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The Potential Use of Plastic Waste as Sustainable Construction Material

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ABSTRACT: Solid waste management is one of the major process which our country has to be given importance. One of the major threats in the solid waste is due to the Plastic Waste generation which are released to the open environment without any proper care. Since the plastic waste take more years to get degraded, the major issue arises is management of plastic waste among the total solid waste produced. They even cause environmental as well as health issues to the living being.The project elucidates about the use of LDPE waste as the construction material i.e., paving tile which is an innovative method for the conversion of plastic waste to a useful product. The pavement tiles showed best results of compressive strength and breaking load when tested. As a result, the so made pavement tile can be used either as pedestrian paving tile or can also be used as paving tile for residential driveways there by showing a compressive strength of 42 N/mm^2 and a breaking load of 3 KN.

KEYWORDS: Solid waste management, LDPE, pavement tile, compressive strength

I. INTRODUCTION

Humans are those species who are least bothered on the impacts of trashes released to the environment, and this practice are one which is being following from the very olden times. Of waste produced what has changed are the types and the quantity, the methods of disposal, and the human values and perceptions on what should be done with it. The applications of plastic materials and their composites are still growing rapidly due to their lower cost and easiness in the manufacturing. Therefore, high amount of waste plastic being piled up which create big challenges for their disposal as well as degradation, Solid waste management is one of the most challenging issues in India than elsewhere at the global. The quantity of solid waste has also increased tremendously with improved life style and social status of the populations in urban centers. Municipal corporations of the developing countries are not able to handle the increasing quantity of waste had resulted in uncollected waste on roads and other public places. According to World Bank study, urban per management rate for most of the low-income countries will be increasing by an amount approximately 0.2 kg per day by the year 2025 because of relatively high annual growth rate of GNP and urban population. If current trends continue, the world may see a five-fold increase in waste generation by the year 2025.

In recent years, Indian cities are invariably getting piled up with large amounts of garbage and solid waste in open places including public road and corners. The waste has been increasing in variety and volume is due to the continuous increase in industrial growth. Which has resulted in the stray dogs, rats and cats meddle with this open disposal of garbage, which spreads diseases. Garbage disposal is severe in slum areas where people live in acute poverty, poor housing and unhygienic conditions without basic facilities.

One of the major threats in the solid waste is due to the Plastic Waste generation which are released to the open environment without any proper care. Plastics can be recycled to produce articles for mass use withholding the concept of resource management. Many useful products have been developed with recycled plastics and large number of people is employed in these activities in small, micro and informal sectors within our country. An informal industry estimates to have a recycling figure of India is nearly around 1.5 Million Tons – close to 50% of plastics used for packaging applications and it is a very high recycling ratio. Recycling ensures that the unwanted and discarded plastics waste does not remain in road side or in landfill.

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However, there are some types of plastic waste like multi-layer laminates, EPS, etc. which are not easily recyclable by most of the conventional process. Sometimes when different types of plastic waste, which are otherwise easily recyclable individually, get mixed with different groups of plastics in the waste stream forming, what we call, comingled plastic waste or combined plastic waste, recycling becomes a difficult process since each of them differ in their properties. Such type of plastic waste, generally, is abandoned by the waste pickers creating waste management problem.

In most of the areas the plastic waste has been disposed without taking any of the required measurements. Since we all know that burning of plastic can lead to many of serious health problems as well as environmental problems due to the emission of harmful gases.

Hence in this project, an initiative is taken to convert plastic into an innovative useful method so that it can be recycled or reused there by giving emphasis to the motto of 4R, s i.e. "REDUCE, REUSE, RECYCLE and RECOVER".

Since it is difficult to manage HDPE (High Density Poly Ethylene) plastics as it requires sophisticated machinery and controlled environment due to the emission of poisonous gas during heating, hence giving importance to LDPE (Low Density Poly Ethylene) in this project. They are the main problem generator as far as the plastic waste is being concerned due to their cheaper availability. In this project work, discuss about the conversion of plastic to pavement tile by heating the soil to a temperature of 80 to 90 C and there by mixing shredded plastic (LDPE) into it. So formed plastic mix when pressed in the mould possess good compressive strength shows a good result of reusing and conversion of plastic to the pavement tiles.

The project elucidates about the use of LDPE waste as the construction material i.e., paving tile which is an innovative method for the conversion of plastic waste to a useful product.

II. EXPERIMENTAL INVESTIGATION ON CONVRESION OF SOIL AND PLASTIC WASTE TO PAVER BLOCKS

Collection Of Plastics From Rag Pickers, Home, Municipality etc. These plastics does not include Low Density Plastics. Different types of plastic include the following: Polyethylene. Polystyrene, Polypropelene(PP)-(Includes Syringe ,Horlicks Bottles etc), LDPE(Water tank), PVC(Polyvinyl chloride includes pvc pipes), High Density Polymers (Buckets etc), HDPE(High Density Polyethylene) etc

The plastic is then washed and is then dried and passed through the shredding machine and is being shredded into fine particles. the shredded plasticis being heated and is then added with the desired colour or dye mainly black or blue or red. The machine through which it is being passed is called plastic mixer .The heating is usually performed at a temperature of 80-85 ˚C .And is then feeded to the plastic extruder machine.In this machine it consists of heater which can heat it upto a temperature of 160-220 degree and suring this process the plastic gets melted and is then passed through a mesh. So that the plastic get separated from any unwanted material which is being accidently got mixed with them. Then this melted plastic is being introduced to a cooling tank in form of small threads and is then cut into small pellets at the end of the cooling tank with a cutter.ie those wires are being taken up by the Granules cutter Machine which is being fixed at the end of cooling tank.

a)cooling tank fixed near the plastic mixer machine b)cooling tank c)Plastic Mixer Machine d)Granules finally obtained

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The granules so obtained above is then used to obtained products of non virgin plastic and is cheap in rate,there by passing through a hydraulic mould after being heated to desired temperature.

III. DEVELOPEMNT OF PAVEMENT BLOCKS USING LOW DENSITY POLYETHYLENE(LDPE)

The strength of the floor tile mainly depends on the mix with sand, Try starting with 50:50 sand: plastic and then increasing the proportion of sand to 60:40 and 70:30 to see what works best.Usually, the tiles contain more sand than plastic, because the plastic serves as a bonding agent to hold the sand together. Figure shows the mould which is being used in the experiment .It is important that correct type of plastic have to be selected. This is mainly because different types of plastic melt and burn at different temperatures and have different physical qualities and compositions. The process highlighted here works well with LDPE. (Water bags, non-woven plastic shopping bags and plastic film are usually made of LDPE). It is to be notted that no other types of plastic is being used since it cause health issues.Now pour the required amount of sand into the barrel and lit the fire to the source. Now the sand is made to get heated to a sufficient temperature. Now the shredded plastic or LDPE Category is mixed to the hot sand so that there will not be any chance of fire rather it gets melted and will acts as a bonding agent to the soil. Try and repeat the experiment with different proportions of sand and plastic.

The mix so obtained above with different proportions of sand and plastic is being placed to the mould with the help of a trowel. It is then compacted and filled effectively so that we obtain a good pavement tile. It is then allowed to get cooled and is then tested for the different parameters of pavement tile and also the strength.

IV. EXPERIMENTAL PROCEDURE& RESULTS

Set up the apparatus in such a manner that the barrel is kept over the stand and the burner is lighted with the heater care should be taken to avoid burning. Use gloves and mask for the protection. Required mount of sand is taken so that it is sieved and passed through 4.75mm sieve and the retained part of the sand is disposed.Now weight the shredded plastic to the corresponding proportion and keep aside.Now pour the so weighed sand into the barrel and heat it to a temperature of 100-150 degree Celsius. One should note that there should be a constant supply of heat else it may cause the strength of the product obtained.

When the sand is heated to the desired temperature the weighed plastic is introduced into it at different intervals.Stir the sand as well as plastic so that the plastic gets melted and get attached to the sand.Oil the mould well and keep it aside. Pour the so-called obtained mix into the mould.Hand ram the mix into the mould up to the desired height.It is then allowed to get set for a time of 24 hrs. and maximum to 72 hours.The sample so obtained is then made to test for compression as well as for flexural strength.

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SL NO:	SAMPLE NAME	PROPORTION	WATER ABSORPTION W (%)	Compressive strength(N/mm2)	Breaking Load (kN)
1	River sand	60:40	3.125	39.97	4.6
		70:30	4	42.126	4.2
		75:25	8.3	33.73	3.966
2	M sand	60:40	2.7	42.613	4.53
		70:30	4.16	39.17	4.3
		75:25	8.3	34.56	3.53
3	Excavated earth	60:40	2.8	39	3.9
		70:30	4.16	32.81	3.93
		75:25	8.61	25.76	3.6

V. CONCLUSION

From the above results and discussions, it has been found that the plastic can be used more efficiently in this method. By using this procedure for producing bulk quantity a large amount of plastic which is being disposed carelessly can be recycled using this method. Also, the highlight of the project is that it only uses plastic and sand for their production. When sand gets heated to a desired temperature of 80-85 0C plastic is being mixed. So that the plastic by its property gets melted and converted to a binding material to the sand. Hence it can be molded to the desired shape using a hand rammer or by a hydraulic press. It is to be noted that the press or ramming have to be done before it gets cooled.

It has been noted that it provides a good compressive strength compared to that specified in the IS code. And it provides a maximum compressive strength of 42 N/mm2 for the proportion of 60:40 and 70:30 for M sand and river sand respectively. It shows that it can be used along with M sand which is cheaply available right now and also with the earth which is excavated from the site and is sieved properly. Hence provide a facility of managing the plastic waste effectively. And so, called made pavement tile shows an effective and efficient breaking load of 4.6 kN and 4.53 kN for sand plastic proportion of 60:40 in river sand and M sand respectively.

Hence from the above all conclusions it can be finalized that the our research product possess a good compressive strength of approximately 42 N/mm2 and with a breaking load not less than 3kN proves that it can be conveniently used as pavement tile for pedestrian usage as well as for residential driveways.Since the minimum breaking load requirement of pavement tile used for residential drive ways are 3 kN

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REFERENCES

[1]. Agnes, Nagy and Rajmund, Kuti. (2016).” The Environmental Impact of Plastic WasteIncineration”. AARMS.Vol .15, No:3, 231-237.

[2]. Puttaraj, Mallikarjun, Hiremath, Shanmukha, Shetty, Navaneeth, Rai,.P.,G, Prathima., T.,B,.(2018), ” Utilization Of Waste Plastic In Manufacturing Of Plastic-Soil Bricks”, International Journal Of Technology Enhancements And Emerging Engineering Research, Vol 2(4).

[3]. Simanshu, P., Pandey1., Sakshi, Gotmare, Wankhede, S.A., (2017),” Waste Plastic Bottle asConstruction Material”, International Advanced Research Journal in Science, Engineering and Technology, Vol. 4, Special Issue 3.

[4]. Shivasharana, C.T., Sheetal, Suresh and Kesti. (2019) “Physical and Chemical

Characterizationof Low-Density Polyethylene and High-Density Polyethylene" Journal of Advanced Scientific Research, 10 (3): 30-34.

[5]. Singh, P., Sharma, V.P., (2016)" Integrated Plastic Waste Management: Environmental and Improved Health Approaches Procedia Environmental Sciences" Procedia Environmental Sciences PP 692 – 700.