

Environment Friendly Construction

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Abstract—The quantum of plastic waste in municipal solid waste is increasing due to increasing in pollution, urbanization, development activities and changes in life style, which leading widespread littering on the landscape. Thus disposal of waste plastic is a menace and become a serious problem globally due to their non-biodegradability and unaesthetic view. Since these are not disposed scientifically & possibility to create ground and water pollution.. The main aim of this experiment is to reduce the plastic waste & using it as a construction material. This waste plastic partially replaced the conventional material to improve the desired mechanical characteristics for particular road mix. In conventional road making process bitumen is used as binder. Such bitumen can be modified with waste plastic pieces and bitumen mix is made. This work uses waste plastics and converts them into building materials with the help of an extruder, thereby reducing the plastic waste which is a key factor for environmental pollution. Out of which brick stand out. Polyethylene terephthalate based waste were recycle and used in the experiment. PET is added with sand and aggregate at various percentage to obtain high strength bricks that possess thermal and sound insulation properties to control pollution and to reduce the overall cost of construction.

Index Terms— Plastic waste, PET, Aggregate.

I. INTRODUCTION

In many countries the compositions of waste is different, that it is affected by the socioeconomic characters, waste management programs and consumption patterns, but generally the level of plastic in the waste composition is high [1]. As much as 60% of both industrial and urban waste plastic is recycled. Indian construction industry creates lots of employment opportunities and accounts for major portion of the capital outlay in successive 5-year plans of our country. Plastic waste is bulky, heavy and unsuitable for disposal by incineration or composing which result in polluting the environment, posing number of problems for the well-being of human race and resulting in hazardous disease [2]. Plastics constitute approximately 3-7% of municipal waste. Presently, municipal garbage disposal departments bury the plastics along with other materials in landfill without even recognizing its ill effects. [3]Human and his activities produce a lot of wastes. At the same time, man consumes many things. Amongst the various things man consumes, building materials happen to be the largest in terms of weight being about 5 tons per capita per year, next only perhaps to water [4]. The threat of disposal of plastic will not solve until the practical steps are not initiated at the ground level. It is possible to improve the performance of

bituminous mixed used in the surfacing course of roads. Studies reported in the used of re-cycled plastic, mainly polythene in the manufacture of blended indicated reduced permanent deformation in the form of rutting and reduced low-temperature cracking of the pavement surfacing. The field tests withstood the stress and proved that plastic waste used after proper processing as an additive would enhance the life of the roads and also solve the environmental problem.

II. WASTE PLASTIC AND ITS SOURCE

TABLE I
WASTE PLASTIC AND ITS SOURCE

Waste plastic	Origin
Low density polyethylene (LDPE)	Carry bags, sacks,milk pouches, bin lining ,cosmetics and detergent bottles
High density polythene (HDPE)	Carry bags ,bottle caps ,house hold articles etc.
Polyethylene Teryphthalate (PET)	Drinking water bottles etc...
Polypropylene (PP)	Bottle caps and closures, wrappers of detergent, biscuit, vapors packets, microwave trays for readymade meal etc...
Polystyrene(PS)	Yoghurt pots, clear egg packs, bottle caps, food trays, egg boxes etc...
Polyvinyl Chloride (PVC)	Mineral water bottles, credit cards, toys, pipes and gutters, furniture.

III. PLASTIC WASTE RECYCLING

Plastic recycling is the process of recovering scrap or waste plastic and reprocessing the material into useful products. Since the vast majority of plastic is non-biodegradable, recycling is a part of global efforts to reduce plastic in the waste stream, especially the approximately eight million metric tons of waste plastic that enter the Earth's ocean every year [16],[17]. This helps to reduce the high rates of plastic pollution. Plastic recycling includes taking any type of plastic, sorting it into different polymers and then chipping it and then melting it down into pellets. After this stage, it can then be used to make items of any sort such as plastic chairs and tables. Soft Plastics are also recycled such as polyethylene film and bags. This closed-loop operation has taken place since the 1970s and has made the production of some plastic products amongst the most efficient operations today. Compared with lucrative recycling of metal and similar to the low value of glass plastic polymers recycling is often more challenging because of low density and

low value. There are also numerous technical hurdles to overcome when recycling plastic. A macro molecule interacts with its environment along its entire length, so total energy involved in mixing it is largely due to the product side stoichiometry. Heating alone is not enough to dissolve such a large molecule, so plastics must often be of nearly identical composition to mix efficiently.



Fig. 1. Plastic waste management

Advantages:

- Generally plastic items like toys, bags can be reused in various ways such as in the manufacturing of fashionable accessories and other plastic goods.
- No doubt the recycling of plastic consume more energy and effort compare to its manufacturing but it is a good alternate to prevent the plastic pollution in environment.
- Plastic materials are light in weight, unbreakable, odorless and can be easily moulded.
- They have excellent finishing; possess good shock absorption capacity, high strength as well as toughness.
- The plastics materials are corrosion resistant and these are inert as far chemical or changes due to atmospheric oxygen goes; besides these have low thermal expansion of coefficient.
- Therefore they possess good thermal and electrical insulating property.
- Plastics have water resistant property and possess good adhesiveness. They are strong, durable, good and cheap to produce.

- It is possible to recycle plastic; therefore no decomposition required which is much more expensive and hazardous than recycling.
- Plastic can be used in building, construction, electronics, packing and transportation industries.
- Plastic can be used to produce other product and reduce soil and wind erosion.
- Because of nonconductive nature of plastic, they can be easily use in electrical installations

Disadvantages:

- Generally plastic items like toys, bags can be reused in various ways such as in the manufacturing of fashionable accessories and other plastic goods.
- No doubt the recycling of plastic consume more energy and effort compare to its manufacturing but it is a good alternate to prevent the plastic pollution in environment.
- Plastic materials are light in weight, unbreakable, odourless and can be easily moulded.
- They have excellent finishing; possess good shock absorption capacity, high strength as well as toughness.
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IV. METHODOLOGY

A. Brick

1) Material requirements

- Aggregate (Coarse and Fine)
- Cement
- Bitumen
- Waste plastic

2) Procedure Of brick

- Step 1: First we have to collect and segregate polyethylene terephthalate (PET) .Plastic waste like bags, bottles etc.
- Step 2: This collected waste plastic is then washed and

cleaned with water and is dried to remove water remain in it.

- Step 3: Now this large plastic is cut into small ones using shredder machine into the range of 3-4mm size.
- Step 4: Take this shredded plastic waste in a container and put it in a muffle furnace at 500-550 degree Celsius until it melts completely. Also keep sand required to add to make brick in another container to remove moisture from it.
- Step 5: After few minutes take out the container in which plastic had put for melting and check out that it is completely melted or not
- Step 6: Now when the plastic is converted to liquid form add sand into it with cement, fly ash and bitumen. The ratio of materials to be added in this, we have to take weight of sand according to 20% plastic, 20% bitumen, 40% cement and 20% of fly ash.
- Step 7: After mixing all the materials it is put in a brick shape mould and this mould is kept in the sunlight to get dry. After drying the strength can be checked using compressibility machine

TABLE II
TYPES OF PLASTIC AND TEMPERATURE

S. No.	Type Of Plastic	Temperature
1	PET(Poly Ethelene Terephthalate)	260-280°C
2	HDPE(high density polyetheleene)	210-270°C
3	LDPE(Low density polyethelene)	180-240°C
4	PP(Poly Propylene)	250-290°C



Fig. 2. Process of plastic brick

B. Road

1) *Material requirements*

- Polymer(PE,PP,PS)
- Aggregate
- Waste plastic
- Bitumen-30040 grade, 60170 grade and 8010 grade

2) *Procedure of plastic road*

- Step 1: Plastics waste like bags, bottles made out of PE and PP cut into a size between 2.36 mm and 4.75mm using

shredding machine. Care should be taken that PVC waste should be eliminated before it proceeds into next process.

- Step 2: The aggregate mix is heated to 1650C and then it is transferred to mixing chamber. Similarly the bitumen is to be heated up to a maximum of 1600C. This is done so as to obtain a good binding and to prevent weak bonding. During this process monitoring the temperature is very important.
- Step 3: At the mixing chamber, the shredded plastics waste is added over the hot aggregate. It gets coated uniformly over the aggregate within 30 to 45 seconds. It gives an oily coated look to the aggregate.
- Step 4: The plastics waste coated aggregate is mixed with hot bitumen. Then this final resulted mix is used for laying roads. The road laying temperature is between 110°C 120°C. The roller used should be of is 8-ton capacity.



Fig. 3. Process of plastic road

V. RESULT

A. *For Brick*

TABLE II
FOR BRICK

Property	Plastic incorporated concrete block	Ordinary concrete block
Weight	16.2 kg	19.8 kg
Block density	1800 kg/m ³	2200 kg/m ³
Water absorption	2.6%	4%

B. *For Road Construction*

The increase in percentage of polymer decreased the penetration value. This shows that the addition of polymer increases the hardness of the bitumen. The penetration values of the blends are decreasing depending upon the percentage of polymers and the type of polymer added. The ductility decreased by the addition of plastic waste to bitumen. The

decrease in the ductility value may be due to interlocking of polymer molecules with bitumen. Flash and fire point increased with the increase in the percentage of polymer. The polymer bitumen blend road surfaces are less affected by fire hazards.

VI. CONCLUSION

For Brick:

- This work effectively converts waste plastic into useful building materials like building bricks and floor interlocks which can effectively reduce the environmental pollution and further decreases the problem of waste plastics in the society. The numerous advantages further research would improve the quality and durability of plastic sand bricks and paver blocks. The use of waste glass as fine aggregate decreases the unit weight of concrete.
- The solid concrete blocks with plastic aggregates can be used as light weight concrete blocks since its weight is less than that of ordinary concrete blocks. Also water absorption and block density is found to be less for plastic incorporated concrete blocks. On comparing the cost of solid concrete blocks with plastic as partial replacement and without replacement, cost of former is lower than the latter when made in a large quantity.
- Lastly, we strongly conclude that, using plastic waste in mix is the best option for the disposal of plastic and will help to increase the strength and avoid disposal of plastic waste by incineration and land filling and ultimately reduces the plastic pollution in the environment and develop a technology which is ecofriendly.

For Road Construction:

- The process is environment friendly. The use of waste plastics in the manufacture of roads and laminated roofing also help to consume large quantity of waste plastics. Thus, these processes are socially highly relevant, giving better infrastructure. The modified bitumen shows good result when compared to standard results. The problems like bleeding are reduce in hot temperature region. Plastic has property of absorbing sound, which also help in reducing the sound pollution of heavy traffic. The waste plastics thus can be put to use and it ultimately improves the quality and performance of road.
- The use of the innovative technology not only strengthened the road construction but also increased the road life as well as will help to improve the environment and also creating a source of income. Plastic roads would be a boon for India's hot and extremely humid climate, where temperatures frequently cross 50°C and torrential rains create havoc, leaving most of the roads with big potholes. It is hoped that in near future we will have strong, durable and eco-friendly

roads which will relieve the earth from all type of plastic-waste. Adding higher amount of plastic bottles resulted in higher flow value.

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