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# Comparison of Hot Oxidized Bitumen And Cationic/Anionic Emulsions For Pavement Resurfacing

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## Abstract

Asphalts orbituminous chemical compounds have been widely accepted materials for road construction, as they have excellent binding characteristics and water proofing properties and also considered as cost effective. Bitumen is a black/dark colored solid or viscous cementitious substances having high molecular weight hydrocarbons derived from distillation of petroleum or natural asphalt, has adhesive properties, and is soluble in carbon disulphide. Tars are residues from the destructive distillation of organic substances such as coal, wood, or petroleum and are temperature sensitive than bitumen. Bitumen dissolved in petroleum oils where unlike tar. In the present article the comparison of the efficiency between hot oxidized bitumen and anionic and cationic emulsions has been reported. The ratio of 80/100 of bitumen has been utilized in both kind of emulsions and results obtained were discussed in terms of strength, stability and durability.

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**Keywords:** Coal tar, Bitumen, Emulsions, Viscosity

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## 1. INTRODUCTION

Coal tar is mixture of hydrocarbons which is obtained by the [pyrolysis](#) of coal [1-2]. Coal tar is a dark viscous liquid employed in the manufacture of other valuable products. The main components of the coal-tar pitches are polycyclic aromatic hydrocarbons (PAHs) and their heterocyclic analogues. Some topologically related hydrogenated and alkylated PAHs, carbazolic and pyrrolic N-heterocycles, O- and S-heterocycles and some oligomeric structures have also been found in appreciable amounts in coal-tar pitches [3-5].

Since the discovery of coal tar from the refinery byproducts, the road surfacing has been done using it [6], a variety of other hydrocarbons have also been studied for the purpose by the researchers to exploit the similar properties [7-8]. The dambar, asphalt, bitumen, coal tar and mastics are the products which have similar properties. The black dambar is having (1) Asphalt/ Bitumen, a hydrocarbon and by product of refineries (2) Coal tar/Mastics, a byproduct of steel plant and a cyclic hydrocarbon (3) Gilsonite, a naturally occurring bitumen [9-11]. Generally a straight grade asphalt/bitumen from refineries is being used in road resurfacing for eg. 80/100 and 30/40 [12-15]. The straight grades are oxidized at elevated temperatures and converted to blown grade 85/25, 90/15, 115/15, 135/10 for various applications. The numbers i.e. 85, 90, 115, 135 denote softening point and numbers 25, 15, 10 represents hardness.

## 2. EXPERIMENTAL PROCEDURE

### *Materials and Methods*

**2.1 Preparation of Tuf Mast:** Tuf mast is prepared in a mastic cooker at temperature 150 °C with continuous heating and stirring.

Bitumen 85/25 =9.6 g

Limestone dust= 20.4 g

Crusher stone dust= 30.0 g

Coarse aggregate = 40.0 g

Passing all the above contents through 20 mm 600 sieve and retained on it.

### 2.2 Preparation of the Anionic Emulsion:

Bitumen 80/100=496.2 g

Furnace oil= 32.5 g

Naphthonic acid=0.60 g

Sulpho= 9.0 g

Bent- Slurry=40.0 g

Caustic Solution (Lye)= 15.0 g

Water=421.0 g

Sulpho- groundnut oil

Bentonite-slurry-s pH 8-8.5

Swelling=100%

Density=48-50 (lbs/eft)

200 mess sieve 99% passing

### 2.3 Preparation of the Cationic Emulsions:

Butumen 80/100= 612.22 g

Furnace oil= 56.685 g

Boy-1= 3.5 g

Calcium chloride=10.0 g

HCl= 12.0 g

Water= 335.7 g

R,M.Specs

Boy-1 Hiquat (Quaternary ammonium salt of Hi Co

Both the above emulsions are made in a attraitor with continuous stirring with rpm 20-40/minute. Addition of RM is done one by one serially.

## 2.4 Surfactants:

### (i) Anionic surfactants:

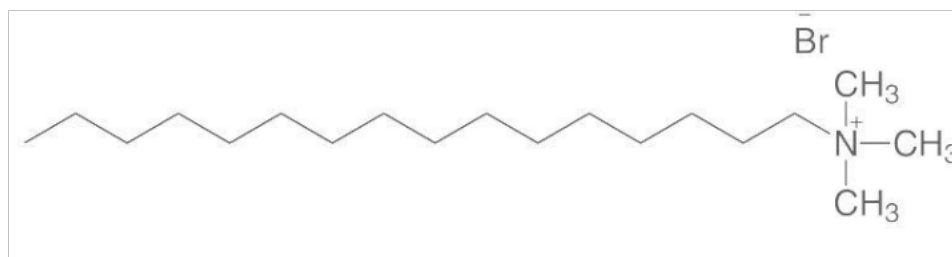
Sulphated alcohols and sulphonated hydrocarbons

$C_{12}H_{25}O-SO_2O-----Na^+$  ( Sulphated alcohols)

$R_2CH-O-SO_2O-----Na^+$  ( sulphonated alcohol Teepol<sup>R</sup>)

$C_{12}H_{25}-C_6H_6-SO_2-----Na^+$  (sulphonated hydrocarbons) Dispersol<sup>R</sup>

### (ii)



Cationic

### Surfactants:

Quaternary ammonium compounds and quaternary heterocyclic compounds such as pyridinium derivatives

A tetra alkyl ammonium salt cetyltrimethyl ammonium bromide

### 3. RESULTS AND DISCUSSION

The prepared products in the three categories in which one is based on hot process using basic product called as Tuf Mast. Then the other two types of products synthesized are emulsions (i) Bitumen 80/100 and (ii) Bitumen 30/40 which is the basic raw material and is a byproduct of refinery. These products have many applications and here we compare these with Asphalt for road resurfacing. Tuf mast product covers the pot holes, tack coat, anti skid and mastic. It can be prepared in mastic cookers at site only at 150 °C. We can't produce and keep it for long time. However in case of both the emulsions the products are reusable and can be readily use anywhere.

#### 3.1 Anionic Emulsions:

- i. Difficult to use with silicone aggregates
- ii. Not a natural Adhesion agent
- iii. Does not breaks rapidly on contact with aggregates
- iv. damaged by sudden showers immediate after application
- v. Cannot be used in cool and inclement weather
- vi. No dilution
- vii. The charge is lower cannot attribute plating action effectively and cannot help to take advantage of smaller aggregate charge.

#### 3.2 Cationic Emulsions:

- i. Can be used with all type of aggregates
- ii. Emulsifier used are all natural adhesion agents
- iii. Begin to break rapidly on contact with aggregates
- iv. Not damaged by sudden showers immediate after application
- v. Can be used in cool and inclement weather
- vi. Dilution is possible to some extent if required
- vii. The charge on an emulsion particle is double that of anionic emulsion and this force

attributes to the plating action and help to take advantage of smaller aggregate charge.

### 3.3 Application and superiority of emulsions:

- 1) Bitumen emulsion for water proofing of roofs
- 2) Bitumen emulsion for insulation protection
- 3) Bitumen emulsion for fire retardants ( Coal mine fire in coal field)
- 4) Bitumen emulsion for sticker for rain guards in rubber plantation
- 5) For protection of structural surfaces from corrosion and industrial fumes
- 6) Bitumen emulsion for primer for mastic
- 7) Bitumen emulsion for soil stabilization and mixing with soil for making sun dried and mud plaster.

## 4. CONCLUSIONS

The technological advancement in the field of road construction necessitated the need for superior product for ever-changing traffic and climatic conditions. In order to meet the challenge The modified bitumen and coal tar shown the following properties:

- Lesser susceptibility to daily and seasonal temperature variations
- Higher resistance to deformation at high pavement temperature
- Better age resistance properties
- Higher fatigue life for mixes
- Better adhesion between aggregates and binder
- Prevention of cracking and reective cracking

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