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TREATMENT OF PETROLEUM RESIDUUM

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This invention has for its object the treatment of petroleum distillation residuum in a manner which will yield a high grade of asphalt of a type not heretofore produced from domestic crudes and the production of a secondary asphalt stock having many desirable characteristics.

Heretofore it has been the practice to distill off the lighter constituents of crude oil and to produce asphalt from the residuum by steam reduction or air-blowing or both. This method, which is usually followed in commercial practices, has the drawback, however, in that the oxidation reaction will produce only the same type of asphalt, of the selected melting point, from any one type of crude. In other words, it is difficult or impossible to produce a better grade of asphalt unless a better grade of crude oil is selected.

In accordance with the present invention, the crude oil is distilled, preferably under a vacuum, for the production of a short residuum, that is, a residuum from which the lubricating oil has been removed. The residuum is then treated with a selective solvent for the hydrocarbon oils and the dissolved and undissolved fractions are separated as by settlement and decantation or if preferred they may be separated 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. 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 specifications.

In carrying out the present invention, any suitable selective solvent for hydrocarbon oils may be used, such for example as furfural, sulphur dioxide, nitrobenzol and others. Of the available solvents furfural is preferred because of its effectiveness. The present invention is applicable to the treatment of naphthene or mixed base residua.

As one example of the invention, a separation was made on a vacuum still residuum from Oklahoma crude. This is a typical mid-continental mixed base crude from which it is difficult or impossible to produce a high grade asphalt from the residuum by the usual methods. The residuum in this case was a short residuum from which the gas, naphtha, kerosene distillate, gas oil and lubricating oil fractions had been removed.

The residuum was mixed with a quantity of furfural, in the ratio of approximately two parts furfural to one part residuum. The mixing temperature was approximately 300° F., this temperature being rather high because of the low viscosity of the residuum treated. Temperatures ranging from 100° F. to 300° F. may be selected depending mainly on the viscosity of the residuum and the boiling point of the solvent employed. The quantity of solvent may vary from 100% to 200% of the residuum depending on the effectiveness of the solvent and on the character of the residuum. The residuum was thereafter run into containers and on settling under quiescent conditions separated into an upper layer, containing the insoluble material, which constituted approximately 35% of the residuum, and a lower layer, containing the soluble material, constituting the remaining 65% of the residuum.

The dissolved fraction was treated with steam and fire for a short period, sufficient to remove the solvent which was recovered. The stock was then blown with air for several hours while maintained at a temperature of approximately 450° F. and until the residuum was reduced to a melting point of 129° F. and a penetration of 51 at 77° F.

The undissolved portion was air-blown for a number of hours at elevated temperatures for the production of an asphalt having substantially the same penetration at 77° F. as the asphalt produced from the dissolved portion.

A quantity of the same short residuum as treated above was air-blown, without previous solvent extraction, to produce an asphalt for comparison with that which had been treated. A quantity of Mexican flux was steam reduced for the production of an asphalt of 51 penetration at 77° F. for comparison with the asphalt produced by air-blowing the above extract. The four asphalts, produced as stated above, were tested and found to have the following characteristics:

	1 Air-blown Oklahoma residuum	2 Steam reduced Mexican crude asphalt	3 Air-blown soluble portion from Oklahoma residuum	4 Air-blown insoluble portion from Oklahoma residuum
M.P.—B.&R..	151	128	129	161
Duct.—77° F..	11	100	100	4
Pen.—77° F....	47	51	51	50
Pen.—32° F....	26	16	15	24
Pen.—115° F...	120	235	210	103

The ductility is given in centimeters and the peneration in tenths of a millimeter in accord-

ance with the usual practices as outlined by the A. S. T. M.

It will be seen from the above table that asphalt No. 3, which was made by air-blowing the furfural soluble portion from the residuum used in making asphalt No. 1, is quite similar in melting point, ductility and penetration to asphalt No. 2, which is steam reduced Mexican asphalt, generally recognized as a high grade asphalt. Asphalt No. 3 has one other quality of particular importance, that is, it is substantially stainless. In this respect also it is similar to steam reduced Mexican asphalt and very much superior to either asphalt No. 1 or No. 4.

Asphalt No. 4 produced by air-blowing the furfural insoluble portion from this Oklahoma residuum has a high melting point, for an asphalt of 50 penetration at 77° F. It is a rubbery material with considerable resilience and is useful where these qualities are desired.

Asphalt No. 1, which was produced by air-blowing the original untreated Oklahoma residuum is high in melting point and low in ductility, being intermediate in these respects between asphalt Nos. 3 and 4 produced from the same stock.

The separation of a residuum into the relatively paraffinic and non-paraffinic portions by means of a selective solvent is particularly applicable to a short residuum from which two asphalts may be successfully produced, as stated above.

The explanation for the high grade asphalt stock produced in the undissolved portion and the high melting point asphalt, produced in the dissolved portion apparently lies in the fact that when a selective solvent is added to the residuum, the paraffinic bodies, which are substantially insoluble in the selective solvent, remain in the upper, the insoluble, layer. This accounts for the high melting point asphalt produced from a short residuum. Since the asphalt produced from the insoluble portion has particularly bad staining qualities and that produced from the soluble layer is substantially stainless, it is apparent that those bodies which produce stain are insoluble in the solvents for hydrocarbon oil and are therefore concentrated in the insoluble fraction. The naphthenes, aromatics and unsaturated hydrocarbons are dissolved and remain with the solvent in the soluble fraction, which is characterized by a high specific gravity, sulphur content and iodine value as compared with the solvent insoluble fraction and the original residuum. These bodies, which have a high resin content, tend to produce a greater proportion of asphaltenes in the final asphalt than is present in the usual air-blown asphalt utilizing the entire residuum, thus improving the quality of the asphalt made from the soluble fraction.

While there is set forth a specific example of practicing the present invention, it will be understood that this is an example only and that the invention is limited only as set forth in the appended claims.

I claim:

1. The process of producing asphalt from semi-paraffinic type petroleum oils, such as Mid-Continent crudes and the like, which are normally unsuited for the production of superior grades of asphalt, which comprises distilling the oil to remove fractions including lubricating oils and to produce a short residuum, treating the resulting short residuum with a selective solvent of the type of furfural for substantially separating the residuum into dissolved and undissolved fractions, separating the two fractions so produced, removing the solvent therefrom and reducing the soluble fraction to a desired melting point and penetration in the production of a high-grade substantially stainless asphalt.

2. The process of treating a short petroleum distillation residuum comprising mixing with the residuum a quantity of furfural, subjecting the mixture to settling while under relatively quiescent conditions for the production of an upper and a lower layer comprising the insoluble and soluble fractions, respectively, converting the insoluble fraction, while subjected to heat, to a high melting point, rubberlike, asphaltic material and converting the soluble fraction to a substantially stainless high-grade asphalt.

3. The process of producing asphalt from a lubricant containing residual petroleum oil, which comprises distilling the oil to remove fractions including lubricating oils and to produce a short residuum, treating the resulting short residuum with a selective solvent of the type which is highly selective for naphthenic hydrocarbons to separate the residuum into an insoluble more paraffinic and a soluble more naphthenic fraction, separating the two fractions so produced, removing the solvent from the soluble more naphthenic fraction and reducing the soluble more naphthenic fraction to a desired melting point and penetration in the production of a high grade asphalt.

4. The process of treating a short petroleum distillation residuum comprising mixing with the residuum a quantity of a selective solvent of the type which is highly selective for naphthenic hydrocarbons, subjecting the mixture to settling while under relatively quiescent conditions for the production of an upper insoluble more paraffinic fraction and a lower soluble more naphthenic fraction, converting the insoluble more paraffinic fraction while subjected to heat to a high melting point rubbery asphaltic material, and converting the soluble more naphthenic fraction to a high grade asphalt.

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