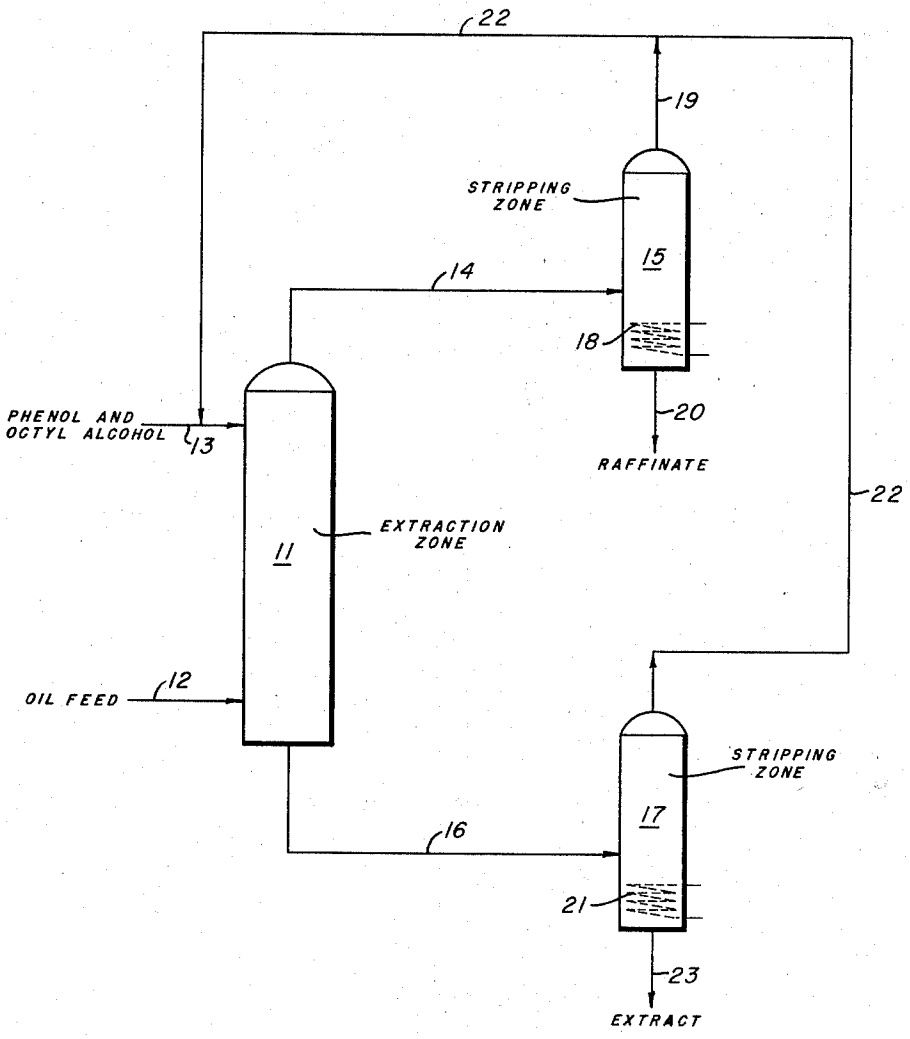
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PHENOL EXTRACTION OF HYDROCARBONS WITH ALCOHOL SOLVENT MODIFIER

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PHENOL EXTRACTION OF HYDROCARBONS WITH ALCOHOL SOLVENT MODIFIER

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The present invention is directed to a method for solvent extracting hydrocarbon mixtures. More particularly, the invention is directed to extraction of hydrocarbon mixtures with a phenol solvent. In its more specific aspects, the invention is concerned with modifying a phenol solvent for separating hydrocarbons.

The present invention may be briefly described as involving a method for separating predominantly saturated from predominantly aromatic hydrocarbons in which a mixture of said hydrocarbons is contacted under extraction conditions with a solvent mixture of phenol and a small but effective amount of a substantially water-insoluble aliphatic alcohol to form an extract phase and a raffinate phase. The two phases are separated from each other and the solvent mixture is separately recovered from each of said phases.

The water-insoluble aliphatic alcohol is suitably a saturated aliphatic alcohol, such as, for example, hexyl, heptyl, octyl, nonyl and decyl alcohols which boil in the range from about 275° to about 450° F. Isomers of these alcohols such as 2-ethyl hexanol, 2-methylpentanol-5, 2,3-dimethyl heptanol-6, may also be used.

The alcohols may suitably be used in a small but effective amount in the range from about 3% to about 10% by volume of the solvent mixture. A preferred amount is about 5% by volume with octyl alcohols which are also preferred.

The extraction conditions employed in the practice of the present invention may suitably include a temperature in the range from about 100° F. to about 250° F. with good results being obtained at about 110° F. with octyl alcohols.

The amount of alcohols used based on the hydrocarbon may range from about an equal amount up to about 300 volume percent. These amounts of phenol may be added incrementally and in stages as may be desired.

The hydrocarbon feed to the present invention may suitably be hydrocarbon fractions boiling in the range from about 500° up to about 1000° F. and may suitably include fractions in the kerosene, gas oil, heating oil, and lubricating oil fractions in this boiling range. Other lower boiling fractions may be used but when a hydrocarbon fraction boiling below the boiling point of phenol is employed, the extract and raffinate phases will be distilled from the solvent mixture rather than the solvent mixture being distilled from the hydrocarbons.

The present invention will be further illustrated by reference to the drawing in which the single figure is in the form of a flow diagram.

Referring now to the drawing, numeral **11** designates a solvent extraction zone comprised of a plurality of extraction stages and represented by an extraction tower provided with suitable internal liquid-liquid contacting means, such as baffle plates, distributing means, bell caps, and the like. It will also be understood that extraction zone **11** includes means for inducing reflux and means for adjusting temperatures in order to obtain the best results.

Introduced into zone **11** by way of line **12** is a hydrocarbon feed which suitably may be a lubricating oil fraction. Also introduced into tower **11** by way of line **13** is a solvent mixture of phenol and an aliphatic alcohol, such as octyl alcohol, which is arranged to flow countercurrently to the oil feed introduced by line **12**.

Removed from zone **11** by way of line **14** is a raffinate phase which is introduced thereby into a stripping zone **15**. Withdrawn from tower **11** by line **16** is an extract phase which is introduced thereby into a second stripping zone **17**.

Stripping zone **15** is provided with a heating means illustrated by steam coil **18** for adjustments of temperature and pressure for removal of solvent mixture by way of line **19** and for recovery of raffinate by way of line **20**.

In stripping zone **17**, the solvent mixture is removed from the extract phase by adjustment of temperatures and pressures by heating means illustrated by steam coil **21**. The solvent mixture is removed from zone **17** by line **22** and the stripped extract phase is recovered by line **23**.

The solvent mixtures from zones **15** and **17** are admixed in line **22** and re-introduced into line **13** for re-use in zone **11**.

The raffinate phase withdrawn from zone **15** after stripping of the solvent mixture therefrom is suitable for use as a lubricating oil.

In order to illustrate the invention further, the following examples are presented to show the advantages of using the improved solvent:

A base lubricating oil fraction from a Coastal crude was extracted with two 100 percent treats of phenol. The same quantity of phenol containing 5 percent water was compared as an extractive agent with phenol containing 5 percent octyl alcohol. These runs were made in batch equipment and the solvent was mixed with the base lubricating oil fraction for 30 minutes and settled for 45 minutes. The extract phase was separated from the raffinate phase and the raffinates from the several operations were stripped with steam to remove solvent therefrom and then the stripped raffinates were dried by blowing with an inert gas. Inspection of the raffinates with yields and other pertinent data are presented in the following table:

TABLE

Extraction of Coastal lub distillates

Experiment No.	1	2	3	4
Phenol, Vol. Percent of Charge	[1] 200	[1] 200	[1] 200	[2] 150
Water, Percent on Phenol	5			
Octyl Alcohol, Percent		5	5	5
Miscibility Temperature, °F.	200	166	166	
Treating Temperature, °F.	170	130	110	110
Rafinate Yield Percent of Charge	70.5	54.2	61.5	68.2
Gravity, API°	25.0	25.8	25.5	24.9
Viscosity at 100° F.	613	556	560	611
Viscosity at 210°F.	61.6	59.5	60.3	61.4
Viscosity Index	58.7	59.5	66.0	58
Flash O.C., ° F.	455	455	465	425
Neutralization No.	.27	.25	.25	.38
Vis.-Grav. Constant	.840	.834	.836	.841

[1] Two 100% treats.
[2] Two 75% treats.

From the foregoing data, it will be apparent that my improved operation allows several advantages to be obtained. These advantages may be summarized as follows:

(1) The quantity of solvent required for a given yield and viscosity index is decreased 25 percent by use of the water-insoluble alcohol. This also means that 25 percent more oil treating capacity can be employed than when using water as an anti-solvent. For this advantage, a comparison of Run No. 1 and Run No. 4 is in order.

(2) The treats were made at 30° F. below miscibility temperature, that is 110° F. with alcohol-phenol solvent while water-phenol solvent required 170° F., thus affording an appreciable saving in heat and equipment.

Although not reflected by the data, in these operations decreased emulsion formation and enhanced phase separation were observed. The alcohol-phenol solvent separated into phases in a few seconds, whereas the phenol-water solvent formed an emulsion and separated only after standing an appreciable length of time, for example a matter of fifteen minutes. The selection of a miscible co-solvent with a boiling point adjacent the boiling point of phenol provides an advantage in that the solvent mixture distills as one solvent and does not require the addition of separate solvent. Thus alcohols, such as 1-octanol and 2-octanol, boil at 383° F. and 353° F. which is on each side of the boiling point of phenol at 363° F. and, therefore, would distill with the phenol.

It will be seen from the foregoing examples and the description taken with the drawing that a new and improved operation is provided which is of considerable utility.

The nature and objects of the present invention having been completely described and illustrated what I wish

to claim as new and useful and to secure by Letters Patent is:

1. A method for treating a lubricating oil fraction which comprises contacting said fraction with a solvent mixture of phenol and a small but effective amount of a substantially water-insoluble saturated aliphatic alcohol boiling within the range from about 275° F. to about 450° F. under conditions to form a raffinate phase and an extract phase, separating said phases, and separately recovering said solvent mixture from said phases.

2. A method in accordance with claim 1 in which the alcohol is octyl alcohol.

3. A method in accordance with claim 2 in which the amount of alcohol is in the range from about 3% to about 10% by volume of said solvent mixture.

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