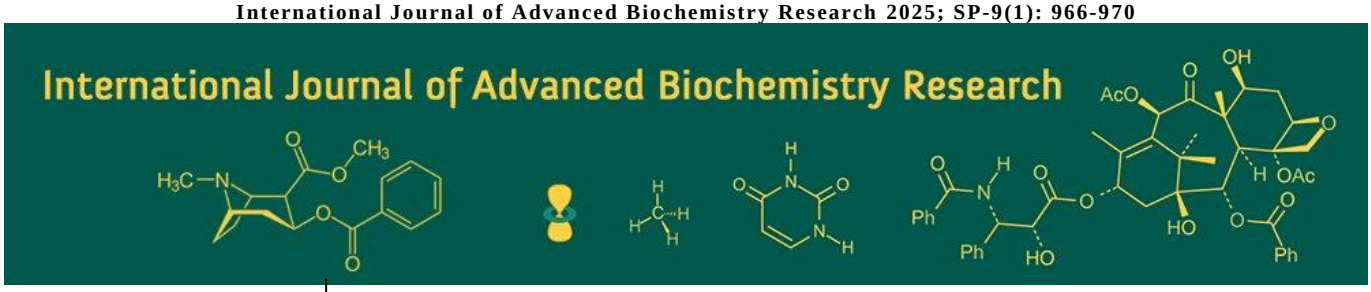

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Making of eco-friendly bricks by utilization of single used waste plastic and fly ash

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Abstract
Construction industry is gradually increasing through the whole of the world and it is consuming natural resource as raw materials for construction materials. Traditional way of producing clay brick without giving care for natural resource brought deficiency of natural resource. Now a day, plastics waste is also the big challenge for world on environmental impacts and hence alternative using Low-Density Polyethylene (LDPE) plastic waste brick for construction material is preventing environmental impact of plastic and in other hand saving natural resources clay soil. So, we try to finding efficient way to solve this problem of plastic waste. So we added this plastic wastes into the bricks and create the bricks by using plastic wastes. It is most economical solution present in the construction industry and it is also economical and environment friendly solution of the plastic wastes. Plastic brick is the form of brick manufactured from the combination of non - recyclable waste plastic with other constituents (Sand, fly ash, etc.). In this research work we make a new type of brick (size 160x120 x55 mm) from plastic waste, fly ash and sand. We have prepared total 6 numbers of bricks by using single used waste plastic, sand and fly ash in different ratios. We have also tested the above prepared bricks.

Keywords: Herbal soap, guava leaves, neem leaves, antibacterial properties

1. Introduction
This report examines the durability of plastic bricks made with fly ash and sand. The experiment involved the production of plastic bricks using LDPE & PP plastic waste, sand and fly ash as a replacement of clay [1-5]. The bricks were subjected to various tests to determine their strength, water absorption, and resistance to weathering. The results were then tabulated and analyzed to determine the durability of the plastic bricks. The proposed plastic bricks which are made up by adding plastic waste in melted form with sand and fly ash may help to reuse the plastic waste as one of the additives material of bricks, and to help the disposal problem of plastic waste [6-9]. The properties of plastic bricks which contain varying percentages of plastic were tested for compressive strength, water absorption and Efflorescence.
In this research work we make a new type of brick (size 160x120x55mm) from plastic waste, fly ash and sand. We have prepared total 6 numbers of bricks by using single used waste plastic, sand and fly ash in different ratios. We have also.

2. Materials and Methods
2.1 Material required
(i) Plastic (ii) Sand (iii) Fly ash (iv) Clay pot (v) Granite Mould (vi) Iron rod (vii) Traditional stove

2.2 Methodology
2.2.1. Making of Brick Mould The moulds used are granite moulds and are made in the carpentry shop. All the sides and surfaces of the mould should be even for the brick to have better surface finish. Both fixed and movable moulds can be used for the purpose. Granite mould will be cost effective and serve the purpose whereas if better surface finish is needed then cast-iron moulds can be used. Mould size would be (160x120x55) mm Mould.

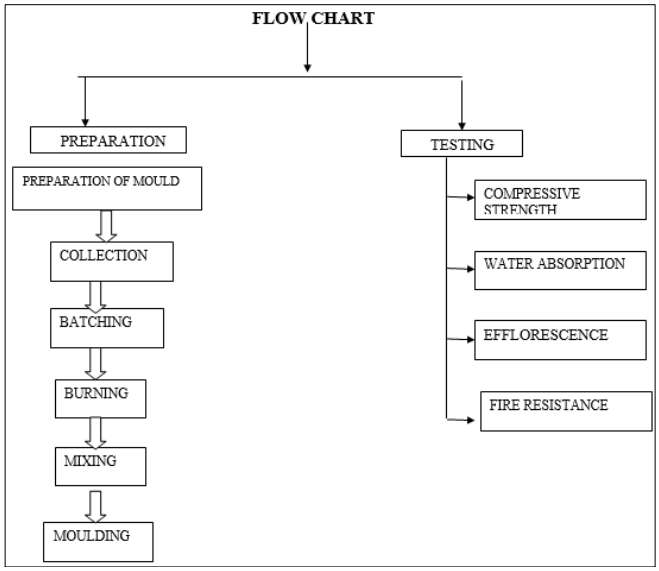

Fig 1: Flow Chart

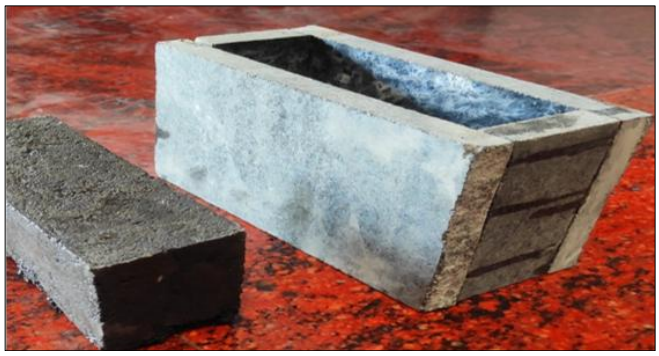

Fig 2: Showing making of bricks mould by using granite.

Fig 2.2: Showing collection of waste plastics from different sites of Raipur

Fig 2.3: Showing sieve and sieving of sand

2.2.2. Collection of Material

We have collected these plastic from a function which is organized in our college campus. The more you collect the more plastic you will divert from the landfill or clean up out of the environment. We have also collected sand and fly ash from a nearby construction site in order to make brick.

2.3.3. Batching

Measurement of materials is known as batching. The waste bottles are rinsed with water and then dried after which the weights of bottles are measured. Sieving of sand is done by 1.18 mm sieve. and this sand will be used for making bricks. Various proportions of plastic bottles fly ash and sand is taken for bricks.

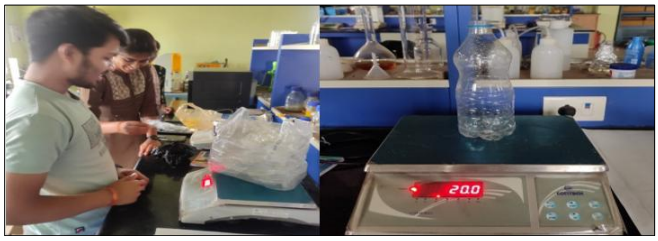

Fig 2.4: Showing weighing and batching of plastic

2.3.4. Burning

In this burning of plastic bottles is done. Plastic bottles are cut into pieces and then these pieces are put in clay pot for melting. In the first step stones, clay pot and firewood are arranged. The stones hold the clay pot and the firewood is ignited. Clay pot is heated to remove moisture from the clay pot. The plastic is then put into the clay pot and allowed to melt.

Fig 2.5 Showing cutting and melting of plastic.

2.3.5 Mixing

Pieces of plastic are added into clay pot for melting until the proportion required by us is achieved. River sand and fly ash is used for addition in mixture. When the temperature of the melted plastic in the clay pot is around 120-130 °C then fly ash and the sand is added into the clay pot and stirred continuously so that they get bonded perfectly. As the plastic pieces melt it start getting bonding with the sand particles & fly ash and during this process the temperature is maintained hence the mixture required for brick is created.

Fig 2.6: Showing the Moulding and de-moulding process

Fig 2.7: Showing mixing of fly ash and sand in melted plastic.

3.3.6. Moulding

In moulding process, the prepared mixture is then filled into granite mould and then compressed by iron rod. The pressure is applied by the iron rod so as the mixture gets filled properly in the mould. Then it is left for cooling in air as we uses the granite mould the brick can be easily removed by its smooth surface. The brick then can be removed from mould after 1-2 hours.

2.4. Process of Making Plastic Brick:

Table 1: Composition of different waste materials in prepared bricks.

BRICK	Ratio (Plastic: Fly ash: Sand)	Plastic (gm)	Flyash (gm)	Sand (gm)	Weight (gm)
SPECIMEN 1	6:5:10	600	500	1000	1050
SPECIMEN 2	2:1:2	1000	500	`1000	1490
SPECIMEN 3	3:1:2	1250	500	1000	1780
SPECIMEN 4	2:3:4	500	800	1000	1790
SPECIMEN 5	3:1:1	1500	500	500	1910
SPECIMEN 6	2:1:2	800	400	800	1690

3. Result and discussion

We made six different samples by using different compositions of materials, of dimension 160 mm X 120 mm X 55 mm. The compositions of different samples are tabulated in table 1.

3.1 Mix Design

These are the ratio which represents the plastic, fly ash and sand respectively.

4.2.1 Mix Design Calculations

1. Ratio (6:5:10)
Size of brick= (16x5.5x7) cm
= (0.16x0.055x0.07) m
Volume of brick = $6.16x10^{-4}m^3$
2. Ratio (2:1:2)
Size of brick = (16x5.5x8) cm
= (0.16x0.055x0.08) m
Volume of brick=$0.00153m^3$
3. Ratio (3:1:2)
Size of brick = (16x5.5x9.5) cm
=(0.16x0.055x0.095) m
Volume of brick=$0.36x10^{-4}m^3$
4. Ratio (5:3:4)
Size of brick= (16x5.5x11.5) cm
=(0.16x0.055x0.115) m
Volume of brick = $0.012x10^{-3}m^3$
5. Ratio (3:1:1)
Size of brick=(16x5.5x11.5) cm
= (0.16x0.055x0.115) m
Volume of brick=$0.012x10^{-3}m^3$
6. Ratio (2:1:2)
Size of brick = (16x5.5x12) cm
= (0.16x0.055x0.12) m
Volume of brick=$1.056x10^{-3}m^3$

3.1 Tests of bricks

3.3.1 Compression Strength test (BS 5628: Part 1: 1992)

In this test, the cubical brick specimen is placed in the compression strength testing machine. After placing it we will apply the load on the brick without any shock. The load will be increased at a rate of 140kg/cm2 min continuously till the specimen's resistance to increasing load breaks down and it cannot withstand any greater load further. Recording the maximum load applied to the brick specimen and the appearance and type of failure is also noted along with any unusual features. Compressive Strength= Maximum Load Applied Specimen Area
Compressive Strength = F/A
Where, F - Maximum load applied (KN)
A – Specimen Area (mm2)

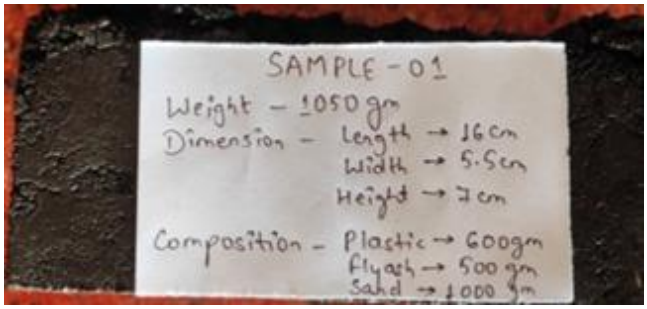

Fig 3.1: Top view of sample 01

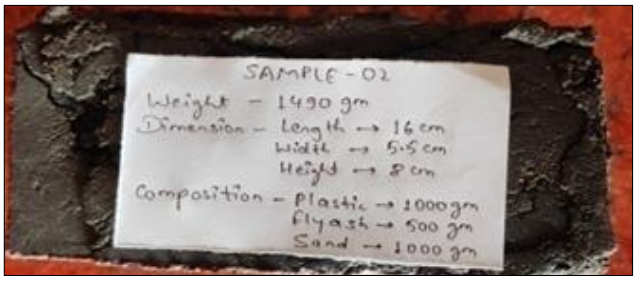

Fig 3.2: Top view of sample 02

Fig 3.3: Top view of sample 03

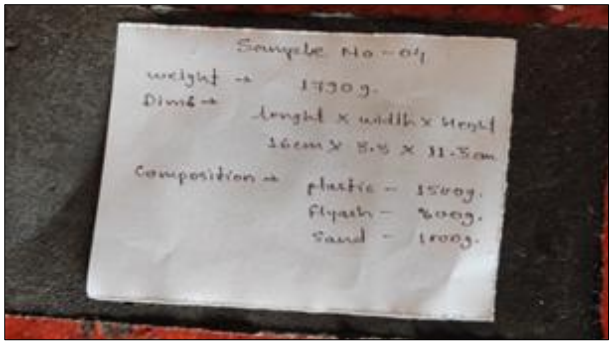

Fig 3.4: Top view of sample 04

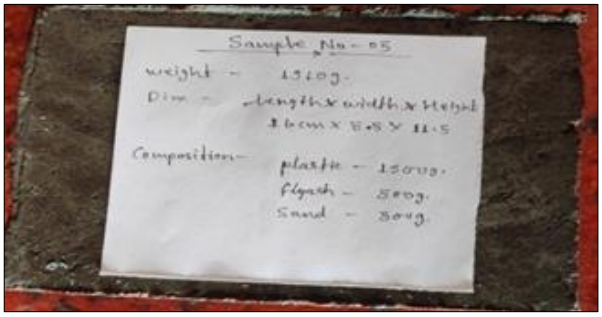

Fig 3.5: Top view of sample 05

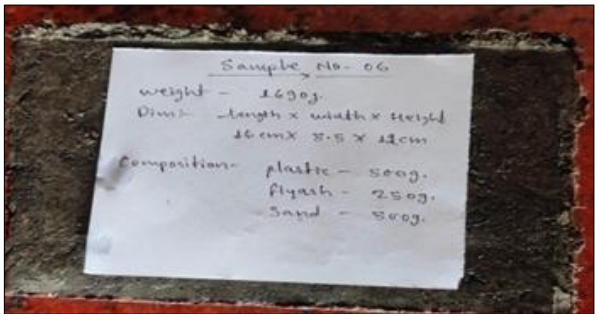

Fig 4.6: Top view of sample 06

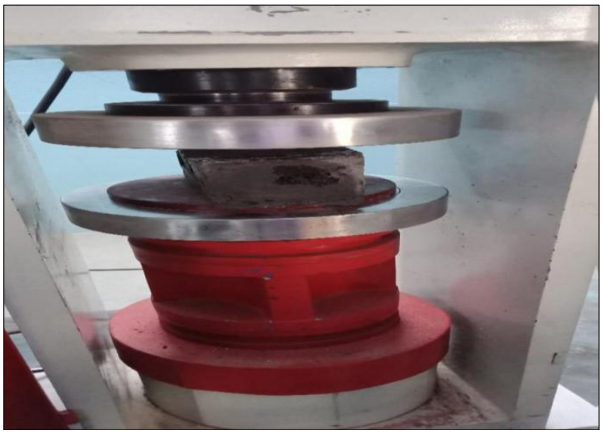

Fig 3.1: Compressive strength test of plastic bricks

Table 3.1: Result of compressive strength test for different samples of plastic bricks

Compressive Strength of Prepared Brick (MPa)						
Sample 1	**Sample 2**	**Sample 3**	**Sample 4**	**Sample 5**	**Sample 6**	**Average**
4.5	2.5	3	5	2.5	3.6	3.5

3.3.2 Water Absorption Test (IS1077-1970)

In this test at first the bricks are weighed in total dry conditions. Then they will be allowed to be dipped in fresh water for about 24 hours in a container. The bricks are taken out of the water after 24 hours and are wiped with a cloth. The wet brick is weighed using a weighing machine. For the calculation of water absorption, the difference between wet brick and dry brick is calculated. The difference is the amount of water absorbed by the brick. After that the percentage of water absorption is calculated using the data. Water absorption of bricks tells about the bonding of bricks with mortar. Although other factors such as grooves and design on bricks also improve the bonding. For sand bricks which have less water absorptive leaner mortar layer is used for bonding bricks and mortar. Greater quality bricks absorb less amount of water. For a good quality brick, the water absorption should be less than 20% of its own weight.

Water absorption = {[Weight of wet brick–Weight of dry brick]/Weight of dry brick}*100

Fig 3.2: Water absorption tests of plastic bricks

Table 3.2: Results of Water Absorption test for different samples of plastic bricks

Water absorption ratio (%)						
Sample 1	**Sample 2**	**Sample 3**	**Sample 4**	**Sample 5**	**Sample 6**	**Average**
8%	4%	4%	5%	6%	3%	5%

3.3.3 Fire Resistance Test

The standard used for the test is BIS 3809 1979. The plastic alone is readily susceptible if not flammable to elevated temperatures and in case of fire, the sand and plastic mixture may withstand temperatures that plastics alone usually cannot.

It has been observed that the structural integrity of the bricks holds very well up to 180 ºC. In this test we will first heat and maintain the brick at the standard testing temperature in the furnace to check whether the properties change or not.

Table 3.3 result of fire resistance test for different samples of plastic bricks

Fire resistance value						
Sample 1	**Sample 2**	**Sample 3**	**Sample 4**	**Sample 5**	**Sample 6**	**Average**
Lower	Low	Slightly better	Better	Limited	Low	Low

4. Summary and Conclusions

The above intends to resolve in reducing the plastic waste disposal problem as it utilizes the waste even in its finest form and converts that useless material into a useful

construction material. Extruder machine plays a prominent role in the conversion of waste plastic into its melted form. Also, extruder does not possess any threats to the environment and hence can be used without any restriction. We made six different samples of bricks using different compositions of materials (Plastics, fly ash and sand) of dimension 160 mm X 120 mm X 55 mm. After making of bricks I have tested different properties and find that it is a good strength and water resistance. The end product can be used as brick, which is having a higher strength than conventional brick. Also, the water absorption capacity is higher in comparison to conventional brick with a lower weight. Its uses are not restricted as only brick; it can even be utilized as a building block by increasing the dimension of the mould. Also, it reduces the use of wire used for fencing. Floor tiles, sleepers, etc. can also be produced from it. This brick also turns out to be economical than conventional brick, by reducing the cost of incinerators for burning purpose and landfills.

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