



Experimental Study on Properties of Bitumen With Fibres

KEYWORDS

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ABSTRACT *The enhancements in the quality of Bitumen by adding fibres were studied. The work was carried out by adding fibres in various Bitumen samples and quality of Bitumen with and without fibres were studied by analyzing main structural properties. The properties studied includes stability, Viscosity, ductility, flash and fire point and softening point of specimen with and without fiber. Study shows that addition of fibres does not enhance Viscosity, Ductility, flash and fire point where as it increases the strength of Bitumen.*

1. INTRODUCTION

Bitumen is a mixture of organic liquids that are highly viscous, black, sticky, entirely soluble in carbon disulfide, and composed primarily of highly condensed polycyclic aromatic hydrocarbons. Naturally occurring or crude bitumen is a sticky, tar-like form of petroleum that is so thick and heavy that it must be heated or diluted before it flows. At room temperature, it has a consistency much like cold molasses. Refined bitumen is the residual (bottom) fraction obtained by fractional distillation of crude oil. It is the heaviest fraction and the one with the highest boiling point, boiling at 525 °C (977 °F).

2. BITUMEN LABORATORY TESTS

2.1 Grades of bitumen

The grade 80/100 bitumen was used in following test.

2.2 Tests on bitumen

The following tests are usually conducted to evaluate different properties of bituminous materials.

1. Penetration test
2. Ductility test
3. Softening point test
4. Viscosity test
5. Flash and Fire point test
6. Marshall Stability test

3. OBJECTIVES

1. To analyse the properties of the Specimen
2. To analyse and characterize the quality parameters of the Specimen
3. To check the viability of using natural fibers as additives in the Specimen
4. To check possibilities of increasing the strength properties of Specimen
5. To check possibilities of increasing the durability properties of Specimen.

4. EXPERIMENTAL TESTS AND RESULTS

4.1 Determining Penetration of Bitumen

This test is done to determine the penetration of bitumen as per IS: 1203 – 1978. The principle is that the penetration of a bituminous material is the distance in tenths of a mm, that a standard needle would penetrate vertically, into a sample of the material under standard conditions of temperature, load and time (Table 4.1).

Table 4.1. Penetration of Bitumen

Samples	Without Fibre (mm)	With Fibre (0.5%) (mm)	With Fibre (1%) (mm)	With Fibre (1.5%) (mm)
Sample 1	19	17	16	6.5
Sample 2	22	18.5	15.5	7
Sample 3	23	18	14.5	6.5
Result	21.3	17.83	15.3	6.67

4.2 Determining Viscosity of Bitumen

Viscosity is defined as inverse of fluidity. The degree of fluidity at the application temperature greatly influences. The time in seconds are 50 ml of the test (Table 4.2) sample to flow through the orifices is defined as the viscosity at a given test temperature.

Table 4.2. Viscosity of Bitumen

Samples	Without Fibre (sec)	With Fibre (0.5%) (sec)	With Fibre (1%) (sec)
Sample 1	46	680	900
Sample 2	48	660	900
Sample 3	47	675	900
Result	47	671	900

4.3. Determining Softening Point of Bitumen

This test is done to determine the softening point of asphaltic bitumen and fluxed native asphalt, road tar, coal tar pitch and blown type bitumen as per IS: 1205 – 1978. The principle behind this test is that softening point is the temperature at which the substance attains a particular degree of softening under specified condition of the test (Table 4.3).

Table 4.3. Softening Point of Bitumen

Samples	Without Fibre (°C)	With Fibre (0.5%) (°C)	With Fibre (1%) (°C)	With Fibre (1.5%) (°C)
Sample 1	39	42	44	48
Sample 2	40	41	46	49
Sample 3	41	43	47	49
Result	40	42	46	49

4.4. Determining Flash and Fire Point of Bitumen

This test is done to determine the flash and fire point of asphaltic bitumen as per IS: 1209 – 1978. The principle behind

this test is given below (Table 4.4).

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.

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.

Table 4.4. Flash & Fire Point of Bitumen

Test	Without Fibre(°c)	With Fibre (0.5%) (°c)	With Fibre (1%) (°c)	With Fibre (1.5%) (°c)
Flash	102	118	126	126
Fire	109	142	180	180

4.5. Determining Ductility of Bitumen

This test is done to determine the ductility of distillation residue of cutback bitumen, blown type bitumen and other bituminous products as per IS: 1208 – 1978. 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 (Table 4.5).

Table 4.5. Ductility of Bitumen

Sample	Without Fibre (cm)	With Fibre (0.5%) (cm)	With Fibre (1%) (cm)	With Fibre (1.5%) (cm)
Sample 1	38	41	44	49
Sample 2	39	40	46	45
Sample 3	37	41	41	48
Result	38	41	44	47

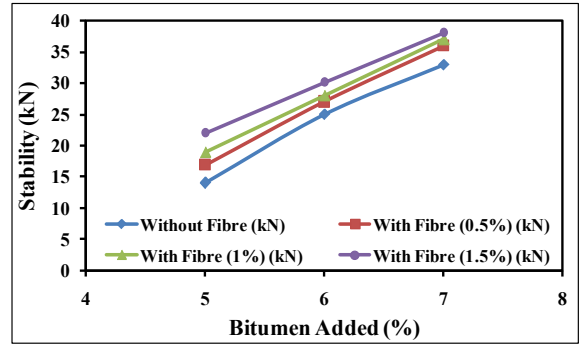
4.6 Determining Marshall Stability of Bituminous Mixture

This test is done to determine the Marshall stability of bituminous mixture as per ASTM D 1559. The principle of this test is that Marshall Stability is the resistance to plastic flow of cylindrical specimens of a bituminous mixture loaded on the lateral surface. It is the load carrying capacity of the mix at 60°C and is measured in kN (Table 4.6).

Table: 4.6. Stability of Bitumen

Sample	% of Bitumen Added	Without Fibre (kN)	With Fibre (0.5%) (kN)	With Fibre (1%) (kN)	With Fibre (1.5%) (kN)
Sample 1	5	14	17	19	22
Sample 2	6	25	27	28	30
Sample 3	7	33	36	37	38

GRAPH Plot % of bitumen content on the X-axis and stability in kN on the Y-axis to get maximum Marshall Stability of the bitumen mix. A sample plot is given



4.6.1. Graph: Stability of bitumen

5. RESULT AND DISCUSSION

It is found during this studies that the marshal stability value which is the determining factor of the strength of bitumen is steadily increasing under the application of fibers to a certain level, further studies were prescribed to obtain optimal level of bitumen and fibers for various quality bitumen. It is also found that flow properties such as ductility, viscosity and softening point were not showing any considerable change by the addition of fibers but they cannot be treated as major parameter to define the strength of bitumen.

One of the major concerns which are to be addressed is the optimal aspect ratio of the bitumen which is to be found by further studies, only under the optimal aspect ratio the behavior of the bitumen can be studied. Under the standard aspect ratio the same should be studied to verify the exact parameters that are defining the characters of the bitumen, in overall it is found that the addition of fibers in the bitumen is viable even though its highly corrosive in nature and also it increases the strength considerably.

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