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ASPHALT BLENDS OF HYDROCARBON PRECIPITATED ASPHALTS WITH HYDROCARBON AROMATIC EXTRACTS

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8 Claims

ABSTRACT OF THE DISCLOSURE

Asphalts of about 200–350 penetration at 77° F. having improved specific gravity and ductility properties and a method for producing such asphalts are disclosed. The asphalts contain about 70 to 85 weight percent of a hydrocarbon precipitated asphalt having a penetration at 77° F. of about 30–65, and about 15 to 30 weight percent of a hydrocarbon aromatic extract having a gravity of about 18 to 20° API. These components are derived from Mid-Continent crude bottoms having a viscosity of about 800 to 1500 SSU at 210° F.

This invention relates to improved asphalts and to a process for producing high grade asphalts which can be used for instance, for paving roads. More particularly, this invention concerns a new method for processing Mid-Continent crude to meet particular specifications of high quality asphalt.

Asphalts of various types can be produced by the distillation of crude oil. For example, a crude oil can be distilled, preferably under a vacuum, to produce a dark residuum, i.e., one from which lubricating oil has been removed. The residuum can then be treated with solvents selective for the hydrocarbon oils and the dissolved and undissolved fractions can be separated by settlement and decantation or if preferred by the use of a centrifuge. The dissolved fraction can be used as a high grade asphalt stock to be converted in the usual manner and the undissolved fraction is a suitable stock for the production of a different type of asphalt of a lower quality than that represented by the dissolved fraction, but which is particularly useful for certain applications.

The requirements and specifications placed on asphalts will vary depending upon their particular use and the conditions to which they are exposed. For example, when considering paving asphalts for roads the demands placed upon the asphalt will vary depending upon the climatic conditions which the asphalt must tolerate. Thus in colder climates, the required specifications for paving asphalts will differ from those in warmer climates.

This invention comprises a novel process for manufacturing asphalt with grades between about 200–350 penetration at 77° F., to meet specific asphalt requirements which cannot be met with conventional methods of manufacture, when processing Mid-Continent petroleum crude oils. The required specifications which must be met by the asphalt produced by the process of the present invention are shown in Table I, and are compared with vacuum reduced asphalt prepared from Mid-Continent crude by conventional methods of manufacture.

As can be readily seen, for all three penetration grades between 200–350 penetration, the vacuum-reduced asphalt does not meet specific gravity specifications of greater than 1 and the 250–300 and 300–350 penetration grades do not meet ductility specifications of greater than 100. Thus there is a need for an improved asphalt in the 200–350 penetration range which meets the required specifications listed above.

In order to obtain a feedstock for the process of the present invention Mid-Continent crude can be first processed in a conventional crude still to remove the light ends and provide reduced crude bottoms. The reduced crude bottoms can then be fed to a vacuum still to remove the gas oil as overhead product and to produce as bottoms, a product which has a viscosity of about 800 to 1500 SSU at 210° F., preferably about 1300 to 1500 SSU at 210° F., and which represents a substantial but minor part of the total crude, say for example about 10 to 30 volume percent.

This bottoms product is next deasphalted by solvent extraction using a hydrocarbon which is well known in the deasphalting art and often containing from about 3 to 5 carbon atoms such as, for example, propane, butane, pentane, and mixtures thereof, with propane being the preferred solvent. The amount of solvent employed in the deasphalting step may often vary within a solvent to oil weight ratio range of about 2 to 10:1. Particularly desirable ratios are about 3 to 4 volumes of solvent per volume of residual oil charged.

The temperature at which the deasphalting step can be conducted may be within the range of about 110 to 190° F., preferably about 120 to 165° F. There may be a temperature gradient in the deasphalting tower with the highest temperature at the deasphalted oil outlet. The temperature gradient within the tower may range from about 0° to 60° F. Thus it may be desirable to control the temperature at the top of the extraction tower at say for example about 160–165° F. and at the bottom of the tower at about 120–140° F. These operating conditions often produce deasphalted gas oils with a viscosity of about 150 to 250 SSU at 210° F. It is preferred to control the process to give deasphalted gas oils with a viscosity in the range of about 185–195 SSU at 210° F. with a viscosity of about 190 SSU at 210° F. being particularly desirable. The deasphalted gas oil is taken off at the top of extraction tower generally in yields of at least about 25% by volume based on the amount of feed introduced into the extraction unit and as high as about 50% by volume and even higher, although a yield of about 35 to 40% is desirable. The hydrocarbon precipitated asphalt which is recovered from the bottom of the tower may have a penetration at 77° F. of about 30–65; however, a product having a penetration of about 45–65 is preferred.

The deasphalted gas oil recovered as overhead from the hydrocarbon extraction tower is fed to a conventional aromatic selective solvent treating plant or extraction unit. Due to the relatively low aromatic content of the feed material to the treating plant, a relatively small volume of aromatic solvent can be employed. The solvent to gas oil ratio and tower temperatures are controlled to yield two products after the removal of the solvent. One, which is less soluble in the solvent, known as raffinate, and the other, which is more soluble in the solvent, known as ex-

TABLE I

Tests	Required Specifications			Vacuum-Reduced Asphalt from Mid-Continent Crude		
	200-250	250-300	300-350	200-250	250-300	300-350
Penetration at 77° F., 100 g., 5 sec.	200-250	250-300	300-350	200-250	250-300	300-350
Specific Gravity, 77/77° F.	1.00+	1.00+	1.00+	<1.0	<1.0	<1.0
Ductility at 77° F., cm.	100+	100+	100+	100+	<100	<100
Olefin Spot	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.

tract. In achieving these products the solvent to gas oil feed ratio can vary widely, often from about 1:1 to 6:1, more preferably about 2:1 to 4:1. The temperature at which the solvent treating step can be conducted may be in the range of about 150 to 230° F., preferably about 170 to 210° F.

While phenol is generally used as the aromatics extraction solvent, other solvents such as furfural, sulfur dioxide, 2,2-dichloro diethyl ether, nitrobenzene, etc. can also be employed. The °API gravity of the solvent-free raffinate can vary, for instance be in a range of about 15 to 35; however, for preferred operations, the raffinate has a gravity of about 25 to 30 °API, say about 27 °API, and the gravity of the solvent-free extract may often vary from about 18 to 20 °API. The yield of raffinate may be greater than 40% by volume based on the amount of deasphalted gas oil feed introduced into the aromatic solvent extraction unit, preferably the yield is about 50–60 percent by volume.

A precipitated asphalt recovered from the hydrocarbon deasphalting unit previously discussed is blended with an extract recovered from the aromatic solvent extraction unit to give an asphalt blend which meets the asphalt specifications as previously set out. Thus these two fractions can be blended to meet specific gravity and ductility specifications for penetration grades between 200–250, 250–300, and 300–350. The amount of hydrocarbon precipitated asphalt in the asphalt/extract blend may vary depending upon the penetration range or grade of asphalt desired in the final product. Generally about 70 to 85 weight percent precipitated asphalt can be used with the preferred amount depending upon the grade of asphalt to be produced. The extract is then usually about 15 to 30 weight percent of the blend. In any event the blend has a specific gravity greater than 1.

The following table lists the properties of a hydrocarbon precipitated asphalt and an aromatic extract of this invention and shows two typical blends, both of which meet the desired paving asphalt specifications.

TABLE II

	Propane Precipitated Asphalt	Extract
Laboratory Tests:		
Penetration at 77° F., 100 g., 5 sec.	53	-----
Ductility at 77° F., cm.	+151	-----
Specific Gravity at 77° F.	1.0156	.9440
Flash, COC, ° F.	630	585
Kinematic Viscosity at 210° F., centipoises.	-----	62.6
API Gravity.	-----	18.4
	Blend I	Blend II
Stocks:		
Propane Precipitated Asphalt, Wt. Percent.	80	75
Extract, Wt. Percent.	20	25
Total, Wt. Percent.	100	100
Laboratory Tests:		
Penetration at 77° F.	211	305
Ductility at 77° F.	+151	+151
Specific Gravity, 77/77° F.	1.0031	1.000
Olefin Spot.	Negative	Negative
Flash, COC, ° F.	610	605

The propane precipitated asphalt of Table II can be made from a reduced crude having a viscosity of 1410 SSU at 210° F. In the propane extraction the solvent to oil volume ratio is 4:1 and the tower temperatures are 160° F. at the top and 125° F. at the bottom. The yield of deasphalted oil is 37 volume percent and the yield of asphalt is 63 volume percent and the asphalt has characteristics essentially as set forth in Table II. The deasphalted oil has a viscosity of 190 SSU at 210° F. and is phenol extracted at a solvent to oil volume ratio of 3:1 in a tower having a temperature of 210° F. at the top and 205° F. at the bottom. Tests on the resulting solvent-free extract are essentially those given in Table II.

Thus, by using the processing method of the present invention, paving asphalt which meets desired specifications can be made from Mid-Continent crude which could not otherwise be done when processing Mid-Continent crude by conventional methods of manufacture. Although the present invention for producing a high grade asphalt is discussed in terms of one integrated process, the hydrocarbon precipitated asphalt and the extract components which are blended together to produce the desired asphalt product need not be derived from the same reduced crude.

It is claimed:

1. A process for making asphalt which comprises deasphalting Mid-Continent crude bottoms having a viscosity of about 800–1500 SSU at 210° F. by contact with a C₃ to C₅ hydrocarbon solvent at a temperature of about 110–190° F. to produce a deasphalted gas oil and a hydrocarbon precipitated asphalt having a penetration at 77° F. of about 30–65, extracting said deasphalted gas oil with a solvent selective for aromatics from the group consisting of phenol, furfural, sulfur dioxide, 2,2-dichloro-diethyl ether, and nitrobenzene, at a temperature of about 150–230° F. to form a raffinate and an aromatic extract having a gravity of about 18–20 °API, and blending about 15 to 30 percent by weight of said aromatic extract with about 70–85 percent by weight of said hydrocarbon precipitated asphalt to produce an asphalt product having a penetration range at 77° F. of about 200–350, a specific gravity, 77/77° F. of greater than one, and a ductility at 77° F. greater than 100 cm.

2. The process of claim 1 in which the deasphalting hydrocarbon solvent is propane.

3. The process of claim 1 in which the aromatic solvent is phenol.

4. The process of claim 1 in which the deasphalting hydrocarbon solvent is propane and the solvent selective for aromatics is phenol.

5. A process for making asphalt having a penetration at 77° F. of about 200–350, a specific gravity, 77/77° F. of greater than one, and a ductility at 77° F. greater than 100 cm. which comprises deasphalting Mid-Continent crude bottoms having a viscosity of about 1300–1500 SSU at 210° F., by contact with a C₃ to C₅ hydrocarbon solvent at a temperature of about 120–165° F. to produce a deasphalted gas oil having a viscosity of about 185 to 195 SSU at 210° F., and a hydrocarbon precipitated asphalt having a penetration at 77° F. of about 45–65, extracting said deasphalted gas oil with a solvent selective for aromatics from the group consisting of phenol, furfural, sulfur dioxide, 2,2-dichlorodiethyl ether, and nitrobenzene, at a temperature of about 150 to 230° F. to form a raffinate and an aromatic extract with a gravity of about 18–20 °API, and blending about 15 to 30 percent by weight of said aromatic extract with about 70–85 percent by weight of said hydrocarbon precipitated asphalt to produce the said asphalt product.

6. The process of claim 5 in which the deasphalting hydrocarbon solvent is propane.

7. The process of claim 5 in which the solvent selective for aromatics is phenol.

8. The process of claim 5 in which the deasphalting hydrocarbon solvent is propane and the solvent selective for aromatics is phenol.

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