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STUDY ON BIOASPHALT

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ABSTRACT:-

The project investigates the utilization of Pyrolysis as a management method for the recycling of yard waste. Pyrolysis is a process encompassing a variety of methods for the thermal degradation of organic substrates in the absence of oxygen. Pyrolysis is a process that has been used for the production of charcoal for millennia. With this method, the yard waste recycling only leads to one product: compost. Pyrolysis of all biomass feedstock's (including that of yard waste) can produce multiple products: bio char (a solid product) and bio-oil (a liquid product). Bio char can be used as a carbonaceous soil amendment which improves fertility and serves as a carbon sequestering agent, preventing additional greenhouse gas (GHG) emissions. Bio-oil consists of viscous organics which can have a variety of applications, including the potential use as a non-petroleum-based asphalt pavement binder. Both of these products could play roles in reducing greenhouse gas (GHG) emissions from waste management and reducing the demand of fossil fuels within the asphalt industry.The fundamental approach applied in this research is described in a later section. Before discussing these project details, it seems prudent to document the context from which this project emerged. Pyrolyzing yard waste is not an obvious 0 approach for yard waste management or the production of useful by-products. It is, however, plausible and emerged as an option during exploratory research based on a growing interest in Pyrolysis as a sustainable technology. Therefore, the following sections present some of the background information that led to this project.

1. INTRODUCTION

Bioasphalt is an asphalt alternative made from non-petroleum based renewable

resources.These sources include sugar, molasses and rice, corn and potato starches, natural tree and gum resins, natural latex rubber and vegetable oils, lignin, cellulose, palm oil waste, coconut waste dried sewerage effluent and so on.The project investigates the utilization of Pyrolysis as a management method for the recycling of yard waste.The project has been designed to explore the feasibility of recovering sufficient amounts of bio-oil from yard waste Pyrolysis to support the production of Bioasphalt.

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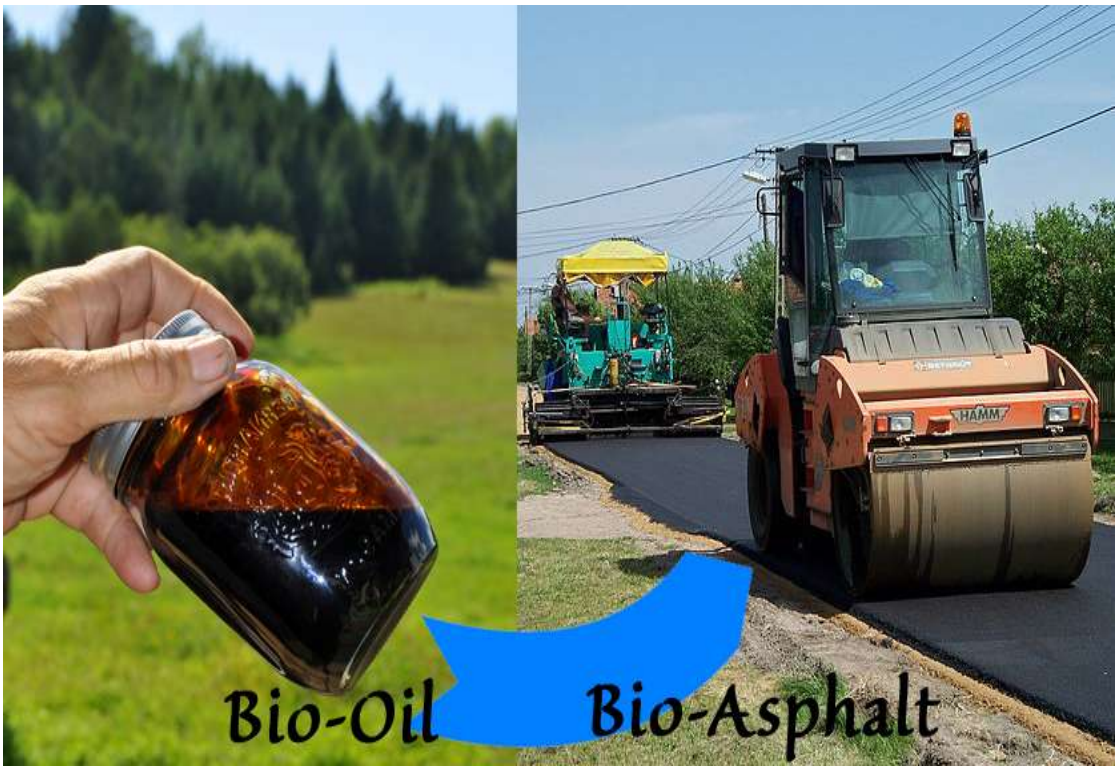

1.1. NEED FOR BIOASPHALT

Asphalt is the residue from traditional crude-oil refining distillation processes and is primarily used for road construction and roofing applications. Many refineries have switched to heavier crude oil feed stocks and installed petroleum coking units that do not produce asphalt. These changes in refining have resulted in less asphalt available to the market. Several states have reported shortages of liquid asphalt or the petroleum derived polymers that improve asphalt 5 pavement performance. A significant price increase for asphalt occurred during the commodity price run up from 2004 through 2008 which followed price increases for crude oil.

2. MATERIAL:-

2.1 General:

In the previous chapter, the need for the study, objectives, literature review and observations made from literature review were presented. In this chapter, the methodology adopted for the current study is presented.

2.2 Description

In this study, the Bituminous Concrete BC mix design was carried out using Marshall Method with standard Marshall compactor (75 blows on each side) and optimum bitumen content (OBC) was arrived. The properties of BC mix with 4.5%, 5%, 5.5%, and 6% of the bitumen are analysed using standard compaction techniques. Marshall Specimens were prepared with dosages of 2%, 4%, and 6% of bio oil by weight of bitumen. Two sample specimens for each binder composition are prepared. A total of 32 specimens were prepared using standard Marshall Compacter.

The following properties are arrived and analysis is made.

- Stability
- Flow
- Density
- Unit weight
- Per cent air voids
- VMA per cent

Per cent voids filled with bitumen The optimum binder content is arrived

3.0 OBJECTIVE:-

To explore the feasibility of recovering sufficient amounts of bio oil from yard waste Pyrolysis for production of bio asphalt

- To check the feasibility of using bio asphalt in the road mix and checking its strength parameters
- To compare the results obtained from bio asphalt with ordinary asphalt

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4.0 METHOD AND METHODOLOGY

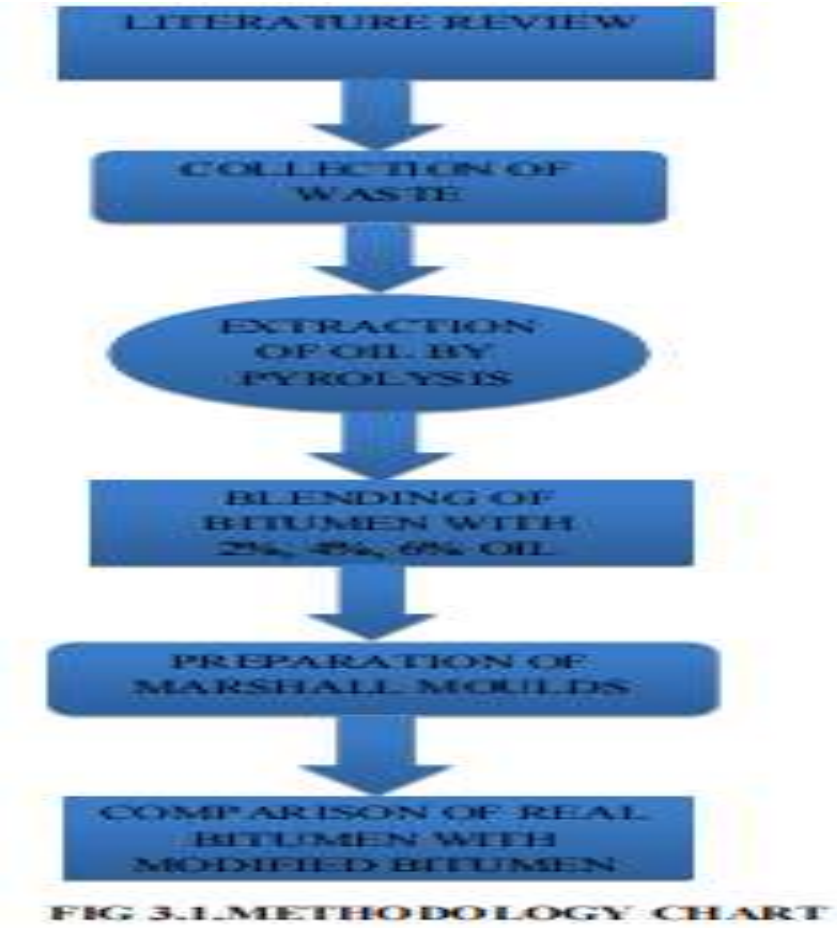

FIG 3.1 METHODOLOGY CHART

5. EXPERIMENTAL ANALYSIS AND TESTING

GENERAL

In the previous chapter the methodology adopted is explained with the help of the flow chart and the materials used for conducting the current study is presented. Various test carried out are explained in detail.

5.1. PYROLYSIS

Pyrolysis is a process of thermo chemical decomposition of organic material in the absence of oxygen. Pyrolysis methods yield products in the solid, liquid, and gas phases. Specific products and amounts in each phase depend on the feedstock and the process method used. In general, methods with slower heating rates and longer off-gas residence times produce a

greater fraction of solid products (e.g. charcoal, char, or bio char), while methods with faster heating rates and shorter off gas residence times produce a greater fraction of liquid products. Shorter residence times prevent the off-gases or vapours from continuing to react with each other.

Typical methods of pyrolysis include traditional / carbonization, conventional/ "slow," "fast," flash-liquid, flash-gas, hydro-pyrolysis, methano-pyrolysis, ultra pyrolysis, and gasification. The main product of interest from traditional and conventional/slow pyrolysis is charcoal or char, and yields are typically around 35% by weight. In fast and flash-liquid pyrolysis the product of interest is liquids with yields around 75% by weight. Flash-gas, ultra pyrolysis, and gasification pyrolysis processes focus on the production of gas, with yields around 85%. The difference between slow and fast pyrolysis generally based on temperature and heating rates, but there is no explicit distinction between the two.

5.3. TESTS ON BITUMEN

The properties of the bitumen that are tested are

- Specific Gravity Test
- Penetration Test
- Softening Point Test
- Viscosity Test
- Ductility Test
- Flash and Fire point Test

5.4. Specific Gravity Test (IS: 1202)

This test was conducted to find whether the supplied bitumen is without any adulteration. The specific gravity of bitumen is to be greater than 0.99 for good binder.

The following steps are followed for the determination of specific gravity.

- The weight of empty vessel was taken as W1g
- Some quantity of heated bitumen was poured into the empty vessel and cooled to room temperature then weighed as W2 g
- Water was added over bitumen up to top of the vessel and weighed as W3 g

- The vessel was filled with water alone and weighed as W4 g

Formula:

Specific Gravity = (W2-W1) / (W4-W1) - (W3-W2)16

Calculations:

Weight of empty vessel, W1 =50 g

Weight of Bitumen + empty vessel, W2 =88g

Weight of Bitumen + empty vessel + water, W3 =109.23g

Weight of Empty vessel + water, W4 =108g

Specific Gravity of Bitumen = (88 - 50) / (108 - 50) – (109.23 - 88)

= 1.03

5.5. Penetration Test (IS: 1203)

The test was conducted to find the grade of bitumen we have used i.e., 60/70. This test determines the hardness or the softness of bitumen by measuring the depth in tenths of millimetres to which a standard loaded needle will penetrate vertically in 5 seconds. The penetrometer consists of needle assembly with a total weight of 100 grams and a device of releasing and locking it in any position.

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REAL BITUMEN			6% BIO-OIL			4% BIO-OIL			2% BIO-OIL		
1	2	3	1	2	3	1	2	3	1	2	3
63mm	63mm	64mm	68mm	71mm	71mm	65mm	62mm	62mm	67mm	63mm	63mm

Table 4.1.Penetration Test

5.6. Softening Point Test (IS: 1205 - 1978)

The softening is the temperature at which the substance attains a particular degree of softening under specified condition of test. The softening point of bitumen is usually determined by Ring and Ball test.

Real Bitumen		6% Bio-Oil		4% Bio-Oil		2% Bio-Oil	
Ball 1	Ball 2	Ball 1	Ball 2	Ball 1	Ball 2	Ball 1	Ball 2
49°C	49°C	46 °C	45 °C	47 °C	48 °C	50 °C	49 °C

Table 4.2. Softening Point Test

5.7. Viscosity Test (IS: 1206)

The viscosity test measures the viscosity of bitumen. Both the viscosity test and the penetration test measure the consistency of bitumen at some specified temperatures and are used to designate grades of bitumen. The advantage of using the viscosity test as compared with the penetration test is that the viscosity test measures a fundamental physical property rather than an empirical value. Viscosity is defined as the ratio between the applied shear stress and induced shear rate of a fluid.

Real Bitumen		6 % Bio-oil		4 % Bio-Oil		2 % Bio-Oil	
Test-1	Test-2	Test-1	Test-2	Test-1	Test-2	Test-1	Test-2
335 poise	337 poise	267 poise	270 poise	280 poise	281 poise	300 poise	304 poise

Table 4.3.Viscosity Test Chart

5.8. Ductility Test (IS: 1208)

This test is done to determine the ductility of bituminous products. The principle is the ductility of a bituminous material is measured by the distance in cm to which it will elongate before breaking when a standard briquette specimen of the material is pulled apart at a specified speed and a specified temperature.

Real Bitumen		6 % Bio-oil		4 % Bio-Oil		2 % Bio-Oil	
Test-1	Test-2	Test-1	Test-2	Test-1	Test-2	Test-1	Test-2
103 cm	104 cm	95 cm	97 cm	90 cm	92 cm	110 cm	113 cm

Table 4.3.Ductility Test

5.9. Fire Point Test:

The principle behind this test is given as **Flash Point** – The flash point of a material is the lowest temperature at which the application of test flame causes the vapours from the material to momentarily catch fire in the form of a flash under specified conditions of the test and **Fire Point** –The fire point is the lowest temperature at which the application of test flame causes the material to ignite and burn at least for 5 seconds under specified conditions of the test.

Real Bitumen		6 % Bio-oil		4 % Bio-Oil		2 % Bio-Oil	
Test-1	Test-2	Test-1	Test-2	Test-1	Test-2	Test-1	Test-2
180 °C	181 °C	186 °C	185 °C	184 °C	184 °C	183 °C	181 °C

Table 4.5.Flash Point Test

CONCLUSION :-

From the experimental investigations conducted in this study, the following conclusions are drawn.

- Use of bio oil BC mixes, improves the stability, air voids and voids in mineral aggregate.

- The Bio oil coated aggregate bitumen mix and bio oil modified bitumen forms better materials for flexible pavement construction as the mixes shows higher Marshall Stability value and suitable Marshall Coefficient,
- The use of bio oil for flexible pavement is one of the best methods of easy reuse of bio degradable waste.
- The method of solid waste management is carried out and thereby reducing the Air Pollution.
- These processes are socially highly relevant, giving better infrastructure. Let us grow with these newer technologies.

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