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Reuse of Plastic Waste into Flooring Tiles

Prof. Patil A.A. , Miss. Nadaf N .I. , Miss. Mahedi S .I. ,Miss. Bhusare M.B.

[1]*ME (Envoirment Engineering)Head of Department of Civil Engineering, V.V.P.I.E.T Solapur Maharashtra, India.*
[2]*Student(Civil Engineering), Solapur University of Engineering and Technology, Solapur, Maharashtra,India.*
[3]*Student, (Civil Engineering), Solapur University of Engineering and Technology, Solapur, Maharashtra, India.*
[4]*Student(Civil Engineering), Solapur University of Engineering and Technology, Solapur, Maharashtra, India.*
Corresponding Author: Prof. Patil A.A.

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ABSTRACT: One of the main environmental problems today is the disposal of the waste plastics. The plastic waste is increasing day by day. On another side, the construction industry is facing problem due to the insufficient and unavailability of the construction materials. So we need to search new construction material as well as an efficient method for reuse of plastic waste. To find the solution of above problems, one of them can be used to solve other.

As per this study it can be considered to use plastic waste as a binding material instead of cement in the manufacturing of floor tiles. The present investigation aims at manufacturing floor tiles using waste plastic in different proportions with fly ash to evaluate different physical and mechanicals properties, tests like water absorption , transverse resistance, resistances to impact, an abrasion resistance test were carried out as per IS specifications on the plastics tiles.

KEYWORDS: WASTE PLASTIC, FLY ASH ,COAL

I. INTRODUCTION

Plastic is a kind of material that is commonly known and used in everyday life in many forms. It becomes an important part of every one's life**.** Plastic pollution is the accumulation of plastic objects and particles (e.g.: plastic bottles and much more) in the Earth's environment that adversely affects wildlife, wildlife habitat, and humans. 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. Plastic pollution can afflict land, waterways and oceans. It is estimated that 1.1 to 8.8 million metric tons (MT) of plastic waste enters the ocean from coastal communities each year This study aims at investigating the possibility of how plastics can be applied in construction industry. waste plastics have no value, resulting in uncontrolled disposal . Dumping into waterways has severe adverse effects on local communities. Waste plastics are not only unsightly, but they block urban drainage systems and sewers, causing flash floods, as well as providing a fertile breeding ground for mosquitoes and other water- borne diseases. Plastics have become a vital asset for humanity, often providing functionality that cannot be easily or economically replaced by other materials. Plastic products have brought benefits to society in terms of economic activity, jobs and quality of life. Most plastics are robust and last for hundreds of years. They have replaced metals in the components of most manufactured goods, including for such products as computers, car parts and refrigerators, and in so doing have often made the products cheaper, lighter, safer, stronger. Plastics have taken over from paper, glass and cardboard in packaging, usually reducing cost and also providing better care of the items.

Plastics also play a very vital role in hospitals and medical field. Plastics are used on large scale in hospitals. The daily plastic waste generation includes disposable syringes, I.V sets, glucose bottles, disposable plastic aprons; B.T sets; catheters and cannulas etc. are disposed of on daily basis. Plastics may be easy and convenient for everyday use, but their negative impacts on our health cannot be overlooked. Due to its non-biodegradable nature, it keeps on piling in the environment and is creating tons of trash around the world., the ineffective recycling policies and lack of producer . In coming times also, the applications of plastics definitely are expected to increase as more

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new products and plastics are developed to meet demands. The increased use and production of plastic in developing and emerging countries is a particular concern, as the sophistication of their waste management infrastructure may not be developing at an appropriate rate to deal with their increasing levels of plastic waste. Generally, there are two kinds of commercial plastics, thermoplastic (reheated, melted, and molded into different shapes) and thermosetting plastics which degrade and turn into other substances if reheated after molding . Today, there are many different types of plastics manufactured in the plastic industry. The table below summarizes names of all commonly used plastics and their applications . New technologies and products were found after extensive research made in the field of plastics. Earlier the drawbacks of plastics were not known. The plastics are usually non-biodegradable.

[1].**Plastic:**

- Plastic has slowly become an integral part of all human requirements. Plastic carry bag, packing materials, bottles, cups and various other items have slowly replaced everything made of other materials due to advantages of plastic. Plastic is easy to produce, lightweight, unbreakable, odorless & chemical resistant. But plastic does not decompose. This is its biggest drawback.
- On heating at 140 - 160°C, plastics such as carry bags, plastic cups, plastic packaging, etc. exhibit good binding properties.
- Finding proper use of the disposed plastics waste is the need of the hour. They are mostly littered after their use. The littered plastics, a non-biodegradable material, get mixed with domestic waste and make the disposal of municipal solid waste difficult. The municipal solid waste is either incinerated or used for land filling. Both are not right techniques to reuse the plastic waste in an eco-friendly way is the thrust area of today's research.

[2]. Fly ash:

- Fly ash is produced by coal-fired electric and steam generating plants. Typically, coal is pulverized and blown with air into the boiler's combustion chamber where it immediately ignites, generating heat and producing a molten mineral residue. Boiler tubes extract heat from the boiler, cooling the flue gas and causing the molten mineral residue to harden and form ash.

Fig.2 fly ash

II. OBJECTIVE

- To study the effects and causes of plastic waste on environment.
- To study the properties of plastic waste as a construction material.
- To reuse the plastic waste as flooring tiles

III. SCOPE

Reducing the various environment, pollution & social impact associated with waste plastic & cement manufacturing industries.

IV. METHOD AND MATERIAL

Materials used for Reuse of plastic waste as flooring tiles.

Materials and equipment used is as follows:

1. Waste plastic
2. Flash
3. Coal
4. Mould
5. Hand gloves
6. Trowel

- To study the properties of plastic waste as a construction material.

Each plastic material has its own peculiar properties to suit its particular uses. The success of plastic as an engineering material will depends up on the selection of variety of plastic. There are the general properties of plastic Appearance, Chemicalresistance, Dimensional stability, Ductility, Durability, Electric insulation, Finishing, Fire resistance, Fixing, Humidity, Optical property, Recycling, Sound absorption, Strength, Thermal property, Weather resistance Weight.

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MANUFACTURING FLOW CHART

COLLECTION OF RAW MATERIAL
(PLASTIC WASTE AND FLY ASH)
↓
SHREDING
↓
HEATING
↓
ADDING FLY ASH
↓
MIXING
↓
POURING INTO MOULD
↓
COMPACTION
↓
SETTING
↓
FINISHING
↓
FINAL PRODUCT

1. To reuse the plastic waste as flooring tiles

STEP: 1 First of all we want to make a product from recycled plastics, make sure you save all your plastic bottles, caps, buckets and more

Fig.PLASTIC WASTE

STEP:2: Then we melt the plastic at Light a small fire under the metal drum and gently heat it. Add the plastic waste. As it warms up it will reduce in size Light the plastic at the top using a small flame to help it melt down. Make sure the fire does not get too hot. Keep adding plastic gently until it melts down to a black liquid. add small amount of flash.

Fig. Heating

STEP:03: Then mix the mixture of plastic and fly ash solution.

STEP:04: Then Prepare the mould of standard size by making sure it is very clean, with no pieces of plastic on it from previous Moldings and well oiled**.**

Fig.. MOULD

STEP:05: Press and work the mixture in to the mould so there are no air gaps.

STEP:06: Set Allow the hot mixture in the mould to set for a few minutes, repeatedly shaking

STEP:07: The mould to loosen the edges (a rocking motion works well).Keep trying to lift the mould. When the mixture has hardened enough that the slab will not collapse, remove the mould and leave. It should harden in around 2 hours.

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Fig.. Final tiles

V. FEASIBILITY STUDY

Cost analysis :

Considering the total demand for recycling of plastic waste we have carried out some technical and cost studies which are as follows.

1.Fixed cost –

cost which does not vary with level of production. Which is mandatory irrespective of production. e.g. rent for land, salaries to be paid to staff etc.

2. Variable cost

It is the cost which directly varies with the production .if quantity to be produced increases this amount may vary accordingly .e.g. manufacturing, operational charges.

3.Total cost –

It is sum of above two i.e. fixed cost + variable cost.

4. Total revenue

It is product of sales price and number of unit produced. i.e. .Q X S

Where Q is number of unit produced and S is the sales price.

monthly production -25,000 unit

Annual production -25,000x12 months = nos (3 lac)

Total cost =fixed cost+ working capital+ tech how know charges

=20,000+75,000+37500

=1,32,500/-(one lac thirty two thousand five hundred)

As per cost benefit ratio =(benefit /cost)=1.33

Benefit =1.33x cost =1.33*1,32,500=1,76,225/-Rs

Per unit cost =1,76,225/25000=7.04 Rs per unit.

*as per market enquiry normal clay tile held 18 Rs/per unit price as compared to our plastic tile**.**

- **Laboratory tests conducted on the specimens produced**
- Physical and mechanical tests:

1. Physical properties:

(i) Water Absorption: The water absorption test was carried out in accordance with IS 456-2000. The test specimens for moulded plastics were in the form of a size 130mmx130mm and 20 mm thickness . The specimens we dried in an oven with temperature of 105 o C to 110 o C for duration of 24 hours and placed in a desiccator to cool. Immediately upon cooling, the specimens were weighed. The specimens were then emerged in water with 23oC for 24 hours and specimens were then removed, patted dry with a lint free cloth and weighted. Water absorption is expressed as increase in weight per cent. Per cent (%) of water absorption = (wet weight – dry weight)/ dry weight X100, and (ii) Density and Specific gravity: The density and specific gravity of these waste plastics were carried out according to IS code. The specimen was first weighted in air, then weight when immersed in distilled water at 23oC using a sinker and wire to hold the specimen completely submerged as required. Hence the density and specific gravity were calculated. Any convenient specimen size can be used for the test.

2. Mechanical properties

- Tensile Strength: The rate at which a sample was pulled apart in the test was ranged to be from 0.5 inches per minute (0.212mm/sec).
- Compressive Strength: The speed of the movable load was 0.05inch per minute (0.0212mm/ various recycled plastic waste

SR NO	TEST	TEST RESULTS FOR DIFFERENT PERCENTAGE OF WASTE PLASTIC			NORMAL CEMENT TILE
		30 %	40 %	50 %	
1	WATER ABSORBTION (%)	3.80	4.50	2.81	9.5
2	TESILE STRENGTH(N/MM2)	10.80	13.74	20.80	22.75
3	ABRASION RESISTANCE (IN CM)	0.90	0.82	0.72	0.79

- **Difference between plastic waste tiles and ceramic tiles**

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The table below shows the different between plastic waste tiles and ceramic tiles

Property	SI units	Ceramic tile	Plastic tiles
1. Density	g/cm3	3.52	1.116
2. Young's Modulus	MPa	270	152.4
3. Flexural Strength	MPa	275	4.720
4. Compressive Strength	MPa	1.77 GPa	3.349
5. Specific Gravity	–	Nil	1.119
6. Water Absorption	%	None	2.81
7. `Maximum Use Temperature	^{o}C	1250	300
8. Cost	per unit	18 Rs /nos	7.04Rs/nos

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VI. RESULTS :

The waste plastic is added as a binding agent with fly ash in different proportions of 30%, 40% 50%by weight of fly ash . proportions of 10% and 30% were found to be insufficient to prepare tiles , since after removal of mould the tiles got failed as shown in fig . to evaluate different physical and mechanical proper tiles tests like water absorption test , resistance to impact and abrasion test were carried out 30% , 40%, 50% as per IS specification on waste plastic tiles and these were compares with the normal cement tiles .the result obtain have the 50% proportion tiles is good .we can use this proportion of plastic and fly ash tiles

FIG.. 30% PROPORTION TILES

VII. CONCLUSION

Plastic and fly ash tile possess more advantage which include cost efficiency, resource efficiency, reduction in waste etc. Plastic fly ash tile can also be known as "Eco-Tile'' made of plastic waste can be used for construction purposes. It increases the compressive strength when compared to normal tiles**.** Considering the total requirement and need of society , as well as according to cost analysis and project profitability statement it is concluded that the project is technically viable and financially feasible

From the results obtained from these studies the following conclusions can be drawn:

1. The compressive strength values of all waste plastic concrete mixture tend to decreases below the values for the references concrete mixtures with increasing the waste plastic ratio at all the curing ages.
2. The flexural strength at each curing age also decreases with the increase of the waste plastic and sand ratio.
3. Cost Comparison in use of plastic in the floor tiles with normal tiles.

Advantages of plastic waste tiles :

- Plastics are strong yet lightweight, and so they are easy to transport & manoeuvre.
- They are durable, knock-and scratch resistant with excellent weatherability.
- They do not rot or corrode.
- Plastics are easy to install; many have a snap-fit kind of jointing procedures.
- Plastics offer limitless possibilities in design achieved by extrusion, bending, moulding etc.
- They can be given
- of heat and thus are used as insulation materials in green building concepts. any range of colours by adding pigments.
- The plastics are low conductors
- The plastics products can achieve tight seals.
- They can be sawn and nailed employing standard carpentry tools and skills.
- They can be easily removed and recycled.
- They are bad conductors of electricity.

Disadvantages of plastic waste tiles :

- Plastics may be degraded under the action of direct sunlight which reduces their mechanical strength.
- Many plastics are flammable unless treated.
- High embodied energy content
- Low modulus of elasticity: makes them unsuitable for load-bearing applications.
- Thermoplastics are subject to creep and soften at moderate temperatures.
- Thermal expansion for most plastics is high: adequate thermal movement has to be allowed in detailing.
- Many types of plastics are not biodegradable thus cause pollution when they accumula

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