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Effective Utilization of Plastic Wastes in Tile Manufacturing: A Step Towards Sustainability

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Abstract:

In India, 70 percent of total plastic consumption is discarded as waste. Around 5.6 million tonnes per annum (TPA) of plastic waste is generated in country, which is about 15,342 tonnes per day (TPD). To a large extent in India, plastics management is seen more as a waste management rather than generation of plastics. Another major concern about plastics in the waste stream is their longevity and whether or not they are truly biodegrade. It is estimated that most plastics would take 500-1000 years to break down into organic components. Because of this longevity and the low rate of recycling, much of our plastic waste ends up in landfills or as litter. Some of this plastic waste makes its way via rivers and wind to the ocean. Garbage barges, and the trans-continental transport of recyclable materials also lead to an increasing amount of plastics in our oceans and waterways. *Plastics* have a high energy content that *can be converted to* electricity, synthetic gas, fuels and recycled feedstocks for new *plastics* and other products of chemistry. Recovering this abundant energy also reduces *waste* sent *to* landfills and complements *plastics* recycling. Hence keeping all these factors in mind, it is liable to utilize plastic waste into useful construction material. Hence an attempt is made to utilize plastic in manufacturing of tiles with suitable proportions. Experiments are conducted to assess the compressive strength, rupture, abrasion, impact strength and water absorption. SEM analysis is performed to examine the micro level distribution of plastic wastes in manufactured tiles. It is believed that such initiative will lay the path towards the goal of "waste to wealth".

Keywords *: Plastic waste, flooring material, waste utilization*

I. Introduction

India is facing a serious challenge in disposing waste in many landfills throughout the country. The landfills situation is resulting in high disposal cost and potential environmental problems. If current trend continues, with waste production projected to grow by each year. A product that would help old age/disabled people by protecting them from skidding. A beneficiary product that could be helpful in the

future to face upcoming energy crisis times. Development of low cost tiles affordable by all community of the society. It means that made a low coast material tiles in that piezo electric sensor is embedded inside so it will absorbs energy in day time and it will release energy at night time through the light emitting tiles without current. According to Government of India, more than 15,000 tons of plastic waste are generated in India every day, of which 6,000 tones remain uncollected and littered. Such huge waste

from the society not only poses the environment threat problems like ozone layer depletion, ground water pollution and increased pressure on other land resources. Keeping this in view, an attempt has been made to develop new form of tiles that could sense the motion of the human being and guide them by emitting light along the path of the tiles. Such innovation may help the society during night time accessible areas and in particular elderly and disabled people may considered as main beneficiaries from this proposed idea

II. MATERIAL USED

A. Cement

Ordinary Portland cement (53 grade) confirming to the standards of IS : 12269-1987 was used throughout the investigation. The specific gravity and fineness is found to be 3.15(IS :4031-PART1) and initial setting time be 30min and consistency (IS :4031 PART 5) is 36%.

B. Fine Aggregate

Manufactured sand (M-Sand) is a substitute of river sand for concrete construction. Manufactured sand is produced from hard granite stone by crushing. The crushedsand is of cubical shape with grounded edges, washed and graded to as a construction material. The size of manufactured sand (M-Sand) is less than 4.75mm..

C. Plastic waste(LDPE)

Plastic waste used in making tiles was collected from the surrounding locality LDPE is indicated by resin number 4. It includes plastic bags. The plastic bag used is of about 50 microns. The basic properties are provided below.

Table 1. Properties of LDPE

Sl.No.	Particulars	Value
1	Melting point	150^{o}
2	Thermal coefficient of expansion	100 to 200 x 10^{-6}
3	Density	0.910 to 0.940
4	Tensile strength	0.20 to 0.40(N/mm^2)

Plastic are inexpensive & durable and as a result level of plastic production by humans are high. Plastic pollution can afflict land waterways & oceans. Moreover 1.1 to 8.8 million metric tons (MT) of plastic waste in India in each year.

Carry bags(product cover) - 70%

Water bottle - 30%

Figure 1 : LDPE

III. PLASTIC SAND :

Plastic waste used in making tiles was collected from the surrounding locality LDPE is indicated by resin number 4. It includes plastic bags. The plastic bag used is of about 50 microns. The basic properties are provided above. Plastic wastes are heated in a metal funnel at a temp of above 150˚. As a result of heating the plastic waste melt.

Figure 5 : liquification of plastic in M-sand

The materials fine aggregate and coarse aggregate as described in previous chapter are added to it in right proportion at molten state of plastic and well mixed. After using the metal mold is cleaned through at using waste cloth. Now aggregate is coated with plastic and it will dried 24 hours.

Figure 6 : M-sand with plastic

Now this mixture is transferred to the mold. Then the blocks are allowed to dry for 24 hours so that they

harden. After drying the tiles is removed from the molds and ready for the use.

IV. Methodology

Harvesting kinetic energy may be considered as a sustainable method for generating electricity without depleting natural resources for the benefit of human comfort living. Even though huge figure cannot be targeted, small amount of electricity generation can be probable that could enable to tile to guide the path. The core technical part of the project is to develop paving slabs (i.e., tiles) This would help visually impaired people to visualize the path (kitchen/bathroom) to move during night time, especially
…….

This project mainly focuses to help the old age group people apart from normal people and can be claimed as novelty of the project. It is proposed to design a suitable mold type for the production of the flooring material with piezo sensors embedded.

Eco friendly tiles made from wate materiials with suitable percentage of waste plastic of 10%,20%,30%30%,40%,50% may be considered replacement of sand. Main challenge lies in fitting the tile system according to plan of the house where the beneficiary is targeted. As the human motion is detected in the form of foot pressure on the tiles, sensors senses the pressure and convert them into electrical energy that uses the tiles to be light glowing showing the direction. Such light emitting tiles not only guides elderly/disabled people to basic amenities also take the technological benefits to appropriate target groups. Developed low cost tiles will be affordable by all community of the society. It is a beneficiary product that could be helpful in the future to face upcoming energy crisis times. Also it is the duty of every civil engineer to engage him/her to develop new materials from the waste materials available on earth, A force applied along a neutral axis displaces charges along the x direction, perpendicular to the force. The amount of charge depends on the geometrical dimension of the piezoelectric element the amount of energy displaced is strictly proportion to the applied force and independent of the piezoelectric element size and shape.

V. CEMENT TILES

The material to produce the tiles are cement, msand, plastic sand(LDPE), aggregate chips

Figure 7 : cement tiles

Table 2: Proportioning of samples

Materials	10%	20%	30%	40%	50%
Fa	0.7 kg	0.68 kg	0.6 kg	0.53 kg	0.45 kg
Opc	0.7 kg	0.7 kg	0.7 kg	0.7 kg	0.7 kg
Water Content	0.4%	0.4%	0.4%	0.4%	0.4%

In above table describe that replacement of sand in this experiment give the best result in 10%,20%,30%plastic sand it give best result
The proportioning of materials were done with a suitable scale. The proportioning of samples was listed in table 1

TEST ON SAMPLES

A. compressive strength

The results are obtained, its show that compressive strength of tles in 7days. The compressive strength of sample I obtained as 17.9N/ mm², 17.7N/ mm², 9N/ mm², 7.22 N/ mm² sample 1,sample 2, sample3, sample 4 respectively..

Figure 7 : compressive strength of tile specimens

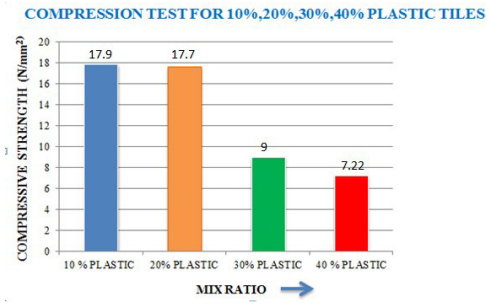

Figure 7 : compressive strength of tile specimens

VI. IMPACT TEST:

E = WHn
W-weight
H-Height
n-number of blows
E= 35.16 joule

VII. RESULT AND DISCUSSION

Based on the raw materials collected, the mix proportions were designated with appropriate ratios. Tile specimen were cast according to the mix proportions planned and cured for a period of seven days.

After seven days , the tile specimen were tested for its compressive strength and water absorption. The compressive strength for sample s1, s2, s3 were found to be satisfactory with respect to their compressive strength. Water absorption were found to be satisfactory (5%-6%) increase in its total weight.

A separate tile was made with embedded Sensors within them. Those sensors are then connected with strip lights that glow when pressure is applied over those tiles by the principle of piezo electric sensor. Those electrical energy are saved in an external battery in morning times. Those energy are used at night times.

CONCLUSION

Based on the preliminary investigation it is proposed to implement light weight tiles by introducing waste material (plastic, paper sludge, construction waste) in the sample in the future work.

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