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Application of Single Use Plastic in Non-Structural Elements of Building

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Abstract: *Plastic waste is a non-Biodegradable waste which cannot decompose and this creates water, land, pollution, and air pollution. Also, while we burn the plastic waste in dumping ground, the percentage of plastic waste is increasing rapidly. it is estimated that the plastic waste will double after a decade as we use hundreds of grades of plastic in our life. We can recycle, reuse the plastic waste. The present investigation at manufacturing floor tiles using waste plastic and comparing results with normal tiles to evaluate different physical and mechanical properties, tests like water absorption test, compression test, flash and fire point test carried out on plastic tile and test results are compared with normal cement tiles like vitrified tile. As per this study it can considered to use plastic waste in manufacturing of floor tiles. The project is helpful in reducing plastic waste in a useful way. In this project we have used LDPE plastic bags only. The proper utilisation of waste plastic are suitable for manufacturing of plastic tile and it will not only bring out singnificant saving on tile material cost but simultaneously shall help in tackling the problem of such waste material. The plastic tiles were prepared and tested and the results were discussed.*

Keywords Single use plastic, Physical Properties, Compressive Strength, floor tiles

I. INTRODUCTION

Plastic waste is increasing due to increase in population, urbanization and development. The disposal of waste plastic has become a serious problem globally due to their non-biodegradability. Annually approximate 500 billion plastic bags are used worldwide. Over one million sea birds and 100000 marine mammals are killed annually from plastic in our oceans. To overcome these defect we can use the plastic in construction sectors as row materials in different ways like by preparing tiles, bricks, pavement and also used for irrigation. The waste plastic will be large in household time in many countries the composition of waste is different, that it is affected by the socioeconomic character waste management programs and consumption pattern recycling the plastic has advantage since it is widely used and has a long service life. For the first time in South India, plastic waste will be recycled to manufacture tiles in Vizag.

The National Research Development Corporation's Intellectual Property Facilitation Centre at Visakhapatnam and National Physical Laboratory of New Delhi has transferred the technology to the Vizag-based Vizag Bio-Energy Fuel Private Limited, according to the centre's Vizag head B.K Sahu. Scientists believe that the plastic tiles could be commercially viable as they are unbreakable and water-proof. Promoting them would help combat the threat posed by plastic waste. The technology was developed by scientist S.K. Dhawan and his team at the NPL, the technology was selected in the Smart Fifty innovations by the department of science and technology and IIM-Kolkata. Speaking to this newspaper, Mr Dhawan said: "The idea was to evolve a solution to the huge threat looming on the environment due to plastic waste. Only 20 per cent of plastic waste is recycled and the rest is dumped, causing a huge impact all over including marine life. There is a huge scope to recycle these wastes."

The law – Plastics Waste (Management and Handling) rules have been enacted in 2011, by Ministry of Environment, Forest and Climate Change, Government of India, and has yet not been implemented in any city or a municipal body in its correct form. For this there is a need for system designing, which encompasses the responsibility of municipal body, getting the plastics industry involved under extended producer responsibility and getting the informal sector in a formal regulated framework.

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Plastic is defined as synthetic or semi-synthetic materials which are polymeric and are composed of large molecules of organics substances known as monomers. The large molecules that are from the during a process known as polymerization are known as polymers.

II. LITERATURE SURVEY

In this chapter survey of all past researches is DONE. This past research has guided us in carrying out this INVESTIGATION. Various study done before and researches carried by experts helps us in this study.

Paper Name: Comparative Analysis of Tiles Made from Recyclable LDPE Plastic Waste
Author: Hardikar, Omkar Borhade, et.al (Feb 2019)
Abstract: In this Paper they studied there is a need for use of materials made from recyclable plastics taking into considerations the adverse effects of plastic waste. There have been numerous procedures carried out for processing and recycling of plastic waste, but the use of LDPE plastic for making of internal partitions, tiles and plastic products with antimicrobial properties has not been well explored. Till date, largely research has been done using plastic as reinforcement but very less research has been done for exploring the use of plastic as a parent material with sawdust or fiber reinforcement. This research illustrates the manufacturing of tiles and bricks from LDPE, Low-Density Polyethylene, plastic waste. The LDPE was procured mainly from the Amazon delivery bags and other daily used plastic waste. Hot-ramming was carried out on the semi-solid plastic achieved by heating till Glass Point Temperature was achieved followed by tests included compression test, flammability test, friction test, etc. These test results were compared with that of traditional Ceramic tiles, in which, for the plastic tiles a weight reduction of 57.7322% was observed as compared to the conventional bathroom tile having the same dimension and flexural strength.

Paper Name: Performance Evaluation of plastic brick composites
Author: ER.P.N.E. Naveen et al (2020)
Abstract: they studied those plastics are one of the most leading and using material in our day to day life only because of its low cost, easily availability and its properties. Even though the plastics are shown tremendous results but usage is limited only because of the material is hazardous environmentally. Plastic pollution is the accumulation of plastic objects and particles (e.g. plastic bottles, bags and microbeads) in the Earth's environment that adversely affects wildlife, wildlife habitat, and humans. Plastics that act as pollutants are categorized into micro-, meso-, or macro debris, based on size. Plastics are inexpensive and durable, and as a result levels of plastic production by humans are high. However, the chemical structure of most plastics renders them resistant to many natural processes of degradation and as a result they are slow to degrade. Together, these two factors have led to a high prominence of plastic pollution in the environment. The main idea of the project is to convert this waste plastic scrap into useful plastic Bricks for constructive purpose under proper environmental conditions. In this the waste plastic is mixed with sand, clay and cement to form the composite bricks to achieve the sufficient strength. The plastic waste was obtained from the bags, cans and bottles which are chopped into the small pieces for mixing with sand and cement to form the composites by using casting and molding process. To analyze the performance of the molded composite, brick the Local brick testing methods were conducted such as free fall of the brick and scratch test. In both of those tests, our brick showed increased strength. The brick was also subjected to compressive and water absorption test to know the proper applicability in construction usage. These results showed that, the Plastic Composite Brick was more efficient than the clay brick and cement brick.

Paper Name: Assessment of Use of Plastic Waste in Manufacturing of Tiles”
Author: Prof.Pramod.R.Thorat et al. (2020)
Abstract: This study has been undertaken to investigate the use of plastic waste for prepared floor tiles which can be recycle the plastic waste. At present nearly 9.46 million tonne of plastic waste generates annually in India. The degradation rate of plastic waste is also a very slow process. Hence project is helpful in reducing plastic waste in useful way. Sample of 300mm x 300mm x 15mm size sample are prepared. To evaluate different physical and mechanical properties, tests like water absorption, compression test, flexural test and flash and fire point tests are carried out as per IS specifications on plastic tiles and these tests were compared with the porcelain tiles, vitrified tiles and paver block.

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The result obtained have shown better results as compared to other tiles. This tile can be better alternative to the paver block and other traditional tiles.

III. METHODOLOGY

The experimental work includes the casting, compressing, cooling & testing of plastic tiles exposed to normal temperature. The locally available thin plastic bags are used.

2.1 Properties of Material

A. Material Specification

The basic material is used for manufacturing of tiles is thin plastic bags.

Sr. No.	Material	Specification
1	Plastic	LDPE (50 Micron)

Table: Material Specification

Design Requirement: Test on Plastic Tiles:

Tests conducted on plastic tiles are as follows,

1. Physical test
2. Water absorption test
3. Mechanical test
4. compression test
5. flash and fire point test
6. Flexural test

Procedure for Making Mould

To give the decided shape to molten plastic, mould was formed as per decided shape of plastic tiles and This was manufactured by welding MS plates together.

Mould for Plastic Tiles

Mild steel was selected for fabrication of mould. It has following advantages over aluminium.

1. It is economical as compared to aluminium.
2. Also, it provides better impact resistance to mould.
3. It has better tensile strength.
4. It is weldable.
5. Having less than 2% carbon it will magnetize well and is relatively inexpensive.
6. It must be painted or otherwise sealed to prevent it from rusting.

For Mould

Table 1: Mould Specification

Material	Size of plate	Shape of plate	Weight of plate
MS	30cm x 30cm x 1.5cm	square	1.5 Kg

Procedure for Making Plastic Tiles

In this research, the component manufactured was made from the waste plastic bags. Following are the steps involved in its manufacturing. Preparation of tiles consist of a thermosetting casting method.

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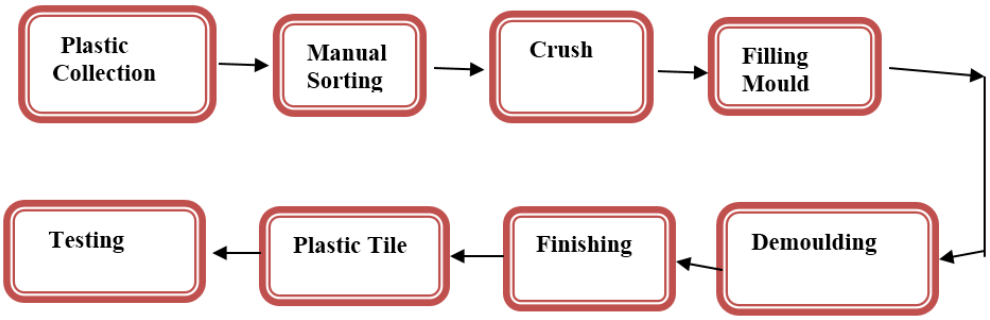
Procedure for Making Plastic Tiles



Test of Plastic Tiles &Conventional Tiles I.E. Porcelain Tiles, Vitrified Tiles, Paver Block

Physical Test:

Water Absorption Test (ISO 10545-3:1995 PART-3)

The test procedure was followed in below:

The test specimen was completely immersed in water for 24 hours. Then the specimen is taken out the water and allowed then to drain for 1 minute. Then the specimen were wiped off and weighted immediately and weight of each specimen is noted. this can be represented as (Ww) then this specimen was dried in a ventilated oven at 107 ± 7℃ for 24 hours. The dry weight of each specimen was recorded and of it is represented by

Water absorption ٪ = [(W2-W1)] / [W1] x 100

Where, W1 = weight of dry tile

W2 = weight of wet tiles

Table 2: Water Absorption Test

Sr.no	Description of specimen	Size	Dry weight of specimen (W1)	Wet weight of specimen(W2)	water absorption ٪
1	Plastic tile	300X300	1940	1945	0.25
2	porcelain tile	300X300	1219	1288	5.66
3	Vitrified tile	300X300	1785	1823.5	2.05

Calculations:

1. Plastic tile:

Water absorption = [(W2-W1)] / [W1] x 100

= [(1945-1940)] / [1940] x 100

=0.25 %

2. Porcelaintile:

Water absorption = [(W2-W1)] / [W1] x 100

= [(1288-1219)] / [1219] x 100

=5.66 %

3. Vitrified tile:

water absorption = [(W2-W1)] / [W1] x 100

= [(1823.5-1785)] / [1785] x 100

=2.05%

Mechanical Test:

Compression Test -(IS 15622-2006)

The test procedure was followed in below:

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The specimen shall comprise of compression testing machine which shall be equipped with two steel bearings blocks for holding the specimen.it is desirable that the specimen have a minimum thickness of 15 mm.the specimen on top through which load is transmitted shall be spherically seated and the block below on which the specimen is shall be rigidly fitted when the bearing area of the steel blocks is not sufficient to cover the bearing area of the specimen to steel bearing plates meeting the requirement. The compressive strength of specimen is represented as follows,

Compressive strength of tile = max compressive load / min c/s area

Table 3: Compression Test

Calculations:

Sr.no	Description of specimen	Cross Sectional Area	Compressive Load in KN	Compressive strength in MPa
1	Plastic tile	300X300	**900-950**	**10.56**
2	porcelain tile	300X300	**3**	**0.03**
3	Vitrified tile	300X300	**5**	**0.05**

1. Plastic tile

Compressive strength of tile = max compressive load / min c/s area

$= 950\times10^3/ (300\times300)$ **=10.56 MPa**

2. Porcelain tile

Compressive strength of tile = max compressive load / min c/s area

$= 3\times10^3 / (300\times300)$ **= 0.03 MPa**

3. Vitrified tile

Compressive strength of tile = max compressive load / min c/s area

$= 5\times10^3/ (300\times300)$ **=0.05 MPa**

Flexural Test (IS 516-Part 8):

The load shall be applied from the top of the specimen in the form of simple beam loading through a roller spaced midway between the supporting roller. The load shall be applied without shock and increased continuously at a uniform rate of 6 KN/minute. The load shall be increased until the specimen fails and the maximum load applied shall be recorded.

The flexural strength of the specimen shall be calculated as follows,

$Fb = 3\ Pl / 2\ b\ d^2$

where, Fb = Flexural strength, in N/mm^2

P = maximum load in N=25Kg=245.25N.

l= distance between central line of supporting roller in mm

b= average width of block in mm

d = average thickness measured from both end of the fracture line in mm.

Table 5: Flexural test

Sr.no	Description of specimen	span	Flexural strength MPa	Remark
1	Plastic tile	300	**0.98**	not breakable
2	porcelaintile	300	**2.75**	breakable
3	Vitrified tile	300	**2.45**	breakable

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1. Plastic tile:

Flexural strength = Fb = 3 Pl / 2 b d²

= (3x245.24x15)/(2x300x150²)=**0.81**

2. Porcelain tile:

Flexural strength = Fb = 3 Pl / 2 b d² = 2.75

3. Vitrified tile:

Flexural strength = Fb = 3 Pl / 2 b d² =2.45

Flash and Fire Point

For Plastic Tile

The flash point of material is the lowest temperature at which the application of test flame causes the vapors from the material and momentarily catches fire in the form of a flash under specified condition of test.

Table 4: Flash And Fire Point

Description	Plastic material
Flash point	280
Fire point	340

IV. CONCLUSION

1. As above project studied that the plastic is harmful for environment and very much amount plastic waste discard in surrounding in daily routing. So we try to minimize as well as utilization of this plastic waste in civil construction field by production of plastic tiles with waste plastic material
2. The plastic tiles are more durable than traditional tiles with respect to various perspectives as written in result.
3. Manufactured tiles float on water making it suitable for marine application.
4. Reduction in waste plastics saves our environment by reducing the amount of waste plastic generated by consumer and industry it also reduces greenhouse gas emission and helps prevent global climate change.

V. FUTURE SCOPE

1. After completion of above project is noted that this plastic tile presenting un economical but in future research on that issue will be possibility make that this tile economical.
2. We will change the percentage of plastic waste also there are possibility to change the binding material like resin – melamine, resin polyesters etc this are the chemical which will be economical.
3. if we use fire proof reagent, modern method, colour reagent for making this tile then it will more glossiness and efficient.
4. if we increase our production in large quantity then there will be possibility of chemical present in it will be at low cost.

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