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Comparative Study of the Oxidation Products of Dimethylglyoxime in Conventional and Microwave Heating Conditions

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ABSTRACT: The population growth, industrialization, consumerism and scientific development have led to the uncontrollable accumulation of waste. Proper waste disposal is of great importance in both pastoral and metropolitan areas. This study discussed the suitability of plastic waste materials for pavement construction.. The waste is mixed in different proportions to the soil sample and their influences on geotechnical properties were studied. The results of the tests indicated that plastic alone is not suitable for pavement subgrade. When quarry dust was added along with soil plastic mix, it maintains the CBR value within the required range.

KEYWORDS: Plastic, Bitumen, Atterberg's limit, HRS Specification, CBR Value.

I. INTRODUCTION

The rate of production of waste has increased tremendously in almost all parts of the world in the past few decades. The quantities of these waste that are accumulating, are causing serious disposal problems. The conservative methods of disposal are found to be inadequate. Due to population growth, industrialization, consumerism and technological development there has been a tremendous increase in the rate of production of waste. Every year, 7.2 million tons of hazardous waste is produced and its disposal is becoming a major issue and about one km^2 of additional landfill area is needed every year. Indian government spends about Rs 1600 crore for treatment & disposal of these wastes. In addition to this, industries release about 150 million tons of high volume low hazard waste every year, which is mostly dumped on open low lying land areas. In this situation, the conventional waste disposal methods are found to be derisory. Through this project, a small attempt has been made at deducing a new technique of waste disposal. This paper aims at proposing a new method of disposal of plastic, quarry dust, and tyre waste by using them in the sub-grade soil of pavement. The Main objective of this study are safe and prolific disposal of wastes - plastic, quarry dust, and tyre, the study of index properties and CBR values of variable mixes of soil and waste and suitability of soil-waste mix in sub grade.

II. RELATED WORK

Growth and Quality of infrastructure is one of the most important developing indication of any nation. Infrastructure includes various sectors i.e Roads, Bridges, Dams, Tunnels, etc, Among all these different sectors, construction of roads takes up the major part of all the infrastructure work in any nation, being it the most basic yet the most useful mode of transport among all the others.
As the construction of roads plays such an important role in the development of any nation it is equally important to assure that it doesn't affect any other developing aspect of it.

The second most important point of concern after infrastructure for any country has to be its environment viz. to make it a better place to live in for any living habitat.

We this research work we are trying to find a balance between these two factors which governs the progress of the nation or any place and also reducing the overall cost of any road project. In the direction of finding this balance we've tried to alter some of the materials and their quantities which are being used in the construction of regular roads. We've tried to replace some amount of bitumen with the processed waste plastic and waste rubber tyres and have carried out complete cost analysis of the same.

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III. DEFINITION

A substance that contains one or more organic polymers of large molecular weight, solid in its finished state and at some state while manufacturing or processing into finished articles, can be shaped by its flow.

IV. TYPES OF PLASTICS

1. Thermosets.
2. Elastomers.
3. Thermoplastics.

V. WHY USE OF PLASTIC?

Polymers have a number of essential properties, which exploited alone or together make a significant and expanding contribution to construction needs.

1. Durable & corrosion resistant.
2. Good insulation for cold, heat & sound saving energy and dipping noise pollution.
3. It is economical and has a longer life.
4. Maintenance free.
5. Hygienic.
6. Ease of processing/ installation.
7. Lightweight.

VI. BASIC PROCESS

1. Segregation
2. Cleaning process
3. Shredding process
4. Collection process

VII. CO-PROCESSING OF PLASTIC WASTE MANAGEMENT

A. PLASTIC WASTE MANAGEMENT

1) Conventional Technology
   - Recycling
   - Incineration
   - Land-filling

2) New Technology
   - Plasma Pyrolysis Technology
   - Liquid Fuel
   - Polymer Blended Bitumen Roads
   - Co-processing in Cement Kiln

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B. ***PROCESS***

1. Wet 2. Dry

i.**Wet Process**

1. Waste plastics by direct mixing with hot bitumen at 160°C.

2. The Mechanical agitator is needed.

3. The Addition of stabilizers and proper cooling.

4. Since the wet process requires a lot of investment and bigger plants.

5. Not commonly used.

ii.**Dry Process**

Mixing the appropriate quantity of dry shredded waste plastic with hot aggregate prior to production of bituminous mixes at hot mix plant by varying percentage of plastic by weight of the mix.

(i) Various types of waste plastic are collected, analyzed as per their type and sent for storage.

(ii) These segregated wastes are then cleaned and dried to remove impurities from them. Then cut into a size of 1.18-4.36 mm using shredding machine, (PVC waste should be eliminated).

(iii) The aggregate mix is heated to 165°C (as per the HRS specification) and transferred to mixing chamber. Similarly, the bitumen is to be heated up to a maximum of 160°C (HRS Specification) to have good binding and to prevent weak bonding. (Monitoring the temperature is very important).

(iv) At the mixing chamber, the shredded plastics waste is to be added to the hot aggregate. It gets coated homogeneously over the aggregate within 30 to 45 seconds, giving a look of oily coated aggregate.

(v) The plastics waste coated aggregate is mixed with hot bitumen at the temperature range between 150°C-165°C. The resulted mix of temperature range 130°C-140°C is used for road construction. The road laying temperature is between 110°C-120°C. Using the roller of 8 ton (min.) capacity.

VIII. **COST ESTIMATION**

The Cost of Waste Plastics: **Rs.7 / Kg.**

The Cost of Processing: **Rs.5 / Kg.**

The Total cost of Waste Plastics: **Rs.12 / Kg.**[5]

- Optimum percentage of plastic in the blend as per the test results is around **8%** (% Wt. of bitumen)

- Generally roads in India are constructed in basic width of **3.0 m, 3.75 m. and 4.0 m**.

- Consider 1 Km length road of width 3.75 m. it uses bitumen approx. 21300 Kg. **For new work** and 11925 Kg. **For Up-gradation**.

The Cost of Bitumen: **Rs.8400 / Drum (200 Kg.)**[6]

The Cost of Bitumen: **Rs.42 / Kg.**

1. Cost of New Road / Km including BBM, Carpet, and Seal Coat: Rs. 18,95,000/-10
→ Bitumen required for work (approx.): **21,300 Kg. / Km**

→ Cost of bitumen in new work: **Rs.8,95,000 / Km**.

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→ Waste plastic, co-processed with bitumen for PMB (8% by Wt.): **Rs.1,704 / Kg.**

→ Cost of waste plastic used: **Rs.20,450 / Kg**.

→ Cost of Bitumen saved (1704Kg. equivalent to plastic used): **Rs.71550**

→ Total savings per Km.: **Rs. 51,100**

- Cost of Road (Up gradation)/km including Carpet and Seal Coat: **Rs. 10, 80,000** [7]

→ Bitumen Required for work (approx.): **11925 Kg. / KM**.

→ Cost of bitumen in repairs (Up gradation) per Km.: **Rs. 5,01,000/-**

→ Waste plastic, co processed with bitumen for PMB (**8%** by Wt.): **954 Kg.**

→ Cost of waste plastic used: **Rs. 11450**

→ Cost of Bitumen saved (954Kg. equivalent to plastic used): **Rs.40,050**

→ Total savings per Km.: **Rs.28,600**

- Optimum amount of waste plastic used in dry process: **10%** (by Wt. of aggregates)
- The Amount of aggregates used in road construction (1 Km length x 3.75 m width):

  3750 sqm x 12.5 Kg per sqm (Avg.) = **46875 Kg.**

→ Therefore Amount of waste plastic used in the road (10% by Wt.): **4687.5 Kg.**

2. Total Amount of waste plastic used in road construction using both the processes together (i.e. Combination of wet process & dry process):1704 + 4687.5 = **6391.5 Kg**

3. Total Cost of waste plastic used in road using mix process: **Rs.76,700**

4. Extra cost for construction of road (Cost of waste plastic used in road construction – Total savings using modified bitumen): 76,700 – 51,100 = **Rs.25,600 / Km**

Table 1: Showing compressive & Bending strength

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

According to the findings as the percentage of Plastic Coating over Aggregate increases the corresponding Compressive and Bending Strength increases.

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IX. ADVANTAGES

1. The Strength of the road increased.
2. Better resistance to water & water stagnation.
3. No stripping & have no potholes.
4. Increased binding & better bonding of the mix.
5. Better reliability property.
6. Maintenance cost of the road is almost zero.
7. No effect of radiation like UV rays.

X. DISADVANTAGES

1) Cleaning process -Toxic present in the co-mingled plastic waste start leaching.
2) During the road laying process- the presence of chlorine will definitely release lethal gas.

XI. COMPARISON

1) The durability of the roads laid out with shredded plastic waste is much more compared with roads with asphalt with the ordinary mix.
2) While a normal 'highway quality' road lasts four to five years it is claimed that plastic-bitumen roads can last up to 10 years.
3) Rainwater will not leach through because of the plastic in the tar.
4) The cost of plastic road construction may be slightly higher compared to the conventional method.
5) The maintenance cost is low as compared to conventional method.
6) Its initial cost is slightly more as compared to conventional method.

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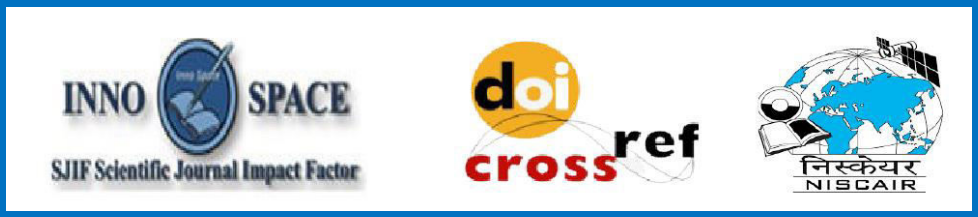

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