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PROCESS FOR MANUFACTURING ASPHALT AND PETROLEUM COMPOSITIONS

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ABSTRACT OF THE DISCLOSURE

An asphaltic petroleum material of less than 25° API gravity is upgraded to an asphaltic composition suitable for road building seal-coat application and other uses by reacting said material with (a) certain dicarboxylic acids or anhydrides and chlorides thereof and (b) certain fatty acid esters.

This invention relates to a process for improving the characteristics of an asphaltic petroleum material of less than 25° API gravity and to the resulting improved composition.

Asphaltic materials have wide application in road paving wherein the asphaltic material is mixed with crushed rock and appled as a road coating or topping material. In a great many areas requiring road improvements there are no crude oil refining facilities from which to obtain asphalt with suitable characteristics for road building. It is thus highly desirable, both economically and from the standpoint of convenience, to be able to convert asphaltic crude oil or poor grades of asphaltic materials to materials which are suitable in road paving applications at any location with a minimum of equipment.

This invention is concerned with a process for converting asphaltic crude oil and low grade asphalt to a road paving material which can be performed with a minimum of equipment, thus rendering the process applicable to improvement of asphaltic materials at on-the-job locations.

Accordingly, it is an object of the invention to provide a simple process for upgrading asphalt and asphaltic crude oil to a product suitable for use in road building as a seal-coat application. Another object is to provide an improved asphaltic product from asphalt or asphaltic crude oil of less than 25° API gravity. A further object is to provide a process for treating asphaltic materials to render same suitable for road building which requires a minimum of simple equipment and is adapted to on-the-job use. Other objects of the invention will become apparent to one skilled in the art upon consideration of the accompanying disclosure.

A broad aspect of the invention comprises treating an asphaltic petroleum material of less than 25° API gravity by reacting said material at an elevated temperature with from 0.1 to 10 percent of weight said material of each of (a) a compound of the formula

$$C_nH_{2n}[CO(OH)_x(X)_y]_2O_z$$

wherein n is a digit from 2 to 12, X is a halogen atom, x, y, and z are digits from 0 to 1, and $x+y+z=1$; and (b) a fatty acid ester of the formula

$$R-\overset{O}{\overset{\|}{C}}-O-R'$$

wherein R is a hydroxy substituted alkyl radical having 16 to 26 carbon atoms and 1 to 5 hydroxy groups, and R' is an alkyl radical having 1 to 5 carbon atoms, and the resulting asphaltic composition.

Compound (a) consists of the dicarboxylic acids and anhydrides and halides of such acids represented by the foregoing formula and including succinic acid, glutaric acid, adipic acid, pimelic acid, suberic acid, azelaic acid, sebacic acid, dodecanedioic acid, brassylic acid, and anhydrides, chlorides, bromides, fluorides, and iodides of such acids. Acids, anhydrides, and halides containing a total of about 6 to about 10 carbon atoms per molecule are preferred for use in accordance with the invention and adipic and sebacic acids and derivatives thereof are particularly preferred.

Compound (b) includes fatty acid esters of the required formula such as methyl 6-hydroxypalmitate, ethyl 10-hydroxyarachidate, methyl 12-hydroxystearate, propyl 4,6,12-trihydroxybehenate, butyl 10,20-dihydroxylignocerate, and isopentyl 4,6,8,10,12-pentahydroxycerotate.

The treatment or reaction is conducted at a temperature in the range of 150 to 550° F. and the mixture of asphaltic crude oil or other asphaltic material with compounds (a) and (b) is held in this temperature range for at least 15 minutes and up to three hours or longer, if desired. All treating is effected in the absence of oxygen, for example, by passing an inert or non-oxidizing gas such as nitrogen, methane, and the like through the mixture during treating or by effecting the process in such a non-oxidizing ambient.

The treatment of the invention is effected with 0.1 to 10 weight percent of acid or ester, based on the weight of the asphaltic material being treated. The preferred weight ratio of acid to ester is in the range of 20:1 to 1:1. At these levels the product of the treatment has a penetration (ASTM D5–61, 100 g., 5 sec., 77° F.) of about 150 mm./10 or less. For use in a seal-coat application, a penetration of about 200 mm./10 or less is desirable. The treatment can be simultaneous, i.e., acid and ester both present at the same time, or a treatment can be sequential, i.e., treatment first with the ester and then treating the treated mixture with the acid or vice versa. In sequential treatment, it is preferred to first treat with the ester and then with the acid, anhydride or halide compound (a). It is also preferred to conduct the simultaneous treatment or the acid treatment at temperatures 50 to 150° F. lower than the temperature used in the ester treatment.

The treating process of the invention is particularly applicable to the improvement of low gravity asphaltic crude oils; however, it is also applicable to petroleum asphalts prepared from petroleum residual oils obtained by the distillation of asphaltic or semi-asphaltic crude oil or thermal tar or by fluxing of harder residual asphalts with heavy petroleum distillates. Such residual oils are high boiling liquids or semi-solids which may have softening points from about 32° F. to about 120° F. and are generally characterized by specific gravities in the range of about 0.9 to 1.1 at 77° F.

It is within the scope of the invention to add 0.5 to 10 weight percent rubber to the crude oil being treated. This rubber, which can be any rubber known to the industry, can be added as crumb, but is conveniently added in the form of a cement in an organic solvent. Such a cement results from the preparation of rubbers by solution polymerization processes, and can be formed easily from natural rubber or rubbers made by emulsion polymerization. The rubber is usually added prior to the treatment of the invention. When rubber crumb or the like is used, it can be added to the cude oil either before or after heating to the temperature used for rubber dispersion. When rubber cement is used, it is preferred to add the cement before heating the crude oil to the high temperature. After rubber dispersion, the crude oil-rubber mixture can be cooled before the temperature is adjusted to that used in the treatment, or the temperature can be simply adjusted to that used in the treatment.

The treating process of the invention is readily effected at on-the-job locations with a minimum of equipment including a tank of substantial capacity, heating means for heating the crude oil or asphaltic material in the tank to an elevated temperature, and stirring means for mixing the required additives into the asphaltic material.

The treatment of the invention utilizing both compounds (a) and (b) has a synergistic effect on the penetration characteristic of the treated crude oil or other asphaltic material. The following specific example is presented to demonstrate the synergistic effect of the treatment and is not to be construed as unnecessarily limiting the invention.

EXAMPLE

A Venezuelan crude oil (Monogas Group II) having an 8.7° API gravity and a penetration of 340+ mm./10 was used in all the tests. Sebacic acid and methyl 12-hydroxystearate were the acid and ester, respectively, used in all tests. Treating time was 1 hour in the tests of Series 1 and 2, and was 1 hour for each treating agent in the tests of Series 3, with the ester treatment preceding the acid treatment. Data are presented below.

ACID TREATMENT (SERIES 1)

Run Number	1	2	3	4	5	6	7
Acid, wt. percent	0.0	0.25	0.5	0.75	1.0	1.5	2.0
Temperature, ° F	410-430	300	293-305	300-307	245-300	300	303-315
Penetration, mm./10	220+	220+	220+	220+	220+	220+	199

ESTER TREATMENT (SERIES 2)

Run Number	8	9	10	11	12	13
Ester, wt. percent	0.0	0.25	0.5	1.0	2.0	3.0
Temperature, ° F	410-430	420	420	415	420	420
Penetration, mm./10	220+	220+	220+	220+	220+	220+

ACID+ESTER TREATMENT (SERIES 3)

Run Number [1]	14	15	16	17	18	19	20	21	22
Ester, wt. percent	0.0	0.25	0.5	0.75	1.0	1.25	1.5	1.75	2.0
Acid, wt. percent	2.0	1.75	1.5	1.25	1.0	0.75	0.5	0.25	0.0
Ester Temp., ° F		430	413	420	412	418	415	408	420
Acid Temp., ° F	300	308	305	300	295	303	303	303	
Penetration, mm./10	199	80	97	118	153	220+	220+	220+	220+
Expected [2]		203+	205+	208+	210+	213+	215+	218+	

[1] Run 14 is the same as Run 7, and Run 22 is the same as Run 12.
[2] From a straight-line interpolation between the values of Runs 14 and 22.

It is apparent that a synergistic effect is obtained between the two treatments, with a penetration of about 150 mm./10 or less being obtained with acid to ester weight ratios in the range of 20/1 to 1/1.

Certain modifications of the invention will become apparent to those skilled in the art and the illustrative details disclosed are not to be construed as imposing unnecessary limitations on the invention.

I claim:

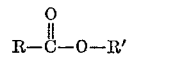
1. A process for treating an asphaltic petroleum material of less than 25° API gravity to produce an improved product which comprises reacting said material at a temperature in the range of about 150 to 550° F. in a non-oxidizing ambient with from 0.1 to 10 percent by weight of said material of each of

(a) a compound of the formula

$$C_nH_{2n}[CO(OH)_x(X)_y]_2O_z$$

wherein n is a digit from 2 to 12, X is a halogen atom, x, y, and z are digits from 0 to 1, and $x+y+z=1$; and

(b) a fatty ester of the formula



wherein R is an alkyl radical having from 16 to 26 carbon atoms and 1 to 5 hydroxy groups, and R′ is an alkyl radical of 1 to 5 carbon atoms and wherein the weight ratio of (a) to (b) is in the range of 20:1 to 1:1.

2. The process of claim 1 wherein said material is reacted first with (b) and thereafter with (a).

3. The process of claim 1 wherein said material is reacted simultaneously with (a) and (b).

4. The process of claim 1 wherein said temperature is in the range of 150 to 550° F. and the mixture of said material and (a) and (b) is held at said temperature at least 15 minutes.

5. The process of claim 4 wherein said material is first reacted with (b) and thereafter with (a) and the reaction with (a) is effected at a temperature of 50 to 150° F. lower than with (b).

6. The process of claim 1 wherein an amount of rubber in the range of 0.5 to 10 percent by weight of said material is incorporated therein.

7. The process of claim 6 wherein said rubber is incorporated in said material prior to reaction with (a) and (b).

References Cited

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