Utilization of Plastic Waste

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Abstract- *Plastic is everywhere in our today's life style. Several million tone of plastic waste are producedin India every year , plastic being a non-biodegradable produce. Causing environmental pollution, reproducing problem in human and buring plastic leads to contamination of poisonous chemicals lead to air pollution and respiratory problem or generated due to toxic chemical. Recycling of plastic waste are done with different different techniques such as pyrolysis , gasification, etc. Efforts of utilization of plastic waste has been taken in following 2 ways; 1) by plastic brick and 2) by plastic road. This process lead to increase in productivity of wastes and decrease the concrete waste generation. This paper deals with the reuse of plastic waste as partial replacement of coarse aggregate in brick and replacement of bitumen with plastic using in % with bitumen. Waste plastic were incrementally added in 10% , 8% and 6% to replace the same amount of aggregate in brick and in road added 20% and 30% to replace pure bitumen in brick test were conducted in coarse aggregate , amount of waste plastic to determine that physical property. Similarly in road test were conducted on bitumen , waste plastic and aggregate. Size of block 200mm x 150mm x 60mm. And their strength is tested for 7 , 14 and 28 days. The results shows the compressive strength of plastic block in 4% for paver block and 2% of solid blocks.*

Keywords- Plastic waste ,Environmental pollution, Coarse aggregate

I. INTRODUCTION

A plastic material is any of a wide range of synthetic or semi-synthetic organic amorphous solids used in the manufacture of industrial products. Plastics are typically polymers of high molecular mass and may contain other substances to improve performance and/or reduce cost. Monomers of plastic are either natural or synthetic organic compounds. Discarded thin plastic carry bags are a menace. In town they clog drains, cause flooding, choke animals that eat them and are unsightly strewn across fields, they block germination and prevent rainwater absorption by soil.

Plastic pollution is the introduction of plastic products into the environment which then upset the existing ecosystem in different ways. These pollutant cause environmental degradation and also affect different living organism and their habitats negatively. They create such condition which are not favourable for living organisms, wildlife and humans. It can be prevented and the effects minimized when the right measures are put in place.

Due to plastic different type of pollution take place such as air pollution, water pollution and land pollution. To reduce this utilization of plastic waste is prime important.

Theu quantum of solid waste is ever increasing due to increase in population, developmental activities, changes in life style, and socio-economic conditions, Plastics waste is a significant portion of the total municipal solid waste (MSW). It is estimated that approximately 10 thousand tons per day (TPD) of plastics waste is generated i.e. 9% of 1.20 lacs TPD of MSW in the country.

The plastics waste constitutes two major category of plastics;

(i) Thermoplastics and
(ii) Thermo set plastics.

Thermoplastics, constitutes 80% and thermo set constitutes approximately 20% of total post-consumer plastics waste generated in India.

The Thermoplastics are recyclable plastics which include; Polyethylene Terephthalate (PET), Low Density Poly Ethylene (LDPE), Poly Vinyl Chloride(PVC), High Density Poly Ethylene (HDPE), Polypropylene(PP), Polystyrene (PS) etc.

II. PLASTIC 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 tonnes of waste plastic that enter the Earth's ocean every year. This helps to reduce the high rates of 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.

When different types of plastics are melted together, they tend to phase-separate, like oil and water, and set in these layers. The phase boundaries cause structural weakness in the resulting material, meaning that polymer blends are useful in only limited applications. The two most widely manufactured plastics, polypropylene and polyethylene behave this way, which limits their utility for recycling. Recently, the use of block copolymers as "molecular stitches" or "macromolecular welding flux" has been proposed to overcome the difficulties associated with phase separation during recycling.

Another barrier to recycling is the widespread use of dyes, fillers, and other additives in plastics. The polymer is generally too viscous to economically remove fillers, and would be damaged by many of the processes that could cheaply remove the added dyes. Additives are less widely used in beverage containers and plastic bags, allowing them to be recycled more often. Yet another barrier to removing large quantities of plastic from the waste stream and landfills is that many common but small plastic items lack the universal triangle recycling symbol and accompanying number. An example is the billions of plastic utensils commonly distributed at fast-food restaurants or sold for use at picnics.
The percentage of plastic that can be fully recycled, rather than downcycled or go to waste, can be increased when manufacturers of packaged goods minimize mixing of packaging materials and eliminate contaminants. The Association of Plastics Recyclers have issued a "Design Guide for Recyclability".

III. EXPERIMENTAL WORK

In our project we have done 2 experiment from waste plastic.

I. Brick from waste plastic
II. Road from waste plastic

3.1 PLASTIC COLLECTION METHOD

- **Collection & Segregation**: Plastic waste collected from various sources and according to their type it is separated from other wastes that is segregation is done. Segregation is important to separate biodegradable and non-biodegradable waste and to avoid difficulties in melting plastic as different types of plastic melts at different temperature.
- **Cleaning process**: As waste plastic in thrown and dumped on the earth and so Plastic waste contains impurities which can create problems in the further recycling process . So plastic waste cleaned and dried to make the further process ease. And to avoid impurities come in the melting chamber.
- **Shredding process**: Shredding is done to make the melting process easy. The large plastic bags, bottles etc will be shredded or cut into small pieces using shredder machine. The plastic waste retaining on 2.36 mm IS sieve is collected.

3.2 METHOD OF BRICK

- The main objective of this research work is to develop an efficient way to effectively utilize the waste plastic which is a great threat for the sustainment of ecological balance, With the late rite quarry waste to manufacture an alternative building material by which both the questions of a scientific disposal of waste plastic as well as scarcity of traditional building materials can be answered.

3.2.1 RAW MATERIAL

- Cement
- Fly ash
- Sand
- Waste plastic

3.2.2 PROCEDURE OF BRICK

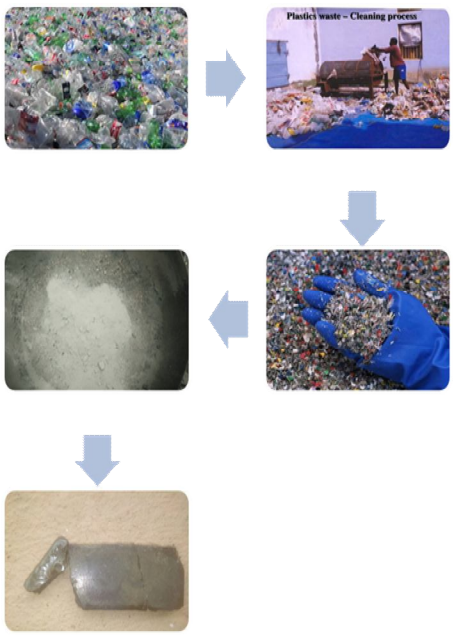
Step 1: First we have to collect and segregate polyethylene terephthalate(PET) .Plastic waste like bags, bottles etc.
Step 2: This collected waste plastic is then washed and cleaned with water and is dried to remove water remain in it.
Step 3: Now this large plastic is cut into small ones using shredder 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 an another container to remove moisture from it.

Step 5: After few minutes take out the container in which plastic had put for melting nd 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.



3.3 METHOD OF ROAD

3.3.1 RAW MATERIAL

- **Aggregate**

Colour	**Black > grey > White**
Strength	Need to be good
Surface Roughness	More Preferred
Porosity	2% tolerance
Moisture Absorption	2% tolerance

- **BITUMEN**

- 60/70/100 grade bitumen.
- Structure-long molecules
- Viscosity-not suitable beyond 160°c.

- **SHREDDED PLASTIC**

- **Waste plastic in the shredded form**

%of plastic coating over aggregate	**Compressive strength (MPA)**	**Bending strength (MPA)**
10%	**250**	**325**
20%	**270**	**335**
30%	**290**	**350**
40%	**320**	**390**

3.3.2 PROCEDURE OF ROAD

Step I: 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 II: The aggregate mix is heated to 165^0C and then it is transferred to mixing chamber. Similarly the bitumen is to be heated up to a maximum of 160^0C. 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 III: 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 IV: 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^oC 120^OC. The roller used should be of is 8-ton capacity.

IV. RESULT

SR.NO	TEST	RESULTS
1	Water absorption	2.30%
2	Sample weight	3.61kg
3	Density	1720.95
4	Specific gravity	2.36
5	Failure load	104.70
6	Compression strength	3.49

COMPARISON BETWEEN ORDINARY BITUMINOUS ROADS AND WASTE PLASTIC BITUMINOUS ROADS:-

S.No.	Properties	Plastic Road	Ordinary Road
1.	MARSHALL STABILITY VALUE	MORE	LESS
2.	BINDING PROPERTY	BETTER	GOOD
3.	SOFTENING POINT	LESS	MORE
4.	PENETRATION VALUE	MORE	LESS
5.	TENSILE STRENGTH	HIGH	LESS
6.	RUTTING	LESS	MORE
7.	STRIPPING(POT HOLES)	NO	MORE
8.	SEEPAGE OF WATER	NO	YES
9	DURABILITY OF THE ROADS	BETTER	GOOD
10.	COST OF PAVEMENT	LESS	NORMAL
11.	MAINTENANCE COST	ALMOST NIL	MORE
12.	ENVIRONMENT FRIENDLY	YES	NO

V. CONCLUSION

- Plastics increases the melting point of the bitumen. 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
- The plastic sand brick possess more advantages which include cost efficiency , removal of waste products thus abolishing the land requirement problems for dumping plastic , reduction in the emission of greenhouse gases by the conversion of flue gases into synthetic oil etc.

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