

PET BOTTLES PAVEMENT BLOCK

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Abstract - The main objective of this research work is to develop an efficient way to effectively utilize the waste plastic which is a great threat for the sustainment of ecological balance and to reduce the plastic waste which is increasing day by day. Bad effects of plastic waste are felt throughout the world. So, in order to solve this issue, an attempt is done to reduce the disposal problem of plastic waste by using plastic extruder machine. Extruder machine utilizes plastic waste and changes the waste plastic into useful construction materials. This study also aims at reducing the soil getting wasted during manufacturing of burnt bricks, by producing a brick which is environmentally friendly and also economical. A comparative study of burnt brick and plastic dust brick is done to showcase the advantage of plastic dust brick in areas of strength, economy, etc. Compression strength test was performed on the plastic block and its strength was found to be 6.66 N/mm² which is higher than normal cement block which have a compressive strength of 3-5 N/mm².

Keyword – PET Bottles Pavement Block, Material Selection, Specification, Tests

I. INTRODUCTION

Plastic is one of the daily increasing useful as well as a hazardous material. At the time of need, plastic is found to be very useful but after its use, it is simply thrown away, creating all kinds of hazards. Plastic is non-biodegradable that remains as a hazardous material for more than centuries [1]

Plastic is an effective raw material because of its large scale production witnessed after the industrial revolution. Today, it is impossible for any vital sector of the economy to work efficiently without usage of plastic starting from agriculture to packaging. Automobile, electronics, electrical, building construction, communication sectors has been virtually revolutionized by the applications of plastics. Thus we cannot ban the use of plastic but the reuse of plastic waste in building construction industry is considered to be the most feasible applications. Plastic have many good characteristics which include versatility, lightness, hardness, and resistant to chemicals, water and impact [Zeus Industrial Products] [2]

Growth of population, increasing urbanization, rising standards of living due to technological innovations have contributed to an increase both in the quantity and variety of solid wastes generated by industrial, mining, domestic and agricultural activities. Globally the estimated quantity of wastes generation was 12 billion tonnes in the year 2002 of which 11 billion tonnes were industrial wastes and 1.6 billion tonnes were municipal solid wastes (MSW). About 19 billion tonnes of solid wastes are expected to be generated annually by the year 2025. Annually, Asia alone generates 4.4 billion tonnes of solid. Critical Review on Types of Bricks Type 14: Plastic Sand Bricks 85 wastes and MSW comprise 790 million tonnes (MT) of which about 48 (6%) MT are

Polyethylene terephthalate and Polystyrene. The large volume of materials required for construction is potentially a major area for the reuse of waste materials. Recycling the plastics has advantages since it is widely used and has a long service life, which means that the waste is being removed from the waste stream for a long period. Because the amount of clay required to make bricks is large, the environmental benefits are not only related to the safe disposal of bulk waste, but also to the reduction of environmental impacts that arise due to burning of plastics [3]



II. PRESENT SCENARIO OF WASTE GENERATION IN INDIA

generated in India. By the year 2047, MSW generation in India, is expected to reach 300 MT [2]



III. MIX DESIGN OF PLASTIC BLOCKS

Material selection depends on the properties of the materials to be used during its construction. If the material does not full fill the requisite condition required for the use then it is not allowed to be used

In order to find the plastic block that they possess high compressive strength with various mix proportions are made and they are tested using compressive testing machine [CTM]. The mix proportions were in the ratio of (1:1.67:0.8:2). These are the ratio which represents the plastic, fly ash, quarry dust, aggregate respectively.

IV SPECIFICATIONS

PET bottles

Polyethylene terephthalate, commonly abbreviated **PET**, is a thermoplastic polymer resin of the polyester family. It is most often used in synthetic fibre, as a material for plastic bottles and food containers, in thermoforming applications, and in engineering resins often in combination with glass fibre

Fly ash

Fly ash is a residue resulting from combustion of pulverized coal or lignite in thermal power plants. About 80% of the total fly ash is in finely divided form which is carried away with flue gases and is collected by electrostatic precipitator or other suitable technology [1].

Quarry Dust

A quarry is a place from which dimension stone, rock, construction aggregate, riprap, sand, gravel, or slate has been excavated from the ground. A quarry is the same thing as an open pit mine from which minerals are extracted. The only nontrivial difference between the two is that open pit mines that produce building materials and dimension stone are commonly referred to as quarries. It can be used as substitute to sand fully or partially. It offers a comparatively good strength compared to sand with or without admixtures in concrete. The advantages of quarry dust are cost effective, easily available, consumption reduces the pollution in environment and effectively used as a replacement material for river sand .[3]

Aggregate

Construction aggregate, or simply "*aggregate*", is a broad category of coarse to medium grained particulate material used in construction, including sand, gravel, crushed stone, slag, recycled concrete and geosynthetic aggregates. Aggregates are the most mined materials in the world. Aggregates are a component of composite materials such as concrete and asphalt concrete.

V. PROCESS OF MANUFACTURING

Batching

The measurement of materials for making block is termed as batching. Use of weigh system in batching facilitates

accuracy, flexibility and simplicity. The collected waste bottles are cleaned with water and dried to remove the water present inside the plastic and then weighted. The other material and the plastic bottles were weighed in various proportions among which the plastic were taken for burning process. The table shows the batching proportion of the materials. [2]

Sr. No	Material	For 1 block in kg
1	PET Bottles	1.5 kg
2	Fly Ash	1.2 kg
3	Quarry Dust	3 kg
4	Aggregate	2.5 kg



Burning of plastic

After batching the plastic bottles were taken for burning in which the plastic bottles are thrown one by one into the container and allowed to melt at 75°C to 255°C. The first step of burning process includes the arrangement of container and furnace. The setup was arranged to hold the container and it is ignited. The container is placed over the setup and it is heated to remove the moisture present in it. [2]

Mixing

Mixing of materials is essential for the production of uniform and strengthens block. The mixing should ensure that the mass becomes homogeneous, uniform in colour and consistency. Generally there are two types of mixing, Hand mixing and machine mixing. In this project, we adopted hand mixing. The percentage of fly ash should be 67% more than PET bottles. The plastic bottles are added one by one into the container, until the entire plastic content required for making block of one mix proportion is added into it and these plastic is thoroughly mix by using trowel before it hardens. [2]



Moulding

The mixture is then poured into the block mould and is compacted by using tamping rod or steel rod. The surface is finished by using trowel. Before placing the mixture into the mould, the sides of the mould are oiled to easy removal of blocks. Mould removed after 24 hours. The mould is used for preparing block in uniform shape. The size of mould is 15x15x15 cm. The mould were assembled and placed on the base plate. The faces must be thinly coated with mould oil to easily demould after casting. [2]



VI. TESTING OF PET BOTTLE BLOCKS

Following test were performed on the paver block

5.1. Compressive strength

Compressive strength of the specimen block was calculated after 14 & 28 days of curing using the formula as follows, Compressive strength = Applied Max load x 1000 (N)/Cross sectional Area (mm²). The universal testing machine is used for testing the compressive strength of blocks. After the curing period gets over blocks are kept for testing. To test the specimens, the blocks are placed in the calibrated compression testing machine of capacity 3000 KN (Kilo Newton) and applied a load uniform at the rate of 3 KN/min. The load at failure is the maximum load at which specimen fails to produce any further increase in the indicator reading on the testing machine. [3]The compressive strength of paver block is 6.66N/mm².



5.2 Water absorption test

The paver block was first weighted in dry condition and they were immersed in water for 24 hours. After that they are taken out from water and they are wipe out with cloth. Then the difference between the dry and wet bricks percentage are calculated [3]. The water absorption is 14.5%.

VII. CONCLUSIONS

PET bottle block possess more advantages which includes cost efficiency, resource efficiency, reduction in emission of greenhouse gases, etc. PET bottle block is also known as "Eco-Blocks" made of plastic waste which is otherwise harmful to all living organisms can be used for construction purpose .It increases the compressive strength when compared to cement blocks.

We can conclude from the above discussion that the use of plastic can be possible to improve the properties of concrete which can act as a one of the plastic reusable method.

- 1) Eco friendly:- By using waste plastic in paver block 20 – 40% of plastic may reduce, it is also dangerous to environment and wildlife
- 2) Strength increases up to 30-35%:- Strength could be increased by using this plastic in the paver block by 30 to 35% by normal paver block and also help in reducing waste by 20 to 40%.
- 3) Economical:-As the plasticizer are not used in plastic concrete paver block the cost of plasticizers is reduces also plastic is zero cost material hence it also reduces the cost of plastic at some extend.

The PET paver block possess more advantages which include cost efficiency, removal of waste products thus abolishing the land requirement problem for dumping plastic, reduction in the emission of greenhouse gases by the conversion of flue gases into synthetic oil etc.

REFERENCE

- [1]MANUFACTURING AND TESTING OF PLASTIC SAND BRICK. International Journal of Science and Engineering Research Volume- 5, Issue-4, April.-2017
- [2]CRITICAL REVIEW ON TYPES OF BRICKS TYPE 14: PLASTIC SAND BRICKS. International Journal of Mechanical and Production Engineering, Volume- 5, Issue-11, Nov.-2017
- [3]EFFECTIVE UTILIZATION OF WASTE PLASTIC WITH SAND IN ADDITION WITH NYLON GRIDS IN PAVER STONES. International Journal of Current Engineering and Scientific Research Volume- 5, Issue- 10, May.-2018
- [4]UTILIZATION OF PLASTIC BAGS IN PAVEMENT BLOCKS. International Journal of Pure and Applied Mathematics Volume- 119, Issue- 15, June.-2018
- [5]UTILISATION OF WASTE PLASTIC IN MANUFACTURING OF BRICKS AND PAVER BLOCKS. International Journal of Applied Engineering Research, Vol. 11 No.3 (2016)