Waste Plastic Will Not Be the Waste Anymore

Gaurav[1] Abhishek Godara[2] Amita Choudhary[3]

[1 2 3]Assistant professors

Department of ECE

Shaheed Udham Singh College of Engineering and Technology, Mohali

Abstract--***With the increasing demand of environment, people always follow the words go green, go green and go green. But what they are doing to have a green, ecofriendly environment is the main topic of concern in this paper. All the equipments, all the machineries, all the techniques are available today but those things are kept in a side to read only, these things are not implemented practically. Hence according to the environmental desire, this paper deals with the most burning topic of this generation i.e the day-by-day increasing use of plastic materials thereby producing plastic wastes. As the use of plastics is necessary today hence it is not the matter of concern whether plastics can be used or not, the main matter of concern is the use and reuse of plastic wastes. With the little concern about the environment these wastes can be converted into the resources, these wastes also provides a way to start business at the cost of very small investments, in an ecofriendly manner. In Waste management mainly Recycling, Paper waste, Tyre and plastic waste, electronics equipments and computers waste are the main segments which have to be managed to make the environment clean and green.***

Keywords—plastic wastes, plastic road.

I. INTRODUCTION

Increased Global Warming has adverse effect on environment so in order to reduce global warming it's necessary to shift towards greener technology [1]. Green technology means to develop new methods to use natural environment and resources which reduces negative impact of human activities [1].

Due to increase in generation, plastic waste becoming a major stream in solid waste. Waste plastic is often the most visible component in waste dump and landfill. According to the recent studies plastics remain 4500 years long on the earth and since plastic waste is growing rapidly hence the improper disposal of plastics causes problems as distant as breast cancer, reproductive problems in humans and animals, genital abnormalities

and much more. Plastics wastes are found in different forms which almost 5% of the municipal solid wastes which is toxic in nature. It is a common sight in both urban and rural areas to find empty plastic bags and other type of plastic packing material littering the roads as well as drains. Due to its biodegradability it creates stagnation of water and associated hygiene problems [2]**.** The plastic consumption is shown in table1.

1.1. Global consumption of plastics

Table 1

Rank	Country	1988 MMT	Country	2000 MMT	Country	2010 MMT	2010/ 2000
1	USA	16.6	USA	27.3	USA	38.9	3.6 %
2	Germany	6.4	China	14.4	China	31.3	8.1 %
3	Japan	4.3	Japan	9.1	India	12.5	14 %
4	China	3.7	Germany	6.4	Japan	11.5	2.3 %
5	Italy	3.1	Korea	4.7	Germany	9.4	3.9 %
6	CIS	2.4	Italy	4.7	Korea	7.4	4.8 %
7	France	2.4	France	4.1	Italy	6.8	3.8 %
8	UK	2.2	UK	3.5	Brazil	6.7	7.0 %
9	Taiwan	1.9	India	3.4	CIS	6.2	9.1 %
10	Korea	1.8	Brazil	3.4	France	6.1	4.1 %
16	India	1.6	Taiwan	3.3	UK	5.2	4.0 %

1.2. Resources at wrong place

The plastic wastes can be the source of resources but due to ignorance of the people, these resources were thrown at wrong places which creates problem to the environment as well as to the health of the human beings living nearby those places [3]. And it also affects the health of the animals, these plastic wastes leads to the death of the animal as well as landfill and incineration.Here are some self explanatory figures of wastes and the plastics [4].

Fig1: waste thrown at wrong places.

Fig2: Animal eating plastics

Any material which is not needed by the owner, producer or processor [3].

1.2.1 Classification of wastes:

- Domestic waste
- Factory waste
- Waste from oil factory
- E-waste
- Construction waste
- Agricultural waste
- Food processing waste
- Bio-medical waste
- Nuclear waste

Fig 3: different types of wastes

Solid waste- vegetable waste, kitchen waste, household waste etc.

E-waste- discarded electronic devices like computer, TV, music systems etc.

Liquid waste- water used for different industries eg tanneries, distilleries, thermal power plants

Plastic waste- plastic bags, bottles, bucket etc.

Metal waste- unused metal sheet, metal scraps etc.

Nuclear waste- unused materials from nuclear power plants [4].

1.3. Plastic wastes as resources:

a) The reprocessors will use the pallets for manufacturing.

b) Plastic wastes can be used for energy generation.

c) Plastic wastes can be used for landfill.

d) It can be used for making fuel from it.

e) **It can be used for making road [7].**

The following types of waste plastic can be used in the construction of rural roads:

a) Films (Carry Bags, Cups) thickness up to 60micron (PE, PP and PS).

b) Hard foams (PS) any thickness Soft Foams (PE and PP) any thickness.

c) Laminated Plastics thickness up to 60 micron (Aluminium coated also) [5].

d) Packing materials used for biscuits, chocolates, etc.

It is noted that Poly Vinyl Chloride (PVC) sheets or Flux sheets should not be used in any case. And the plastic waste should be free from dust for using it as a resource [7].

II. METHODS OF MAKING PLASTIC ROADS

2.1. Polymer Modified Bitumen

In the construction of flexible pavements, bitumen plays the role of binding the aggregate together by coating over the aggregate. A common method to improve the quality of bitumen is by modifying the rheological properties of bitumen by blending with organic synthetic polymers like rubber and plastics. Studies on this subject are going on both at national and international level [6]. The studies of properties of the plastic waste-blended bitumen show that the addition of plastic waste to bitumen increases softening point, decreases penetration value and ductility, increases flash point and fire point, increase stability value and improve anti-stripping properties.

2.1.1. Limitations of polymer modified bitumen

a) The preparation of modified bitumen needs high power stirrer with thermostatic facilities to maintain the temperature between160-180°C. Any increase in the temperature could affect the properties of bitumen [5].

b) The proper storage of such polymer-blended bitumen is very important. It should be stored in a freezer and it is also referred that it is stable for 6 hrs at a temperature of 180°C [7].

c) It was also observed from the separation test that when the plastic was mixed beyond the soluble range (from 2% and above) the excess plastic material got separated on cooling.

These limitations necessitated developing an alternate method for using higher percentage of plastic waste for flexible pavement [6].

2. 2.Modified Process (Dry Process)

An alternate method to find an effective way of using higher percentage of plastic waste in the flexible pavement. The aggregate coated with plastic was used as the raw material. The plastic used were the disposed carry bags, films, and cups etc. with a maximum thickness of 60 microns. The bitumen was not blended with plastic waste [8].

2.2.1. Preparation of Plastic-Waste Coated Aggregate

The aggregate was heated to around 170° C, the plastic waste was shredded to the size varying between 2.36mm and 4.75mm [6]. This shredded plastic-waste was added over hot aggregate with constant mixing to gave a uniform distribution. The plastic got softened and coated over the aggregate. The hot plastic waste coated aggregate was mixed with the hot bitumen 60/70 or 80/100 grade (160°C).It is recommended that the percentage of shredded waste plastic will be 8% by CRRI [8]. However we can adopt 8% as the optimum plastic content for blending the bitumen in the construction of plastic roads. Bitumen of grades 60/70 or 80/100 can be used as binder as in case of conventional method. The detailed process is given below:-

2.2.2. With Mini Hot Mix Plant

The stone aggregate mix (as per specification) is transferred to the mix cylinder where it is heated to 165°c (as per the IRC specification) and then it is transferred to the mixing puddler (Temperature can be monitored using IR thermometer), while transferring the hot aggregate into the puddler, calculated quantity of shredded plastics is sprayed over the hot aggregate within 30seconds [7]. The sprayed plastic films melts and gets coated over the aggregate, thus forming an oily coating. Similarly, the bitumen is to be heated to a maximum of 160°c in a separate chamber and kept ready (The temperature should be monitored to have good binding and to prevent weak bonding).At the mixing puddler, the hot bitumen is added over the plastic coated aggregate and the resulted mix is used for road construction. The road laying temperature is between 110°c to 120°c. The roller used is normal 8-ton capacity [8].

III. APPLICATION

UNEP has developed a programme on integrated solid waste management to support capacity building and technology transfer [6]. In order to contain this problem experiments have been carried out whether this waste plastic can be reused productively in the construction of roads [7]. The experimentation at several institutes indicated that the waste plastic, when added to hot aggregate will form a fine coat of plastic over the aggregate and such aggregate, when mixed with the

binder is found to give higher strength, higher resistance to water and better performance over a period of time. Therefore, it is proposed that we may use waste plastic in the construction of Roads. Hence this new technology developed by a team of entrepreneurs to use waste plastic for construction of roads has caught the Government's attention in some places like Himanchal Pradesh, Bangalore, and Delhi etc [8]. Thus plastic wastes can be utilized in improving the performance of road in road construction.

Fig4: Road made by plastics and polythene in Himanchal Pradesh [7].

The Himachal Pradesh State Pollution Control Board in collaboration with the Public Works Department (PWD) has built three road stretches on a pilot basis by using shredded plastic waste on the outskirts of Shimla [7]. The waste plastic such as carry bags, disposable cups and laminated plastics like pouches of chips, pan masala, aluminium foil and packaging material used for biscuits, chocolates, and milk and grocery items was used in surfacing roads.

IV. PREVENTIONS REQUIRED

These problems of the plastic wastes can be minimized or removed by making certain decisions or by taking certain strict actions against it. This can be suggested as:-

a) The biodegradable and non-biodegradable wastes should not be mixed in order to reduce the problem of cleaning of plastic waste before reusing or recycling [8].

b) Separate dustbins should be used in homes with some colour codes to keep the plastic wastes separately.

c) Government or the businessman should make the waste collection commity in every colony to collect the waste from home in desired manner.

d) Government can fix some taxes also to inhibit the habits of public to throw the waste in undesired manner [8].

V. RESULT AND COMPARISON

According to the primary studies on the use of plastic-waste as a blending material with bitumen, suggest that the blends behave similar to PMB, thus having improved properties compared to plain bitumen [8]. It is also observed that this process of blending has limitation. At high percentage of blending there is separation of plastic. Hence, process modification

was needed and a new product namely plastic waste coated aggregate was developed. This product is not only easy to prepare but also helps to use higher percentage of plastic-waste for coating without much of difficulty [8].

5.1 .plastic waste coated over aggregate

The coating of molten-plastic over the aggregate will reduce water absorption. This shows that the voids at the surface were reduced. Lesser the voids better the quality of the aggregate. Otherwise, the air entrapped in the voids would cause oxidation of bitumen resulting in stripping, pothole formation etc. Moreover, the presence of water in the voids is detrimental to adhesion between aggregate and the binder namely bitumen. Hence the aggregate with lesser voids is considered to be good for better road construction. These observations help to conclude that plastic-waste coated aggregate can be considered as more suitable material for flexible pavement construction [7].

VI. CONCLUSION

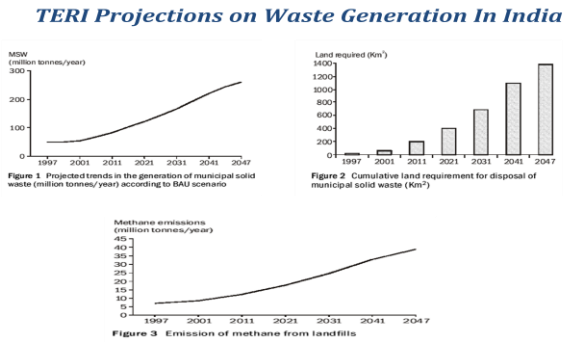

Fig5: Waste production (Plastics) in India in different form by the end of 2047

Polymer Modified Bitumen is used due to its better performance [7]. But in the case of higher percentage of polymer bitumen blend, the blend is a more polymer dispersion in bitumen, which get separated on cooling. This may affect the properties and quality of the blend and also the road laid using such blend. In the modified process (dry process) plastics-waste is coated over aggregate. This helps to have better binding of bitumen with the plastic-waste coated aggregate due to increased bonding and increased area of contact between polymer and bitumen [6]. The polymer coating also reduces the voids. This prevents the moisture absorption and oxidation of bitumen by entrapped air. This has resulted in reduced rutting, raveling, and there is not pothole formation. The road can withstand heavy traffic and show better durability [9].

The dry process thus helps to:

a) Use higher percentage of plastic waste.

b) Reduce the need of bitumen by around 10%Increase the strength and performance of the road

c) Avoid the use of anti-stripping agents. Reduce the cost to around Rs. 5000/Km. of single lane road

d) Avoid disposal of plastic waste by incineration and land filling

e) Add value to plastic waste generate jobs for rag pickers Develop a technology, which is eco-friendly.

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Author Biographies

Er.Gaurav has completed his B.Tech and M.Tech from Punjabi University, Patiala, India. He is presently working as Assistant Professor in the department of E.C.E, Shaheed Udham Singh College of engg. and technology, Mohali, India. His research areas include Micro-electronics technology and Fuzzy logic and signal processing.

Er. Abhishek Godara has completed his B.Tech and M.Tech from Kurukshetra University and Punjab University, Chandigarh, India. He is presently working as Assistant Professor in the department of E.C.E, Shaheed Udham Singh

College of engg. and technology, Mohali, India. His research areas include Digital electronics and VLSI Design.

Er. Amita Choudhary has completed her B.Tech and M.Tech from Punjabi uni. Patiala and Punjab technical university, India. She is presently working as Assistant Professor in the department of E.C.E, Shaheed Udham Singh College of engg. and technology, Mohali, India. Her research areas include computer networks and signal processing.

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