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A REVIEW ON UTILIZATION OF PLASTIC WASTE IN BITUMEN CONSTRUCTION

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ABSTRACT

In today's world, bottles, containers and packing strips etc. is increasing day by day. Because of this amount of plastic waste is increasing on daily basis. This results in environmental problems. This plastic waste which has been produced on daily basis will remain as it is in environment for several years which causes environmental issues. Growth of population, urbanization, vast development and easy lifestyle are mainly responsible for the growth of plastic waste throughout the whole world. But now this a matter of discussion how to use plastic waste to make it environment friendly. Our aim is to find best possible way to use plastic waste in bitumen construction so that we can make it eco-friendly environment. This paper presents the review of possibility of plastic use as waste material in road construction industry. The global plastic production in increasing rapidly with rise in population & change in lifestyle. This makes the disposal of plastic is becoming complicated because of the non-biodegradable property. So, it is better to recycle than disposal. One of the Trend in recycling of plastic is use construction of roads. This type of recycling can also help in protecting the environment from the greenhouse gases that are exposed to atmosphere while disposal. The waste plastic in form of bottles, cups, caps, etc. are made in form of powder or blended with crusher and coated over the aggregate and bitumen by heating process for road construction.

Keywords*: Aggregate, bitumen mixture, plastic, composition, recycling.*

1. INTRODUCTION

In whole world, single India generates1,88,000 tons of garbage. It is common sight in both rural and urban areas to find plastic bags, plastic cups, plastic caps, and other types of plastic waste blocking the roads as well as drains. Due to the problem of poor Biodegradability it creates hygiene issues and blockage of water due to plastic in drains. Bitumen construction is major goal for the country to it's development. For the construction of Roads a large amount of money is spent. In road construction bitumen is act as a binder. Today every sector around the world from agriculture to electrical, packing, automobile, building construction, communication sector are widely using plastic. Generally plastic is a non-biodegradable and many research found that plastic takes several years to degradation. Concrete is a material which consist of mineral aggregate and Bitumen. Bitumen is used as binding material that envelope aggregate. Generally speaking, when looking at the amount of material to be used, road construction is an expensive one. Therefore, we strive to reduce our total cost of road construction using cheaper material such as industrial waste. Now-a-days disposal of different waste produced from different industries is a huge problem.

The main purpose of this study is productive and safe disposal of waste. The rate of production of waste has increased tremendously in almost all parts of the world in the past few decades. Plastic is everywhere in today's life. It is used for packaging, serving, protecting and even disposing of almost all kinds of consumer goods. It was good to know that life of plastic is more than any other packaging materials which is used by human beings but it become a problem to the safety of environment. The use of plastic with bitumen in road construction gives flexible pavement not only increases its smoothness and life but also helps in eco-friendly environment. The plastic are user friendly but not eco-friendly as they are not bio-degradable, generally it is disposed by way of landfilling. If we use plastic waste in road construction it will be beneficial for the road safety as it does not give damps and in this way plastic will be reuse. So concept of plastic waste can be use in bitumen construction as plastic gives binding property to the bitumen, so we can productively reuse plastic waste in bitumen construction.

2. LITERATURE REVIEW

Atha R Prasad Etal (2015): He proves that the bitumen which is conventional material used in the road construction can be partially replaced by the waste plastic and rubber. They added rubber and PET in 3%, 4.5%, 6%, 7.5% and 8% bitumen and found that the optimum content was obtained at 6% by weight of bitumen improves the pavement stability and they found that the use of PET bottles is best.

Dr. R. Vasudevan: He states that the polymer bitumen blend is better binder compared to plain bitumen. Blend has increased softening point and decreased penetration value with a suitable ductility. When it is used for road construction it can withstand higher temperature and load. The polymer

coating of plastics reduces the porosity, absorption of moisture and improves soundness. The polymer coated aggregate bitumen mix forms better material for flexible pavement construction.

Sasane Neha. B etal (2015): Proves that the addition of plastics is the innovative technology which strengthens the road construction and also increases the life of road. As the plastics content increases compared to conventional flexible pavement with the added plastic has good results. According to Marshall stability test the optimum use of plastics is up to 10%

3. METHODOLOGY

The method of mixing are of two types:

1. Dry Process
2. Wet Process

1. **Dry Process:** First of all, plastic waste is collected ,separated that is segregated, clean and then stored. segregation process involves certain kind of plastic such as PVC cannot be used due to safety concerns. The next step is the cleaning of plastic waste. This is the most important step because most of the plastic has been used for packaging. After cleaning plastic waste should be dried. After that plastic waste goes through the process of shredding which involves cutting of plastic waste into 2mm to 4 mm size. After that aggregate heated to around 160^0C to 170^0C. And then in mixing chamber the cut plastic is added to hot aggregate to apply coating uniformly over aggregate for 30-45 seconds. Plastic coated aggregate is added to bitumen at a temperature between 150^0C-165^0C. This temperature is carefully regulated to make sure that the binding is strong.

2. **Wet Process:** In this process, plastic waste is directly mixed with the hot bitumen at 160^0C and this mixture is mixed using a mechanical stirrer. This mixture also contains additional stabilisers and requires proper cooling. This method is not mostly popular because it requires huge amount of investments that is cost, larger plants and many more equipment in the comparison of dry process. So, dry process is economical and best to use in the least cost and least amount of equipment. That's why dry process is widely used.

Advantages

A well-constructed plastic road will result in following advantages:

- Strength and performance of the road increases.
- Reduces the bitumen requirement by around 10% resulting in reduction of overall cost.
- No stripping and no pot holes.
- The maintenance expenditures reduces to almost nil. Generates employment for rag pickers.
- The road life sustainably increases.
- Helps in disposal of plastic waste. Hence minimizing the pollution.

Disadvantages

- The heated treatment of plastic may leads to release of harmful gases to atmosphere.
- Roads made of pure plastic leads to decrease in strength with small variation in temperature.
- The plastic may break into micro plastic particles due to atmospheric oxidation.

4. CONCLUSION & FUTURE SCOPE

As we know, the human population is getting larger day by day thus, quantities of waste are getting larger. A huge problem is that waste that cannot be recycled. Plastic increases the melting point of bitumen. The use of plastic waste in road construction not only increases the strength of road but also increases the road life. The analysis of this paper reveals that plastic waste increases durability, strength, and cheaper cost. It is hoped that in near future we will have strong, durable, eco-friendly roads which will gives plastic free environment.

Along with bitumen, use of plastic waste increases it's life and smoothness. It is economical and eco-friendly. Addition of plastic waste in construction of roads reduces the plastic shrinkage and drying shrinkage. The use of plastic waste improves the abrasion and slip resistance of pavement.

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