International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 09 | Sep 2020 www.irjet.net p-ISSN: 2395-0072

Study of Waste Plastic and Stone Dust for Reuse in Construction Industry as Blocks or Tiles

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Abstract - *In many developing countries plastic is major waste problem. plastic waste includes Drinking Water Bottles, Carry Bags, Bottles Caps, house hold Articles (High Density Polyethylene), Milk Pouches, Sacks, Carry Bags, Bin Linings, Cosmetics and Detergent Bottles, Low Density Polyethylene, Bottle Caps and Closures, Wrappers of Detergents, Biscuit, Electricals Fittings, Handles and Knobs Casting, Bonding Fibers (Polyester resin) etc. Plastic waste is a non-biodegradable waste which cannot decompose and this creates water, land pollution and air pollution. We can recycle, reuse the plastic waste. There is a need to find and use of materials made from recyclable plastics taking into considerations the adverse effects of plastic waste. Till date, largely research has been done using plastic as reinforcement but very less research has been finished exploring the utilization of plastic as a parent material. This research illustrates the manufacturing of tiles and bricks from LDPE, Low-Density Polyethylene, plastic waste. In this research plastic is melted and stone dust is added to it. In proportion of 1:3. This alternatively saves the quantum of sand/clay that has got to be removed from the valuable river beds/mines. The plastic waste is of course available in surplus quantity and hence the value factor comes down. Hence during this thesis, an effort is formed to review regard the properties of the brick which is manufactured using plastic wastes.*

Key Words: LDPE, stone dust, plastic waste, tiles, bricks, strength, mould, mix proportion

1. INTRODUCTION

Waste is defined as any material that is not useful to owner and does not represent any economic value Depending on the physical state of waste. Wastes are classified into solid, liquid and gaseous. Solid Wastes are categorized into municipal wastes, hazardous wastes, medical wastes, and radioactive wastes. If waste is biodegradable it decompose along with sufficient moisture, heat and nutrients to sustain microbial action. Plastic is a very useful substance in our day to day life work, but after the use of plastic it is very difficult for us to dispose of it because it is a non-biodegradable substance. Plastic is a new engineering material in which researchers take more interest to invest their time and money because it has a wide scope to enhance the usage of plastic in different work. The properties of plastic are very unique. Plastic is a composition of synthetic and semi synthetic organic compounds. They are malleable and ductile and remold into any solid substance. It is light weight material easy to transport and handle. Plastic is used in various objects which we use in our daily life like polythene, plastic cups, furniture, carry bags, packaging of food and other accessories, drinking containers, bottles, frames, milk pouches basins, toys, nets used in agriculture, artificial decoration etc. and so many . We need to use better advance techniques and methods to dispose plastic waste properly, otherwise, it will be major crisis of plastic disposal .As waste plastic is just thrown away making unsightly sights, plastic bags and other waste chokes water resources like river canals, water pipelines etc which creates problem for water drainage and causes floods out flaking of rivers and it all damages surrounding areas. In India, incinerators are used to dispose the plastic waste in which plastic waste burns on high temperature. The gases which evolves during this burning process pollute air and water. Due to this, a large number of people get affected and suffer from many harmful diseases and health problem. Researchers suggest that if plastic isn't disposed of soon, it can sustain for 4500 years without degradation. Now, these days the rate of plastic use keeps increasing. So the collection of plastic waste increasing at a rapid speed and it cannot be banned to use plastic. Plastic can be reused in various sectors like marketing, manufacturing, transportation, packing etc. In construction sector, we can use the plastic waste on a very large scale after recycling it, which means the problem of plastic waste can be removed for a long time period. It seems to be more practicable and efficient method to solve this problem. In construction field, many types of bricks and tiles are used like - clay bricks/tiles, concrete bricks, fly ash bricks, foam bricks. In this project we try to use plastic based bricks/tiles which has better characteristics than any other type of bricks. Plastic sand bricks/tiles are cheaper than normal bricks/tiles. People can easily afford these types of bricks/tile

2. OBJECTIVES

- To study conventional block/tile manufacturing process.
- To develop an efficient way and to effectively utilize the waste plastics and stone dust generated dusring rock mining as waste product.
- To reduce the consumption of natural resources such as river sand for the manufacturing of bricks/tiles.

- To minimize and reuse generation of waste plastic on the land and water to avoid land and water degradation and consequent pollution
- To produce cost-effective materials which a common person can afford easily.
- To manufacture blocks/tiles from waste material such as plastic (LDPE) and stone dust which is powder or fine form of stone.
- To test various properties of the manufactured product like compressive strength, water absorption ,density etc

3. METHODOLOGY

3.1 EARLIER WORK DONE

Researchers are working towards using plastic efficiently. Earlier they have used plastic as parent material for block/tile formation. Along with LDPE they used river sand as reinforcing and to give strength to specimen. But as river sand is not easily available for construction purposes and it also illegal to withdraw river sand from river beds one need to find alternative for sand.

3.2MATERIAL SELECTION

In this research waste plastic of Low Density Polyethylene (LDPE) type is used. LDPE is a thermoplastic that can be molded and remolded repeatedly when heated. It is a highly flexible material because it contains numerous side chains that increase the distance between the main C-C chains, reduced packing and intermolecular attraction. It typically has a density in the range of 0.91–0.94 $gcm^{3.}$ It is very safe plastic to handle. LDPE plastic waste includes flexible products like plastic bags for dry-cleaning, newspapers, bread, frozen foods, fresh produce and garbage. Most shrink-wrap and stretch film is also made out of LDPE, as well as coatings for paper milk cartons and disposable beverage cups. Manufacturers also use LDPE to create thin container lids, squeezable bottles and some toys.

We will be using stone dust for manufacturing blocks/tiles. Stone dust is powdered brick, which can be obtained by crushing waste bricks. After demolition of structure numbers of waste bricks are produced.

Fig: LDPE waste

Fig: Stone dust

It is also reuse of waste material from demolition of structure Over all block/tile production is from waste material.

3.3 PROCEDURE

- First, LDPE plastic waste collected and separated it from other wastes.
- Second, the plastic waste is dried and moisture content is removed if present any. We have to use dry plastic waste
- The plastic bags cut into smaller pieces using scissors and cutters.
- To give the molten plastic their final shape of the tile of dimension of 30cm x 30cm x 2.5cm, a mold needed to be made. It will be manufactured by welding MS plates together. Along with it, a hammer manufactured to apply vertical forces and compress the molten plastic to make it compact.
- Melting plastic is stirred in between to distribute heat properly during the process.
- Stone dust added to the plastic when it turns into hot liquid.
- Homogenous plastic bonded stone dust mortar is formed
- Plastic bonded mortar then need to transferred into moulds and compacted
- Sample is allowed to set and harden then removed from mould after setting properly.

Fig: LDPE- stone dust tile

3.4 EXPERIMENTATION AND TESTS

The resultant block and tile required to test for its properties as per standard guidelines given by IS 1237:2012.

It includes following tests:

1. Shape and size test:

   Specimen is moulded to any required shape. Here specimen with dimension 30cm x 30cm x 2.5cm is produced.

2. Water absorption test:

   Specimen created doesn't absorb water. Water absorption is 0%.

3. Color test:

   Prototype is blackish dark in colour, as major constituent is stone dust which is darker in colour.

4. Effloresces test:

   It doesn't show any type of effloresces on surface of specimen.

5. Density test:

   Density of LDPE tile is observed around 950kg/m^3 which is considerably less as compared to normal tile.

6. Static friction test:

   LDPE tile provide friction a like regular tiles used in bathroom.

Results obtained from this tests need to be compared with results from conventional one and analysis to be made whether results from above prototype giving enough positive outcome or not.

4. CONCLUSIONS

- A completely recycled product was manufacture at a very cheap price.
- The material is unbreakable as against ceramic tile
- Manufactured floats on water, making it suitable for marine applications like rafts, floats.
- Removal of waste products thus abolishing the land requirement problem for dumping plastic.
- This method is suitable for the countries which have the difficult to dispose /recycle the plastic waste.

Lower the water absorption higher will be the strength of bricks and as made up of plastic there will be negligible water absorption giving more strength

ACKNOWLEDGEMENT

The authors are thankful to Principal Dr G.A. Hinge, Pune, Maharshtra to permit to carry out the work. The authors are thankful to project guide prof Dr. A. R. Vasatkar for helping and guiding through out project. The authors are thankful to all technical staff members of Civil Engineering Department.

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