Utilization of Plastic Wastes in Road Construction

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Abstract: *Plastic is a toxic & persistent material available in world. It is generally found to be nearly 5%-10% in Corporation Solid Wastes (CSW) which is a major environmental threat. Present day, industrial plastics are used in our day-to-day life for Various purposes via carry bags in various shops. Plastic made manufacture materials are used for making roofs of temporary kutcha houses and hutments, packaging materials in LDPE & HDPE. Which manufacturing industries, in use of drinking water supply, sanitary appurtenances and in electrical appliance. Industrial plastics based materials product and appliances used for domestic used .The results of Life Cycle Assessment (LCA) of these plastic materials is not satisfactory. Most of people are using of these plastic materials and plastic products after their usage it through on open ground surface and not using reuse. In this paper recycle and reduction in Amount of volume which has become a prominent ecological & environmental problem to utilization in construction. Waste plastic bags & waste plastic materials interrupt the infiltration and percolation of rain water through soil pores and in turn diminish the ground water recharge water surface. Present day, we have present various amount of plastic solid* waste *in our surroundings. There are so many institutes which after com system researches have come to a conclusion that waste plastics can be used in modifying roads. if we use plastics in road construction, we can reduce the cost of road construction and pollution index of environment to on appreciable extent. Most of researcher use plastics as binder with bitumen. It may give good characteristics to finish-ability, stable to material, good binding property, resistance to water surface and durability with their life period.*

Keywords: Material, Enormous, LCA, LDPE, HDPE, Corporation Solid Waste (CSW)

1. Introduction

Industrial waste plastic that contains one or more organic polymers of large molecular weight. Which its nature solid in its finished and at some times it manufacturing or processing to made finished articles, can be shaped by its flow, is called as.Plastic is harmful for various earth surface livings. It has cheap in cost, easy to transport, be easy to use for different purpose. For Packaging purpose mainly we use jute bags which are heavy and not economical for transport. Most of People are using it prefer for plastic bags or carry bags.

In a Survey it was found that a plastic can be long lasting more than 400 years. It was known that life of plastic is more than any other packaging material in domestic use.

Plastics, are most important materials and commonly used in various matter but they become problem to the environment. According to review paper, Use of Consumption, Generation of product & different Classification of plastic waste in India. After using they mostly used plastics products are bags, cups, films and foams, made up of polyethylene, polypropylene or polystyrene. India consumption of Plastics will grow 15.0 million tons by 2015* and is set to be thethird largest consumer of plastics in the world.

In our country we use so many plastic made material in our daily life but not safe for the environment.

Table 1: Plastic Waste Consumption

S. No.	Description	World	India
1	Per Capita Per Year Consumption Of Plastic (kg)	25-30	10-15
2	Recycling (%)	30	40
3	Plastic in Solid Waste (%)	10	8

The data we look above a comparison of consumption of plastic made product and its uses in world / India. India generates 5.60 million metric tons of plastic made waste annually, with most of municipal area generating the most of at municipality at 689.5 metric tons every day, according to a report from the Central Pollution Control Board (CPCB).

Table 2: Year Wise Use of Plastic Consumption

Sl. No.	Year	Consumption (Tonnes)
1	1997	62000
2	2002	400000
3	2008	700000
4	2013	140000

5	2014	174000

According to various Municipal Waste Management, Plastic materials comes under solid waste with their state. So by our solid waste management the solid waste dump in an open area but where it is not decomposes.

Figure 1: Pie Chart Showing Municipal Solid Waste in India

The littered plastics, a non biodegradable material, get mixed with domestic waste and make the disposal of municipal solid waste which is very difficult.

Figure 2: Waste Plastic Open Dumping

But as we see plastic does not decompose easily, it takes thousands of years. Disposal of waste plastic results in unnecessary Land Filling & Incineration of land.

Burning Of Plastic Releases Toxic Gases like CO,CO_2 , Dioxin & Ash (Oxides) .

Burning of Plastic Is also responsible for :

- Global Warming
- Air Pollution
- Monsoon Failure

Figure 3: Plastic Burning in open dumping

Industrial Plastic waste was recycling method but it does not reduce it in large amount in India.

Industrial waste plastics most of people also burn to reduce it. But they don't know that on burning plastic which produce dioxin gas released.it is in toxic in nature. So, burning Of Plastic is not a better idea for decomposing and reducing it due to produce of large amount in country. By some industries waste plastics were recycling according to their use which is good for environment. For example: The many industry which are using to crushes waste plastics product into small pieces and use to make cloths by it. They have used their own technique to reuse of plastics which is good for our ecological system.

In present day we can use industrial waste plastic in road construction purpose and others. An industrial waste Plastic increases the melting point of the bitumen. which makes the road retain its flexibility during winters session and resulting in its long life. Shredded plastic waste acts as a strong "binding agent" for tar making the asphalt last long. A process for manufacturing bitumen mix road using plastic waste is better for the use of waste.

The experiment at several institutes indicated that the waste plastic, when added to hot aggregate. It will form a fine coat of plastic with the aggregate and such aggregate, when mixed with the binders to found to give higher strength, higher resistance to water and better performance and durability.

There are two main processes namely:

1. DRY PROCESS
2. WET PROCESS

DRY PROCESS: In Dry process industrial waste plastics are used as coating materials by softening the plastic and not by

process of burning. For a design of flexible pavement hot stone aggregate (l75^{0}C)is mixed with hot bitumen (170^{0}C) and the mix is used for construction of road laying. The aggregate when coated with melted plastics improved its quality with respect to fill voids, soundness, and moisture absorption and decreases porosity. Thus the performance of the design pavement is increased.

WET PROCESS: Industrial Plastic waste is in ground state and made into powder 6 to 8%. Crushed waste Plastic is added to the required bitumen at temp 160'C. In which all material are used in this process to proper in mix .In this way wet process was not adopted and another waste material (crumb rubber) has been adopted to add to it.

For mixing the crushed plastic in the aggregate as well as bitumen. The following temperature should be maintained according to this method.

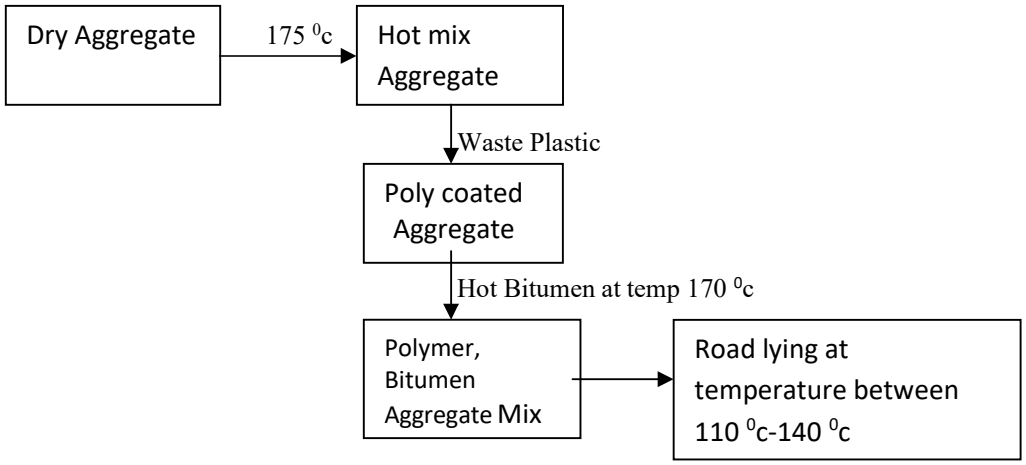

Figure 4: Flow Chart

We required going through this process for mixing plastic in asphalt for Mix. Firstly, we clean and separate the plastic waste. By cleaning we remove all the non-plastic things and other objects. After that we do tearing and cutting of plastics by which may all the plastics crushed into very small fine parts, which is easy to mix and use. After that we use shredding process to mix the bitumen with plastic in mini hot mix plant. In which bitumen and plastic bind together. But mixing of bitumen and waste plastic we can mix with aggregate to the bitumen plastic. In this method we do the process for proper mixing the waste plastic to the bitumen as well as aggregate.

We can see the process by looking at the figure 5:

Figure 5: industrial waste Plastic Tar making process

When bitumen was proper mix with industrial waste plastic which coated required aggregate? This may portion of required bitumen diffused to the plastic layer for binds with aggregate. In this research we use of higher percentage of industrial plastic waste can reduces the utilization of bitumen by 10%. It also increases the strength and performance of the construction road. This result shows the extraction of bitumen by dry process f o r the p r o p e r mixing between aggregate and bitumen. This is experimental results due to the presence of polythene binding properties. This is explained that of following structural models.

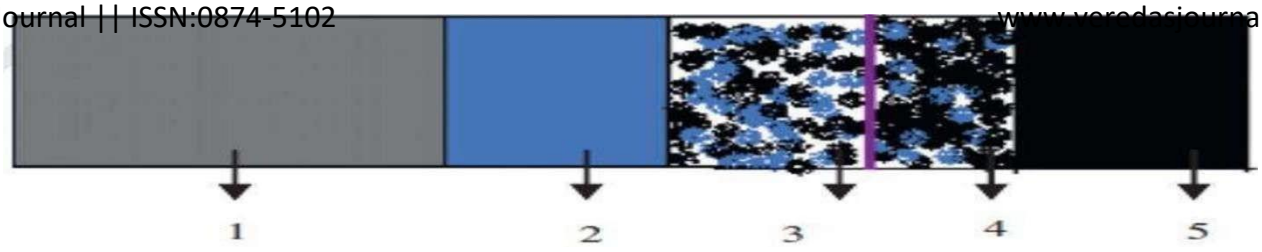

Figure 6: Plastic Waste Coated Aggregate Bitumen.

1. Aggregate
2. Area of Plastics bonded with proper mix aggregate (polymer coating)
3. Area of Bitumen-aggregates plastics mixtures (due to proper diffusion b/w molten plastics & hot bitumen).
4. Area of bonded bitumen for dispersed plastics in design mix concrete.
5. Area of Plain bitumen layer in the mixture.

This study represents the proper utilization of industrial plastic waste in hot bitumen and aggregate to enhance pavement performance, to protect, safe environment and to provide low cost roads.

2. Literature Review

The main idea of using industrial plastic waste in flexible pavement has been done for many years in world. The concept of utilization of industrial plastic waste in construction of road pavement has been done since 2000 in India. The properties of this industrial plastic waste were compared to that of ordinary bitumen. It was Clean mention that the penetration and ductility values of bitumen were decreasing with the increase up to 12 % by Weight. Dr. R.Vasudevan said that the polymer bitumen blend is a good binder properties compared to plain bitumen. Blend has increased Softening point and decreased Penetration value with a suitable ductility.

The coating of industrial plastics waste reduces the porosity, absorption of moisture and improves soundness in use of road construction. Use of plastic waste in road help in many ways like Easy way of disposal, better road and prevention of pollution and safe for the environment.

The experiment results indicated that it has improvement in strength when compared to a conventional mix design of waste plastic. Therefore, the life of pavement surfacing using the waste plastic is expected to increase substantially in comparison to the use of conventional bituminous mix design.
Hence the use of waste plastics for flexible pavement is one of the best methods and easy disposal of waste plastics. This technology not only strengthened the road construction but also increased the road life and durability.

3. Proposed Work

The varying proportions of waste plastic materials and bitumen's are to be used as binder in the preparation of waste plastic road and study is to be done with regard to compressive strength of the metal road as well as abrasion resistance of the aggregates used in the preparation of the road. the road prepared from waste plastic materials and use of bitumen's is not susceptible to water stagnation, because of a precise and experimental study results are proposed to be done by providing irregular surface having micro and macro cavities on the surface of the way.

4. Expected Result

The results of the studies on the extraction of bitumen (Table) by dry process showed that the proper bonding between using material Aggregate and Bitumen .It is improved due to the presence of polymers. It is explained by the following details which come in this experiment results.

Table 4: Bitumen Extraction at certain Interval

Plastic Content(% By Weight)	After 5 Min %	after 10 min %	Bitumen Extracted after 15 min %
0.0	96.00	98.20	99.20
0.50	63.50	88.80	92.50
0.75	63.20	86.90	90.60
1.00	61.30	76.80	83.70

Use of higher percentage of plastic waste reduces the need of bitumen by 10%. It may also increases the Quality, strength and performance of the Constructed road.

In this results show that we can ignore the cavities, unsoundness and water accumulation on the roads. After the construction of plastic waste road make durable and high compressive strength along with abrasion resistant in Road. This is an Cost-effective for construction purpose.

Table 5: Improved Characteristics of Plastic Coatedaggregate

% of Plastic	Moisture Absorption	Soundness	Voids	Aggregate Crushing Strength Test
Nil	3.05%	5.50%	4.20%	24%
1.0%	1.00%	Nil	2.20%	22%
2.0%	1.10%	Nil	1.00%	18%
3.0%	0.80%	Nil	Nil	NA
5.0%	0.39%	Nil	Nil	NA
10.0%	0.13%	Nil	Nil	NA
The Above value shows that the Plastic Coated Aggregate shows improved quality which is responsible for the better performance of the road.				

The main problem for plain bitumen road is occurring in rainy season. The bitumen aggregate mix not gets binding strength due to which pothole form on the roads. So using plastic waste in this experiment for this strength increase. There will be less or may be nil pothole formation. It depends on the ratio of plastic waste which will be added to the bitumen and aggregate with proper mix design.

Table 6: Resistance to Stripping

Type Of Aggregate	Time	Stripping %
Plain Bitumen Coated aggregate	24 Hrs	6%
Polymer Coated Aggregate	72 Hrs	Nil
No Pothole Formation		

5. Conclusion

In this experimental Results that performance of waste plastic used in road Construction. it is good for heavy traffic due to better binding Properties, increased strength and better surface Finished condition. It may take period of exposure to difference in climatic changes and temperature. Above all, the process helps to dispose waste plastics usefully and easily available everywhere.

Following are some points which come from experimental Research:

(I) Develop a technology, which is eco-friendly.
(II) Generate jobs for rag pickers.
(III). Avoid disposal of plastics waste by incineration andland filling.
(IV). Use higher percentage of plastics waste.
(V). Reduce the need of bitumen by around 10%.
(VI). The bleeding are not appears /reduce in hot temperature region.
(VII) . Avoid the use of anti-stripping agents.
(VIII) .It is mostly important with the increase of waste plastic binds bitumen mix Which help to increases the Binding properties of aggregate mix material in Highway Construction.

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