



DEVELOPMENT AND ANALYSIS OF BRICK MADE FROM WASTE PLASTIC BAGS

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ABSTRACT

In our day to day life we come across with many different types of Plastic bags. Throughout the world 600 thousand million plastic bags are produced every year. Generally they are used only once and then thrown away. The thin plastic bags in particular represent a serious ecological problem as they cannot be easily recycled. According to a study, it is estimated that it takes approximately 500 years for a plastic bag to decompose when exposed to sunlight. If not exposed to sunlight it can remain as it is in our environment for indefinite time.

According to Central Pollution Control Board (CPCB), total plastic waste which is collected and recycled in India is estimated to be 9,205 tons per day (approx. 60% of total plastic waste) and 6,137 tons (40%) remain uncollected and littered. This 40% mainly includes thin plastic bags.

To try and provide a solution to this problem we made a brick from waste plastic. Plastic brick is a brick made from 30% waste plastic bags and 70% sand. This brick is resistant to oil, water, salts, acids and alkalies. It can withstand a pressure of 6.31 N/mm². It can be an effective way of recycling waste plastic bags in near future.

Keywords: Plastic bags, Polyethylene, Ecological problem, CPCB, Plastic brick.

1. INTRODUCTION

In our day to day life we come across plastic in almost everything material we handle or observe. This plastic comes right from milk bags, salt packing bags, groceries packaging, vegetable packaging to almost everything we buy, they all come in plastic that ensure their freshness, hygiene, health, safety and etc. But what happens when we remove and throw away the plastic?

Presently, approximately the world produces around 600 thousand million plastic bags. Where do these bags go after use (wearing,tearing,deformation). Generally the thin plastic bags are used only once! These thin plastic bags are causing a great harm to the environment, and are a serious ecological problem. Decomposition of these plastic bags is a great issue and threat for future. These bags have very light weight and get easily tossed up by the wind and we can see many trenches of land turned into landscapes of plastic. These bags also land into rivers and streams and ultimately into the sea, which pollutes water bodies as well. The most common type of plastic shopping bag, the kind we get at supermarkets is made of polyethylene, a man-made polymer that microorganisms don't recognize as food. Although standard polyethylene bags don't biodegrade, they do photo degrade. When exposed to ultraviolet radiation from sunlight, polyethylene's polymer chains become brittle and start to crack. This suggests that plastic bags will eventually fragment into microscopic granules. However, scientists aren't sure how many centuries it takes for the sun to work its magic. According to a study, it is estimated that it takes 500 years for a plastic bag to decompose when exposed to sunlight. If it is not exposed to sunlight, i.e. if it remains at the bottom of the landfill, the plastic may remain intact indefinitely.

To try and provide a solution to this problem we made a brick from waste plastic. Plastic brick is a brick made from 30% waste plastic bags and 70% sand. This brick is resistant to oil, water, salts, acids and alkalies. It can withstand a pressure of 6.31 N/mm². It can be an effective way of recycling waste plastic bags in near future.



Figure No..1. Brick 70% Sand(River Gravel Sand) + 30% Plastic Waste

A) Pollution due to plastic:

Plastic pollution involves the accumulation of plastic products in the environment that adversely affects wildlife, wildlife habitat, or humans. The prominence of plastic pollution is correlated with plastics being inexpensive and durable, which leads to high levels of plastics used by humans. However, it is slow to degrade. Plastic pollution can unfavorably affect lands, waterways and oceans. Living organisms, particularly marine animals, can also be affected through entanglement, direct ingestion of plastic waste, or through exposure to chemicals within plastics that cause interruptions in biological functions. Humans are also affected by plastic pollution, such as through the disruption of the thyroid hormone axis or hormone levels.

B) Environmental Problems:

Environmentally, plastic is a growing disaster. Most plastics are made from petroleum or natural gas, non-renewable resources extracted and processed using energy-intensive techniques that destroy fragile ecosystems. The manufacture of plastic, as well as its destruction by incineration, pollutes air, land and water and exposes workers to toxic chemicals, including carcinogens.

Plastic packaging – especially the plastic bags found everywhere – is a significant source of landfill waste and is regularly eaten by numerous marine and land animals, causing fatal consequences. Synthetic plastic does not biodegrade. It just sits and accumulates in landfills or pollutes the environment.

C) Human Health effect:

In addition to creating safety problems during production, many chemical additives that give plastic products desirable performance properties also have negative environmental and human health effects.

These effects include

- Direct toxicity, as in the cases of lead, cadmium, and mercury
- Carcinogens, as in the case of diethylhexyl phthalate (DEHP)
- Endocrine disruption, which can lead to cancers, birth defects, immune system suppression and developmental problems in children.

2) PREPARATION AND ANALYSIS OF BRICK:

2.1) Block Diagram:

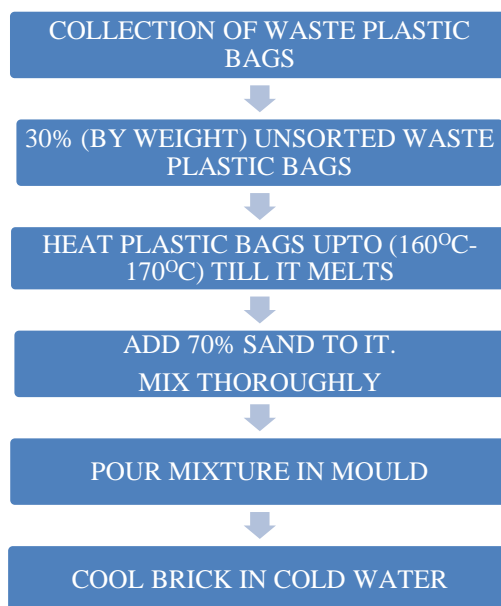


Figure No.2. Flow diagram

2.2) Composition of brick:



Figure No..3

Sand type used - Coarse sand (River gravel)
Composition (sand:plastic) 70:30
Estimated cost of making brick - Rs. 5/- per brick

2.3) PROCEDURE USED FOR BRICK MAKING:

- Unsorted waste plastic bags 30% by weight, ie 1164 grams and Sand 70% by weight, ie 2718 grams were taken for each brick.
- The plastic waste and sand was weighed using “Digital Weighing Machine.”
- The plastic was first heated in 15litre empty oil tin. Wood (conventional source of heat) was used to provide heating to oil tin.
- After some time of heating, the plastic starts turning into semi fluid form and then a thick liquid is obtained whose approximate temperature is above 170⁰C.
- Sand was added to this semi fluid plastic material and mixed thoroughly. Mixing thoroughly is one of the important parts of this method as it directly affects the strength of resulting brick.
- Mixing must be done with constant supply of heat to the container.
- Once the sand and plastic fluid are uniformly mixed with each other, the hot mixture is poured into moulds.
- In moulds the brick is kept for cooling for 10min by placing it in cold water.
- Then the brick was removed from mould and kept for cooling in open air for 6-8hours.
- Weight of each brick is approximately 3882 grams, ie 3.8 Kg.
- The plastic bags which we used are made from Low Density Polyethylene. Its melting point is about 105-110 degree celcius. We are heating these plastic bags till we get a semi-fluid form of this polyethylene. When we add sand to this while it is still hot and in semi-fluid form, and mix it thoroughly, the plastic bounds strongly with the sand particles and the structure becomes rigid after cooling.



Figure No..4
Unsorted Plastic Waste



Figure No..5
Digital Weighing Machine



Figure No..6
Plastic In Semi Fluid Form



Figure No..7
Mould: Steel Box



Figure No..8
Brick In Mould Kept For Cooling



Figure No..9
Plastic Brick

3. ANALYSIS OF BRICK:

3.1) Test for sustainment of day-night temperature:

The brick was kept on terrace to expose it to surrounding normal day-night temperature for 15 days.

TABLE NO.2 Result: No change in dimensions of brick.

DATE	BRICK SIZE(L*B*H)(in mm)	DAY/NIGHT TEMPERATURE (in deg.C)
5 FEB 2018	225*155*125	32/15
6 FEB 2018	225*155*125	33/15
7 FEB 2018	225*155*125	31/17
8 FEB 2018	225*155*125	32/16
9 FEB 2018	225*155*125	32/18
10 FEB 2018	225*155*125	33/17
11 FEB 2018	225*155*125	31/14
12 FEB 2018	225*155*125	35/19
13 FEB 2018	225*155*125	33/19
14 FEB 2018	225*155*125	34/17

15 FEB 2018	225*155*125	33/16
16 FEB 2018	225*155*125	34/18
17 FEB 2018	225*155*125	32/19
18 FEB 2018	225*155*125	35/19
19 FEB 2018	225*155*125	33/16

3.2. Compressive strength Test

In compressive strength test pressure was applied on the brick to find its compressive strength. Tests were done at “HITECH Construction Material Testing Laboratory”

In this test pressure was applied gradually on the brick by a Semi-automatic compression testing machine



Figure No..10 Hydraulic Brick Testing Machine



Figure No..11 Brick Testing



Figure No..12 Machine Reading

Result of compression test:

It is found that average Compressive Strength is 6.31 N/mm².

3.3) ACID TEST:

Acid used: Concentrated Hydrochloric Acid (HCl)

DATE	ACID QUANTITY(in ml)	CHANGE OBSERVED
19 FEB 2018	50	NO CHANGE
20 FEB 2018	100	NO CHANGE
21 FEB 2018	150	NO CHANGE

22 FEB 2018	200	NO CHANGE
23 FEB 2018	250	NO CHANGE
24 FEB 2018	300	NO CHANGE

TABLE NO.3

Result of acid test:

- No change in color of brick observed.
- No change in dimensions of brick.
- No emission of gases observed when acid is poured on brick.
- No change in structure of brick.
- The brick was kept in acid in glass and steel vessel. In steel vessel the colour of acid changed due to reaction with metal while in glass vessel the colour of acid remains same i.e. there is no effect of acid on brick.



Figure No..13
Measuring Jar For Acid



Figure No..14
Brick In Acid (Glass Vessel)



Figure No..15
Brick In Acid (Steel Vessel Day 1)



Figure No..16
Brick In Acid (Steel-Vessel Day 6)

3.4 SALTY WATER TEST:

This test is done to check how much resistant the brick is to saline water so as to use it in coastal regions.

Salty water: It was prepared by adding granular salt to hot water till the water solution becomes saturated,ie anymore salt added to solution remains as it is and can't be dissolved.

Result:

- There was no change in structure of brick after seven days.
- No effect of salt observed on brick.



Figure No..17
Salty Water Preparation



Figure No..18
Brick In Salty Water

4. HOW TO RECYCLE PLASTIC BRICK:

- Collect pieces of broken brick into one oil tin

- Heat them.
- After some time add waste plastic bags and start mixing
- In the semi-fluid mixture so formed add little amount of sand
- Pour the hot mixture into moulds to make a new brick from it.

5. RESULTS AND CONCLUSION:

- This Brick is made from plastic therefore no effect of oil, salts and acids is observed.
- It is less porous to water.
- It can withstand compressive strength of 6.31 N/mm².
- It does not expand too much on heating.
- Its manufacturing cost is low as compared to normal pavement blocks.(Rs.5 /- per brick)
- There is an emission of gases observed at the time of heating plastic in open. As a solution to this we can melt these plastic bags in microwave oven at 150-160 degree Celsius. In microwave there is no supply of air, hence no gas emission takes place Also, a constant temperature can be maintained.
- It insulates against heat and electricity.

6. USES OF PLASTIC BRICK:

- It can be used as paving blocks for footpaths.
- It can be used for construction of compound walls.
- It can be used in construction of road dividers.
- The material can also be used to make drainage/pipeline covers.

 <p>FIGURE NO..18 PAVEMENT BLOCK</p>	 <p>FIGURE NO..19 ROAD DIVIDER</p>
 <p>FIGURE NO..20 COMPOUND WALLS</p>	 <p>FIGURE NO..21 DRAINAGE\PIPELINE COVERS</p>

7. Visit Conducted



Figure No..20

- 1) MSW Plant Moshi (Moshi-Pradhikaran, Bhosari-Chakan Road, Pimpri-Chinchwad, Maharashtra. Here they manufacture paving blocks from waste plastic.

8. REFERENCES

- 1) <http://timesofindia.indiatimes.com/home/environment/pollution/Plastic-waste-time-bomb-ticking-for-India-SC-says/articleshow/19370833.cms>
- 2) <http://www.plasticgarbageproject.org/en/plastic-garbage/problems/plastic-fast-consumption/>
- 3) <http://timesofindia.indiatimes.com/home/environment/pollution/Centre-bans-plastic-bags-below-50-microns/articleshow/51455974.cms>
- 4) http://www.slate.com/articles/news_and_politics/explainer/2007/06/will_my_plastic_bag_still_be_here_in_2507.html
- 5) Plastic bags, how convenience is killing our planet : <http://urbanpeek.com/2012/06/23/plastic-bags-the-planets-silent-killer-infographic/>
- 6) <http://www.technologist.eu/turning-old-plastic-bags-into-bricks/>
- 7) www.thenational.ae/news/uae-news/technology/plastic-and-uae-sand-are-building-block-of-new-brick
- 8) <https://thehomestead.guru/plastic-bricks-sustainable-solution-plastic-epidemic/>.
- 9) <http://www.journalijar.com/article/14502/bricks-from-waste-plastic/>