follows:

1. First class brick-20%
2. Second class brick-22%
3. Third class brick-25%

Heavy duty machine made bricks should not absorb more than 5% of their weight.

Testing of Plastic Brick:-

Determining the compressive strength of three different graded bricks:-

Theory:-

- Bricks are categorized into three different grades as per IS 1977-1976. The minimum compressive strength of the brick is at the class A that is equal to 350 kg/cm.sq.
- The minimum compressive strength of class 'c' bricks should not be less than 350 kg/cm.sq
- Also the compressive test of individual bricks would not fall below the maximum requirement by more than 20%.

Instruments and Materials Required:-

- 1) Compressive testing machine.
- 2) Plastic bricks sample.
- 3) Scale / Ruler.

Application:-

Compressive strength is one of the prime property of bricks as various types of bricks are used for different purpose of work. It is important to check out it's compressive strength for given grades of brick.

Diagram:-



Fig 5.1:- Compression testing machine

Procedure:

- Take a sample of plastic and measure its dimension.
- After measuring the dimension, calculate cross sectional area of bricks with help of it.
- Place the block between the mouth of compression testing machine.
- Apply the load continuously on the block until cracks are formed on the brick.
- When cracks are recognized on bricks, stop the machine and measure applied load and note down the readings.
- Repeat the above procedure for three different types of machines.

Precautions:-

- There should not be any kind of cracks on the brick before testing its compressive strength.
- Mechanism of crack on the brick should be noted delicately.
- Reading should be taken without any mistakes.

Observation Table:

Sr No.	Types of bricks	Size of bricks	Plastic used (in kgs)	Cross-sectional area of bricks	Load applied	Compressive strength
1)	A	22*10*5.5	5kg	55.06cm.sq	5000kg	90.86kg/cm.sq
2)	B	22*10*5.6	10kg	54.30cm.sq	7000kg	128.91kg/cm.sq
3)	C	22.5*9.5*5.8	15kg	50.39cm.sq	10000kg	198.45kg/cm.sq

Calculation:-

$$\text{Compressive strength} = \frac{\text{Maximum load at failure (N)}}{\text{Average area of bed face (mm}^2\text{)}}$$

a) Compressive strength of bricks (A):

$$P/A = 5000/55.06 = 90.86 \text{ kg/cm.sq}$$

b) Compressive strength of brick (B):

$$P/A = 7000/54.30 = 128.91 \text{ kg/cm.sq}$$

c) Compressive strength of brick (C):

$$P/A = 10000/50.39 = 198.45 \text{ kg/cm.sq}$$

Results:-

Compressive strengths of plastic bricks are as follows:

- 1) For class 'A' bricks, compressive strength is 90.86kg/cm.sq
- 2) For class 'B' bricks, compressive strength is 128.91kg/cm.sq
- 3) For class 'C' bricks, compressive strength is 198.45kg/cm.sq

Conclusion:-**Future Scope:-**

After preparing a brick out of plastic waste it can be concluded that this project will be proved very helpful for the rural and coastal region people and will have a great impact on environmental pollution created by plastic wastes. Local people of these areas will be free from the hazardous issues of waste around them and this brick will be used for redesigning their houses which used to get washed away in the monsoon season. This project is an innovative and new idea in itself because it deals with the problem at a very macro level but solves it in a very micro perspective view. This project can be further implemented in the other parts of the world after its success in india.

Final Compressive Strength:-

After testing the three samples of the plastic brick, the average compressive strength comes out to be as follows:

$$\text{Average compressive strength} = \frac{90.86 + 128.91 + 198.45}{3} = 139.40 \text{ kg/sq.cm}$$

The average compressive strength of the plastic brick is 139.40 kg/sq.cm

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