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Ecological Bricks by Using Waste Plastics

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ABSTRACT

This paper manages utilization of waste plastic bottle containers as brick material. Plastic waste which is expanding step by step moves toward becoming high and also dirties the earth, particularly in high mountain towns and visitor trekking areas where no rubbish accumulation framework exists and furthermore which are disposed of or burned which prompts the pollution of land and air. The transfer of waste plastics is a greatest test, as continued reusing of PET bottles containers represent a potential risk of being changed to a cancer-causing material and just a little measure of PET bottles is being reused. Thus this Poly ethylene terephthalate (PET) bottles are cleaned and included with fine total (sand) at different ratios (1:2, 1:3, 1:4) to acquire high quality brick blocks that have warm and sound protection properties to control contamination and to decrease the general expense of development, Thus this sort of brick blocks are ideally utilized for underground septic tank construction, submerged constructions, and underground construction like passages and furthermore utilized for the sub structure of the buildings so as to oppose the leakage of the water on account of less water absorption limit and furthermore have high compressive quality which oppose the substantial basic burdens.

1. INTRODUCTION

Plastic is the very hazardous material and very difficult to decompose it is main problem in the world. Use of plastic is high in our daily life such as polythene bags, disposals, furniture's, packing food packets and other accessories. Plastic is varied in large and various types according to their chemical composition. So, to separation of plastic wastes and mainly big problem in front of us. Nowadays, In the world plastic deposited by burning procedure. They emit large amount of hazardous and toxic gases. These gases effect on the human health and also living animals. Human suffers by the toxic gases such as cancer, high blood pressure, Asthma. etc We are not completely able to stop the use of plastic but we are able to recycle and reuse it by many ways and minimum effect on environment. We use such recycle plastic in the various industries such as construction, transportation, manufacturing. etc. In construction industry, larger cost of project is included in materials up to 60% to 70% of the total cost of the project. So, construction industry large number of bricks are used and they available in various forms such as

clay bricks, concrete bricks, fly ash bricks and foam bricks. In this project, we try to use wastes plastic to manufacture the bricks and increase the strength and achieve economy so the people can easily afford this type of bricks.

2. Material and Methodology

A. Collection process

In this the collection procedure was done to acquire the required measure of materials for the preparing of plastic bricks. And further more to get the great quality materials for getting the extraordinary quality and other physical properties. The accumulation of sand was done from the river bed close Ponnai in Vellore region. The gathered measure of sand is around 50 kg in the cleaned bond sack. The accumulation of waste plastic containers was finished by gathering from the marriage functions, hotels and from the street collectors. So, we collected the plastic wastes at various possible sites. In this the collection procedure was done to get the required measure of materials for the preparation of waste plastic bricks.

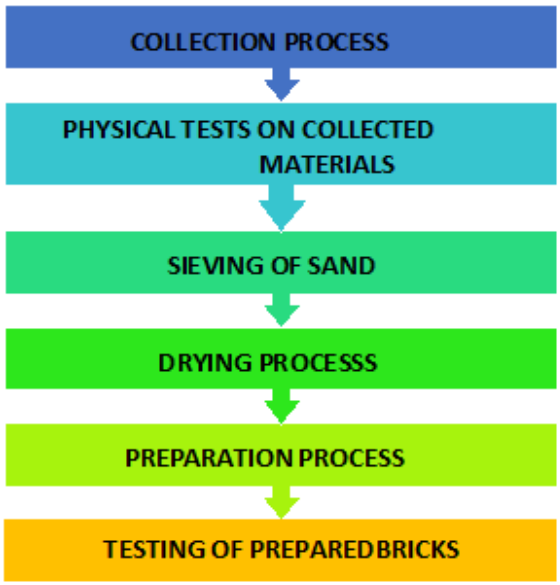

Figure 1: Steps of Methodology

B. Physical Tests on Collected Materials

Sand: Sand is a granular material made out of finely separated shake and mineral particles. It is defined by size. Sand can likewise allude to a textural class of soil or soil type Hence the sand assume fundamental job in the waste plastic blocks. The tests like Specific gravity, Fineness modulus, and Sand Replacement test were directed for getting the physical properties of sand and the acquired outcomes are.

Table 1: Properties of sand

Sr. No	Content	Values
1	Specific Gravity	2.56
2	Bulk Unit Weight	1.42g/cm^3
3	Grade of sand	Grade zone 1
4	Fineness modulus	3.96
5	Coefficient of uniformity	2.48
6	Coefficient of curvature	1.06

Polyethylene Terephthalate (PET)

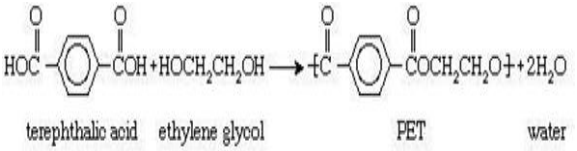

Figure 2: Chemical equation of PET

Presented by J. Rex Whinfield and James T. Dickson in 1940, this plastic is a standout amongst the most ordinarily utilized on earth. Curiously enough, it took an additional 30 years before it was utilized for completely clear drink bottles, for example, the ones created by Coca-Cola and Pepsi Companies. PETE plastics make up 96% of every plastic jug and holders in the United States, yet just 25% of these items are reused. By being careful and making a point to reuse code 1 plastics, you're guaranteeing a cleaner domain and less landfill contamination. Some of the Physical properties of polyethylene terephthalate (PET) are

Table2: Properties of plastic (PET) bottles

Sr. No	Contents	Values
1	Chemical Formula	$(C_{10}H_8O_4)n$
2	Density	1.38G/Cm^3(20°C)
3	Melting Point	> 250 °C
4	Boiling Point	> 350 °C
5	Solubility In Water	Practically Insoluble

Sieving Of Sand: The sieving of sand process was carried out in order to take the required size of sand. And also, to avoid the large size aggregates (chips) from the sand. So, the sand was sieved with IS sieve 4.75mm

Drying Process: The drying process was done in order to remove the water content from the collected river bed sand and collected waste plastic water bottles. In this drying process the collected materials are spreaded over the cleaned surface at the sunlight during day time and then collected the

spreader materials after the sunset and then stored in the covered room. Since the collection was done after the sunset was to prevent the retaining of moisture content from the snow fall during the winter season. This drying process was carried out upto 3 days.

3. Result Analysis

A. Tests On Prepared Bricks

The different sorts of tests on plastic bricks were led to check the characteristics of blocks for developments. This kind of brick tests are led at both in building site and in laboratory center. This brick blocks are most established and imperative development materials in view of their toughness, loading bearing strength, quality and minimum cost. To get the quality structure, the great quality materials are required. To choose the good quality materials a few tests on brick blocks are to be carried out. Hence the tests which are required to discover the reasonableness of the bricks for construction purpose are examined beneath.

Figure 3: Types of Test On Bricks

B. Water Absorption Test

Figure 4: Immersed bricks in water for 24hrs

Absorption test is carried on the brick is to discover the measure of dampness content consumed by the brick under extreme conditions. In this test, dry bricks are taken and weighted. Then these bricks are put in water with full drenching for a time of 24 hours. After 24 hours the wet brick is cleaned the water at the surface with cloth and weight this wet brick. The distinction among dry and wet brick block weights will give the measure of water assimilation. Normally the brick should have less than 20% of water absorption value. Hence this test result is shown.

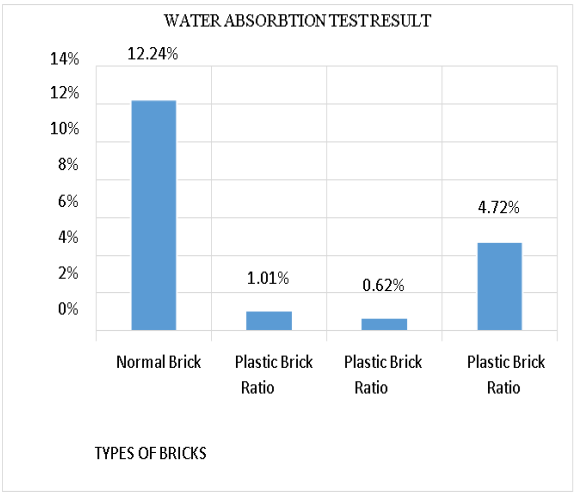

Figure 5: Chart About Water Absorption Results

C. Compressive Strength Test

Figure 6: Compression Testing Machine

Normally the Compressive strength of bricks is determined by compression testing machine. Hence the prepared bricks are placed in the compressive testing machine. After placing this brick in compression testing machine, the load is applied on it until brick breaks. Note down the value which obtained at the breaking point and find out the compressive strength value of brick. Minimum compressive strength of brick is 3.50N/mm2. If it is less than 3.50 N/mm2, then this type of bricks is not useful for construction purpose. The obtained results were shown in chart.

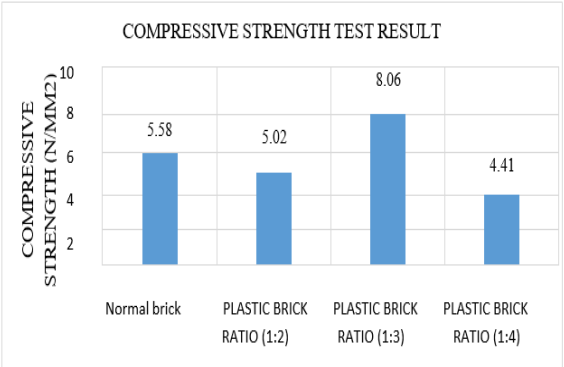

Figure 7: Chart for Compressive Test Results

D. Hardness Test

This type of test was conducted to check the hardness property of the prepared plastic brick. Hence this test was carried out either in laboratory or in construction site. In this test the sharp tool was used to scratch the surface of the bricks and the identifying the hardness by the depth of the scratch which was done by the sharp tool. If the brick has less impression, then the brick is a hard brick. The following figure shows the before and after scratch results.

Figure 8: Before Scratching

Figure 9: After Scratching

E. Soundness Test

From this test, the observed result was that the sound of normal brunt clay brick was less when compared with the plastic sand bricks of different ratios. The plastic bricks do not get any crack or damages during the process of checking the soundness, but the brunt clay bricks get abraded at their surface.

Figure 10: Soundness Test

F. Efflorescence Test

From the testing of efflorescence for the bricks, it was observed that the plastic sand bricks does not show any efflorescence. Since the plastic contains a smaller number of soluble salts in it. Hence finally proved that the efflorescence of the plastic brick was very less.

3. COST ESTIMATION

The chart was plotted on the basis of experimental material cost and collection cost. Since the chart was plotted between the types of bricks along x-axis and cost of a single along y-axis. In this chart the cost of normal burnt clay brick, fly ash brick is compared with prepared plastic sand brick.

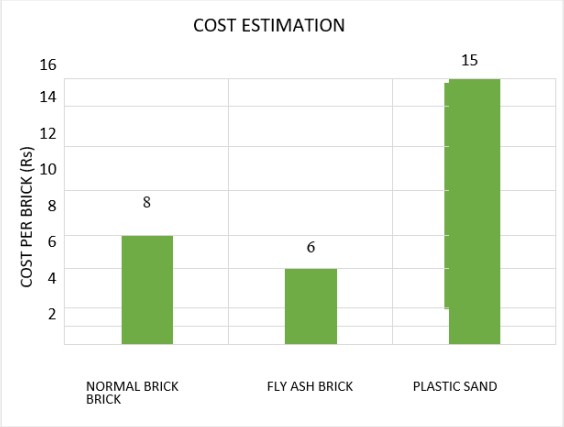

Figure 11: Chart for Cost Comparison

Table 3: Cost Analysis

Sr. No.	Contents	Cost (Rs)
1	Cost of sand per kg	3
2	Cost of plastic per kg	3.5
3	Cost of sand required per brick with 10% wastage	9 (About 3kg)
4	Cost of plastic required per brick with 10% wastage	3.5 (for 1kg)
5	Total cost along with lump sum cost (Rs 2.5)	15 (Per Brick)

CONCLUSION

In this paper, the plastic is used as the binder material so it restricts the absorption of water and also provides the good plasticity to the brick. So hence this type of bricks also resists the earthquake loads. This type of plastic bricks has high compressive or crushing strength at the ratio (1:3). And also has less absorption value when compared to normal conventional burnt clay bricks. So hence the plastic sand brick ratio 1:3 is preferable for the usage for the constructions. By use of plastic sand bricks, the water absorption was highly reduced. This plastic sand bricks are used as foundation bricks below the plinth level in order to avoid the seepage of ground water. Also, the study presented above helps in reducing the plastic waste disposal

problem and converts that useless waste material into a useful construction material. The main drawback of this type of waste plastic sand bricks are easily get fire at normal fire. So, this type of bricks can be used at underwater construction, underground construction and also used for underground septic tank construction. Because this type of bricks can with stand high load than the normal bricks. Hence the main aim of this project was to reduce waste plastic in our environment by utilizing as a material for the building construction. Since by using in the underground construction the plastic also gets degraded naturally.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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