

The Use of Polymer Modified Bitumen Waste in Road Construction

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Abstract – Polymer waste is produced during the day and the need for disposal of such wastes generated additional day in an appropriate manner. This waste, using different methods such as combustion, landfill environmental impact settings; But the polymer is added in an environmentally friendly way process. Dry polymer asphalt bitumen to improve service efficiency. Improved asphaltting efficiency will increase if we use polyolefin powder asphalt up to a certain percentage or waste. The use of this innovative technology (polymer to asphalt) will not only strengthen the road construction but also extend the life of the road, but will also help to create an environment and a source of income. Two types of polymer waste disposal technologies can be used in road construction. Because the process corresponding to the plastic waste in combination with 15% by weight of a suitable drying process. But considering the limitations of this process, it only applies to plastic waste, so we configured the total polymer waste eco-friendly environment, not fully achieve their goals. Wet processing requires strong mechanical stirrer and continuous rotation, intermittent production and separation chamber. In which properly controlling to reduce production time, increases productivity and therefore this method is the time for the drying process to remain economically viable and the limits can be exceeded. By actual experiment, we get a different polymer waste composition optimal results.

Keywords– waste plastics, bitumen, HDPE, LDPE, non-biodegradable.

I. INTRODUCTION

Many everyday items are made of some kind of plastic; the plastic products have become our daily life integral part. For various industries, including the impact of population growth and economic growth, there has been a huge increase in the production of all types of waste around the world. Plastic is everywhere in today's lifestyle. It is use for all types of consumer packaging, protection, and disposal services.

The industrial revolution and large-scale commodity production of plastic after the start proved to be cheap and effective raw materials. Today, the economy began from agriculture to packaging, automotive, construction, communications or IT departments have been through every important application of plastic has almost completely changed. If the emotional ground plastic ban imposed on the use of the actual price is high, the inconvenience, damage or contamination will be very high, but the concern is that this plastic waste is a very useful opportunity for someone to misuse. No process disposes of waste plastic.

Therefore, plastic products must be recycled, rather than exhausted landfill. Plastic recycling offers a viable

solution to these problems. Plastic is known as a source of industrial plastic waste. Recovering part of the secondary customer data recovered with different types of plastics and not knowing the source. Third recovery of monomers or value-added products, such as liquid fuel in the recovery process of recovery. Add the right amount of this waste asphalt to improve the quality of life, reduce road construction costs.

Our amazing increase road capacity, including commercial vehicles and transport vehicles permanently overloaded and called on the country's improved performance on the road daily and seasonal temperature changes significantly each part, and therefore a better combination of quality asphalt transportation right. Every day more and more use of polymers day life is produced by landfills huge plastic and rubber waste incineration and which are non eco- friendly.

Utilization of polymer waste asphalt mixture, so improve the adhesive provides a very promising performance plastic alternative. Use roads construction is not new, it's already using the transit wiring PVC or HDPE or PVC pipe networks together HDPE tube construction, to form a plastic mat. Use plastic garbage these two options help to protect wetlands from road transport throughout surface. But interference load has been very concerned about the long rut of scientists and engineers.

II. LITERATURE REVIEW

In his study, Verma highlighted the use of waste plastics production of plastic roads of the phenomenon. Today, the use of plastics has revolutionized virtually every major sector of the economy, from agriculture to packaging, automotive, communications or non-biodegradable products of InfoTech. Consumption is growing rapidly; the question is how to make waste plastic. If you use plastic prohibited emotional reasons, the real cost will be higher, it will not be bigger chance of damage or contamination will be higher.

Use plastic garbage recent study of these criteria, namely plastic road show some promise in road construction. Bangalore-base company, KK Poly Flex and Bangalore from the RV College of Engineering engineer's research team has developed a proof of waste plastics for road construction. Vigorous tests, methods of asphalt concrete mix, using a laboratory level asphalt binder treated to meet all of the specified martial art with Pilgrim road design standards. In order of two to three times the value or general higher than untreated asphalt, asphalt concrete grouping mix stability values increased significantly. Since 2000, the ongoing construction of flexible pavements in India has paved the way for the construction of the concept of flexible use of waste plastic, combined asphalt. LDPE recycled asphalt mixture does not require any modification of existing plant facilities or technologies. Polymer modified asphalt having a temperature, good water resistance. Modified bitumen important structural material is flexible road pavement. Improved bitumen by which thermoplastics that are, linear low density polyethylene [LLDPE], high density polyethylene (HDPE) and polypropylene (PP) and asphalt penetration index. As penet0 interactions rheological properties Habib etc.Worked modifications known to improve the performance characteristics of the polymer by the use of bitumen, but significantly changes its aerodynamic properties at the same time.

Originally, the thermoplastic copolymer exhibits a penetration deeper than the softening effect of the coating. Bitumen viscosity of the base polymer is also increased with an addition. Recycled plastics, mainly low density polyethylene (LDPE) adhesion bituminous gravel mixture density decreased 16%, 2.36-5 mm instead of 30%, showed increased stability in the grouping 250%. Investigation and point and non-cutting benefits of waste plastics flexible paving stones stabilize the mast asphalt (SMA) mixture. Performance testing is routine (not gum) in the axial direction of the test and its compound Marshall SMA static stability, tensile strength and compressive strength tests are also performed according to the dressing material and the percentage of the weight of the metal. Plastic material weighing 10% by asphalt mixture increases the recommended thickness of asphalt mastic performance. With respect to conventional SMA mixture, 10% of plastic material provides stability, and

were split stretched about 64%, 18% and 75% compressive strength.

Tax assessment test results indicate that a combination of increased resistance to share 44% and 3% reduction angle showed increase in shear strength. Plastic drum with an increased content down value decreases and the value of 10% of the plastic material and only 0.09% SMA blend proved effective stabilizing additive.

Plastic waste generates plastic usage and data There are many Plastics two categories: (i) thermoplastic and (ii) thermal set plastics. Thermoplastics containing about 0% and about 20% of the heat collector comprising waste plastics after total consumption. Table 1 describes the generation of from 0.21 to 0.50 kilograms per day of municipal solid waste average.

Table -I: Plastic consumption in India

S. No.	Year	Consumption (Tones)
1	1996	61,000
2	2001	4,00,000
3	2006	7,00,000
4	2011	13500000

Due to changes in living conditions, the growing demand for polymers worldwide increase in one day.

Table -II: Polymer demands in India (Million tons)

1995-96	2001-02	2006-07	2010-11
0.83	1.83	3.27	7.12
0.34	0.88	1.79	3.88
0.49	0.87	1.29	2.87
0.03	0.14	0.29	0.75
1.69	3.72	6.64	14.62

Table -III: Plastic waste consumption (P/C/ YEAR)

S. No.	Country/continent	Per year consumption (Kg)
1	India	14.0
2	East Europe	10.0
3	South East Asia	10.0
4	China	24.0
5	West Europe	65.0
6	North America	90.0
7	World average	25.0

India has a per capita consumption of plastics; the result is the lowest, as seen in Table 3 the production of plastic waste is very low.

Table-IV: Plastic waste consumption

S. No.	Description	World	India
1	Per capita per year consumption of plastic (Kg)	24-28	12-16
2	Recycling (%)	25	60
3	Plastic in solid waste (%)	7	9

Table-V: Waste plastic and its source

Waste plastic	Origin
Low density polyethylene (LDPE)	Carry bags, bags, milk pouches, bin lining, cosmetic and detergent bottles.
High density polyethylene (HDPE)	Hold bags, bottle caps, household items.
Polyethylene terephthalate (PET)	Drinking Water bottles etc.
Polypropylene (PP)	Bottle caps and closures, detergent wrappers, biscuits, wax packets, readymade meal microwave trays etc.
Polystyrene (PS)	Yogurt posts, egg packs, bottle caps, Foamed polystyrene: food trays, egg boxes, disposable cups, protective packaging etc.

In the heat softening temperature of most thermoplastics between the 1-10-10-1040C. TGA analysis showed thermoplastics, gas evolution and thermal degradation may not occur at a temperature exceeding 1000 °C and the evolution of gas 1-18-11-10000 °C. Thus, waste plastics can be easily read as an asphalt mixed with a range of 155-1650C asphalt construction. Table 7 shows the source of waste plastics.

Table- V: Properties of bitumen

Bitumen		Properties		
Properties		30/40	60/70	80/100
1	Specific gravity	0.99	0.99	0.98
2	Water content (% by wt.)	0.2	0.2	0.2
3	Softening point (°C)	50-65	40-55	35-50
4	Penetration point (100 g/5 sec)	30-40	60-70	80-100
5	Ductility (cm)	50	75	75
6	Flash point (°C)	175	175	175

Bitumen is a viscous in some natural deposits, black and highly viscous liquid or semi-soluble substance. This is a major by-product residue or of highly condensed polycyclic aromatic hydrocarbons in the crude distillation petroleum. Asphalt parts with % carbon and hydrogen (87% + 8% + carbon and hydrogen) 5% sulfur and 1% nitrogen, 1% oxygen and time. 2000 ppm metal. Also an average of 300-2000 asphalt mixtures of chemical components from 500-700. This is the heaviest part of crude oil, with the lowest boiling point (525oC).

Various forms of asphalt

Cutback asphalt: Adding solvents to reduce the viscosity of non solvent. Emulsified asphalt; little suspended in aqueous 60 m and 40 m%% asphalt bitumen finely dispersed state in water. Bitumen primer: Through a

mixture of the distillate oil pitch. Modified: waste plastic or a mixture of crumb rubber and asphalt.

Different grades of asphalt for paving

Grade 30/40: These are a higher softening point and having these thicker materials used in the high temperature regions.

Grade60/70: The medium soft indicating semi-viscous material. Because of its availability and low cost, it is widely used in India. It is very suitable for Indian roadway and highway.

Grade80/100: This type of bitumen is a thin material and is used in tropical areas. The point is, not too soft.

The functions of bitumen

Bitumen is use to build roads. The road is in a contact having different temperature conditions. This may lead to a lot of weather effects, rain, high temperature, etc., but also traffic This is growing. Asphalt tends to crack. Therefore, to overcome these problems, a building material, wear-resistant, should be protected layer by layer.

III. EXPERIMENTAL

1. Methodology

The plastic waste is powdered and mixed with varying percentages of plastic pitch. Polymers increase the melting point of the asphalt, the roads leading to longer life flexible winter. Use cut waste plastics as a strong "bonding agent" as asphalt until the asphalt. Removing plastic and brittleness and increase the elastic properties of the asphalt mix. The plastic waste is melts and mixed amount of asphalt. Dry processing and wet processing is flexible asphalt paving two important processes.

2. Dry process

For flexible paving, hot stone for paving (160 °C) is mixed with hot asphalt (170 °C) and the mixture is. Total IS select the base coding is its strength, the absorption capacity and power. Choose its adhesion, based viscoelastic properties and penetration value of bitumen. Usually when there is a plastic coating that has improved quality voids, hygroscopicity and durability. Reduce the porosity of the plastic coating, and contribute to enhancing its quality and overall performance. Flexible paving. Notably, here, stone <2% porosity function only

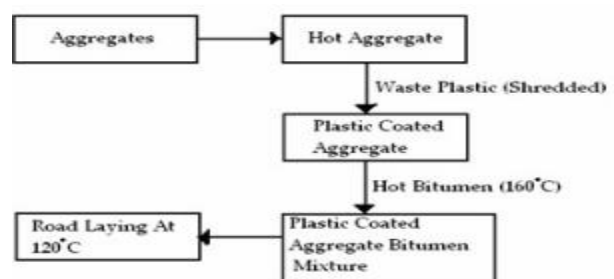


Fig .1. A flowchart of a dry process.

3. Wet process

This method is used for producing a polymer modified asphalt-based, wherein, in said waste polymer directly bonded to the bitumen and heated up to a temperature of 160 °C the suitable mixtures can be dispersed in an appropriate waste polymer asphalt prepared, followed by mixing with heat.

It is then in the second chamber to 120 °C, then cooled in the assembled paddle chamber. The mixture must be cooled, because when the hot mixture was poured together, may form air pockets in the small box and the strength of the rod may be reduced, the road may be deteriorated. When the modified asphalt in the total binding of 110 deg.] C, it is then paved roads, and then the material through the spreader 8 t rolling.

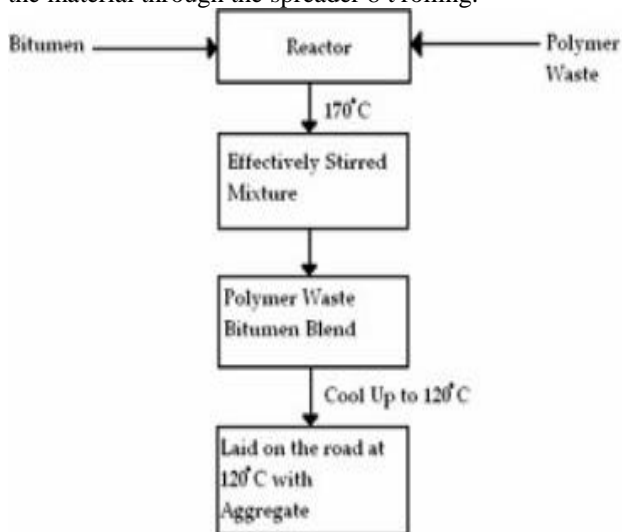


Fig. 2. Flow chart for wet process

The plastic-coated polymeric (for a flexible paving) These are important tests of plastic coated flexible paving executed.

4. Absorbent and porosimetry

For flexible paving, hot stone is mixed (170 °C) with warm asphalt (160 °C), and mixture use for roads paving. It is coded base on it overall strengths, absorption capacity and strength are selected. Choose its adhesion, penetration value viscoelastic properties based on bitumen. In short, to improve the quality of voids, hygroscopicity and durability when there is a plastic coating. A plastic coating to help reduce its peculiarities and improve the overall efficiency and flexibility of quality pavement. Remarkably, only here, the stone <% functional portability.

5. Aggregate crushing value test

Total Crushing Value (ACV) Expressed as a percentage of test sample Quality aggregate content is smaller than 2.36 m. 13.2 meters when the sieve. I have a passing total

pattern. Sieve in the morning and 400 kN maintained at 9.5. CMP is applied gradually be compressed under a load of urine.

6. Aggregated impact value

Role of the plastic coating extended to the overall results of the study value. The total coating weight of the total sum of the results of 1% and 2% of the plastic and plastic-coated is submitted to the compare value and the aggregate value of the test values and uncoated.

7. Marshall Stability

Marshall stability, as measured by the maximum load of bituminous material loaded rate of 50.8 mm/min. Marshall stabilities and deformation, displacement, shear stress resistance and routing bituminous material.

8. Softening point test

This test accomplished by use to the Rings and Balls test equipment. The principle of this test, the softening point is the temperature of the substance under certain conditions, the soft material.

9. Penetration index test

It is calculated using intrometer. Bituminous material penetration distance is several tens of millimeters, the standard needle penetration vertically into the standard conditions of sample temperature material, based on load and time.

10. Ductility index test

Durable asphalt material is measured. When increased, the material is standardized specimens drawn at a constant speed and a certain temperature.

11. Flash and fire point test

In the interest of security, we have enacted laws that set minimum flash point limits in many countries, in order to prevent the highly flammable volatile component of the kerosene fraction included.

IV. RESULTS AND DISCUSSION

Indigenous dispose of waste plastic bitumen is added in order to achieve environmentally friendly solutions. The experimental project involves several components. Examples of HDPE waste, waste, crumb rubber, waste HDPE, LDPE, PP and mixed granular waste rubber are considered for the purpose of the experiment. The reason behind taking this garbage is its availability and a huge customer in your life. Adding plastic to bitumen gives different results. The weight of such waste is determined by the percentage of weight of asphalt. This is a call by two processe; for example. Used in the dry and wet processes, and a process for the asphalt to wet the combination drying process. The size of the aggregates (6 mm) is very small, and the pitch is in a semi-viscous form.

Table –VI: plastic aggregate with and without crushing and impact tests

Aggregates	% Weight of plastics	Test aggregate (Kg)	Waste Plastic(g)	Crushing test in %	Impact test in %
Without plastic	0%	4	0	21.3	19.6
With plastics	1%	4	40	17.5	15.2
	2%	4	80	14.9	13.5
	3%	4	120	11.2	10.7
	4%	4	160	10.3	9.6
	5%	4	200	9.7	8.9

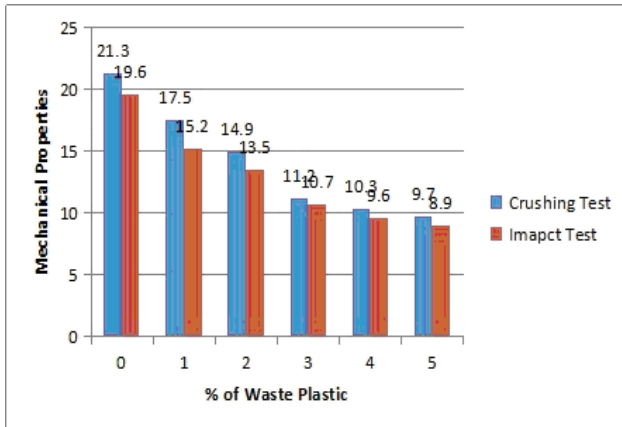


Fig.3. Mechanical properties vs. % Weight of waste plastic

Table –VII: Modified bitumen by HDPE plastics waste

% Weight HDPE waste	Amt. of bitumen in g	HDPE Waste in g	Penetration in mm	Ductility in cm	Softening point (°C)
0	250	0	69	75	42
2	250	5	68	68	48.2
4	250	10	66.3	63	52.5
6	250	15	62	58	55.3
8	250	20	46	48	60.5

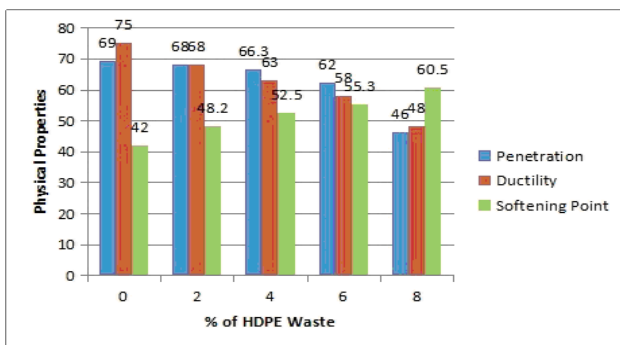


Fig. 4. Physical properties vs. % Weight of waste HDPE plastic

Table –VIII: Modified bitumen by LDPE plastics waste

% Weight of waste LDPE	Amount of bitumen (g)	Waste LDPE (g)	Penetration (mm)	Ductility(cm)	Softing Point (°C)
0	250	0	69	75	42
2	250	5	66	69	47
4	250	10	64	66	51
6	250	15	60	64	53
8	250	20	48	58	57

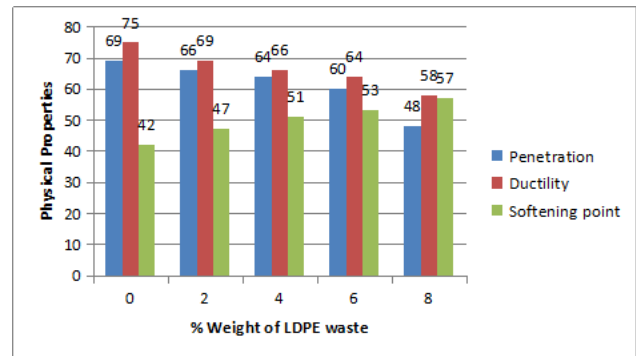


Fig.5.Physical properties vs. % weight of waste LDPE plastic

Table -IX: Flash point test result for 60/70 grades bitumen base bitumen 60/70 flash points-198oC

Polymer % bitumen by weight	HDPE plastic Waste flash point (°C)	LDPE plastic waste flash point in °C
2	215	200
4	222	219
6	240	223
8	257	240

Fig. 6. Flash point vs. Polymer weight % in Bitumen.

The total value of the crushing, the aggregate impact value was 5% by weight of the blend of the most studied of plastic. The results show that the mixed plastic waste loading of up to 5%. Thus, as can be 15% (by weight) was added in the drying process of the total weight of the plastic waste is suitable. But considering the limitations of this process, not only waste rubber but also plastic waste is applicable. It represents the maximum load asphalt road construction waste, waste per olefin mixture obtained, while by 6% loading, the best results in increasing the weight of plastic waste asphalt. As an added amount of plastic is reduced also decreases, with increasing pitch in the service temperature plasticity. A minimum value (in cm) is required to be used in road asphalt suitable; otherwise, it cracks and crazing from bending.

Weight of HDPE plastic waste is added separately, but the only limitation is that no bitumen spread evenly. The maximum load is at most 4% HDPE add more to the lack of waste plastics lowered the asphalt.

is contained in an amount of 6% by weight of LDPE plastic waste asphalt count obtained the best results. add best results

By weight of HDPE waste loaded into the pitch corresponding weights to achieve 8%. Waste may be added to the polymer bitumen maximum of 8%. Performance of asphalt on top of it fell sharply.

To investigate the flash and fire out - depending on the grade of the bituminous material, the high temperature stability is observed. This instability is susceptible to fire, which is why (the explosion) or fatal. Therefore, the temperature must meet each grade bitumen.

Flash and fire polymer (%) Concentration asphalt used in this experiment is significantly increased. This reduces the chance of dangerous situations.

V. CONCLUSION

The increase of the melting point of the plastic pitch. Innovative technologies will not only strengthen road construction and extend the life of roads, and to help improve the environment, sources of income generated. Plastic road will be in India, where temperatures often exceed 0 °C, the destruction caused by heavy rains, most of the roads have large potholes gospel hot and humid climate. Hopefully in the near future we have a strong, sustainable and environmentally friendly way, the earth will be free of all kinds of plastic waste.

The combination of wet and dry, a portion of waste plastics can be coated to improve the aggregate by application of impact and the dry process and therefore by applying a wet mixing the remaining part of waste plastics in the hot crushing strength of aggregate in asphalt add tall Waste plastic can be enhanced, as well as improved mechanical properties can arise.

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