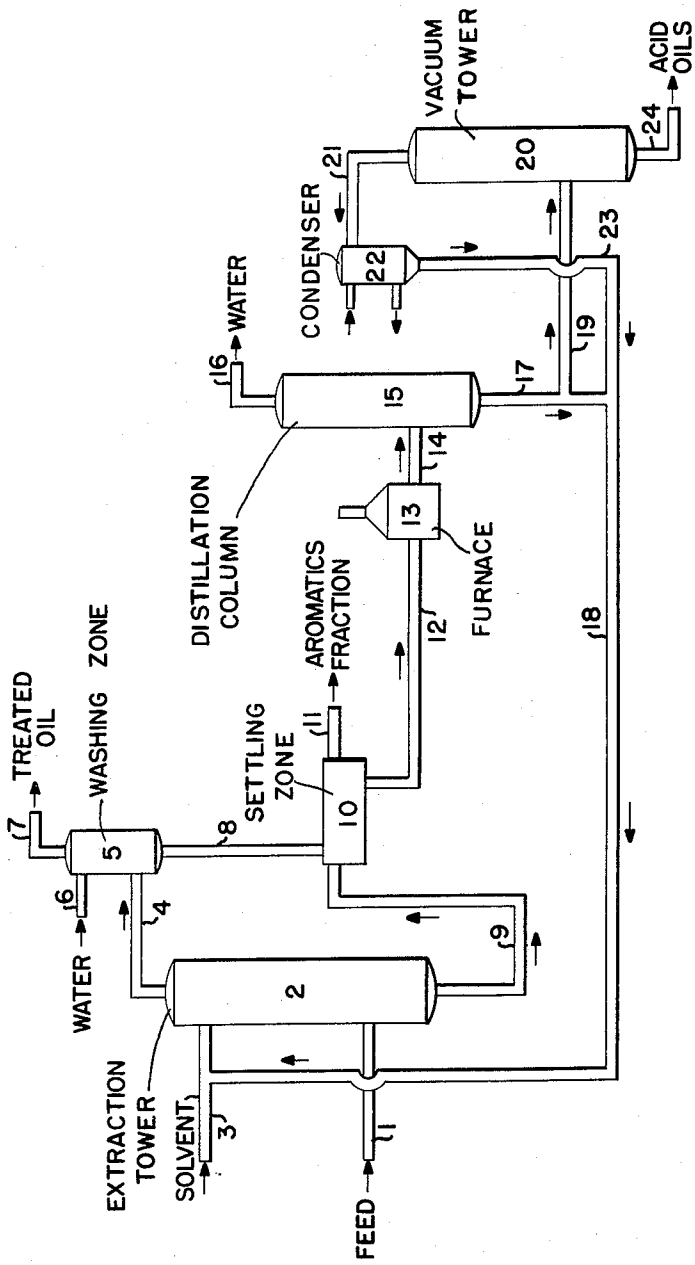
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PROCESS FOR REMOVING ACIDS WITH AN ETHYLENE GLYCOL MONOALKYLAMINE ETHER

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PROCESS FOR REMOVING ACIDS WITH AN ETHYLENE GLYCOL MONOALKYLAMINE ETHER

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The present invention relates to the upgrading of hydrocarbon oils and more particularly relates to an improved solvent extraction process for removing acid oils from petroleum distillates by treating such distillates with ethylene glycol monoalkylamine ethers.

This invention is a continuation-in-part of that described in copending application S.N. 618,793, filed on October 29, 1956.

The removal of acid oils from petroleum distillates has long constituted a serious problem in the refining of hydrocarbon oils. Conventionally these materials, which consist of phenolic compounds such as alkylated phenols, cresols, xylenols, thiophenols and the like and are unrelated to organic and inorganic acids, are removed by caustic treating intended to improve the stability, odor and corrosivity of the distillates. Such processes employing caustic are not entirely satisfactory, however, because of problems in disposing of the resulting spent caustic. Caustic consumed in reactions with acid oils cannot be regenerated by conventional procedures, although mercaptans and other contaminants present in spent caustic can be removed by oxidation or similar treatment. As a result, sodium phenolate, sodium thiophenolate and similar contaminants derived from the reaction of the caustic with acid oils accumulate in the caustic solution until it loses its effectiveness as an extracting agent and tends to form stable emulsions with the oil being treated. At this point it becomes necessary to discard the caustic solution. Because of the voluminous quantities of caustic used for treating stocks containing acid oils and because of the increasing emphasis placed upon preventing stream pollution, disposal of caustic spent in this manner is becoming a serious problem. Much effort has been directed toward the development of caustic regeneration processes which will avoid the necessity for disposing of spent caustic in this manner but to date suitable processes have not been developed.

The present invention provides a new and improved solvent extraction process for the removal of acid oils from petroleum distillates which avoids the use of caustic and the problems arising therefrom. In accordance with the invention, it has been discovered that petroleum distillates substantially free of acid oils and having very low copper numbers and improved odors can be produced by contacting distillates containing acid oils with ethylene glycol monoalkylamine ethers under conditions such that separate extract and raffinate phases are formed and thereafter recovering the hydrocarbons from each phase. It has been found that such treatment, in addition to removing acid oils, also removes sulfur compounds from cracked distillates and takes out small amounts of sludge-inducing nitrogen compounds not removed in conventional solvent extraction processes. The acid oils removed by the ethylene glycol monoalkylamine ethers, unlike those extracted with caustic, may readily be recovered and further processed for use as chemical by-products. The ethylene glycol monoalkylamine ethers have a surprisingly high capacity as solvents and may

be readily regenerated to permit their repeated use. The invention thus provides a new and improved process for the removal of acid oils from petroleum distillates which is considerably more advantageous than processes used heretofore.

The ethylene glycol monoalkylamine ethers which are used for the removal of acid oils from petroleum distillates in accordance with the present invention are those containing from about 3 to about 13 carbon atoms per molecule. These compounds have one terminal hydroxyl group and one terminal amino group and have the following general structural formula:

$$HO—(CH_2—CH_2—O)_x—(CH_2)_y—NH_2$$

where x is a digit from 1 to 4 inclusive and y is a digit from 1 to 5 inclusive. The solvents employed in accordance with the invention thus include both monoethylene glycol monoalkylamine ethers and polyethylene glycol monoalkylamine ethers. Compounds within this group are monoethylene glycol monomethylamine ether, monoethylene glycol monoethylamine ether, monoethylene glycol monopropylamine ether, monoethylene glycol monobutylamine ether, monoethylene glycol monoamylamine ether, diethylene glycol monomethylamine ether, diethylene glycol monoethylamine ether, diethylene glycol monopropylamine ether, diethylene glycol monobutylamine ether, diethylene glycol monoamylamine ether, triethylene glycol monomethylamine ether, triethylene glycol monoethylamine ether, triethylene glycol monopropylamine ether, triethylene glycol monobutylamine ether, triethylene glycol monoamylamine ether, tetraethylene glycol monomethylamine ether, tetraethylene glycol monoethylamine ether, tetraethylene glycol monopropylamine ether, tetraethylene glycol monobutylamine ether and tetraethylene glycol monoamylamine ether. Of these, monoethylene glycol monopropylamine ether, diethylene glycol monopropylamine ether, and triethylene glycol monobutylamine ether have been found particularly effective and are therefore preferred for purposes of the invention.

The ethylene glycol monoalkylamine ethers which constitute the solvents of the invention are not to be confused with glycols which have been employed as solvents in the past. Although low molecular weight glycols such as diethylene glycol can be used for the extraction of aromatic compounds from hydrocarbon oils, such glycols exhibit no selectivity for acid oils and are therefore unsuitable for the purposes for which, in accordance with the invention, the ethylene glycol monoalkylamine ethers have been found effective. It should also be noted that mixtures of glycols and amines suggested as solvents for aromatic hydrocarbons in the past are similarly ineffective for the removal of acid oils from petroleum distillates. Such mixtures lack the selectivity necessary to permit their use for purposes of the invention and in addition are extremely difficult to handle because the amine compound is ether leached from the solvent on contact with the hydrocarbon phase or is lost when it is attempted to recover the solvent. The ethylene glycol monoalkylamine ethers are thus singularly adapted for extracting acid oils from petroleum distillates and possess properties which distinguish them from solvents employed in the past.

The ethylene glycol monoalkylamine ethers used in the process of the invention may be employed in either anhydrous or aqueous form. Aqueous solvents containing from about 1 to 50% water by weight will selectively extract acid oils from the distillates treated without the removal of aromatics to any appreciable extent. If, however, it is desired to remove aromatics as well as acid oils, an anhydrous solvent may be employed, in which case an aromatic extract useful as a solvent base, as a

fuel constituent, or as a starting material in chemicals manufacture can be recovered. In most cases use of the aqueous solvents to permit highly selective extractions of acid oils alone will be preferred.

Ethylene glycol monoalkylamine ethers may be employed in accordance with the invention for removing acid oils from a wide variety of petroleum distillates including naphthas, middle distillates and gas oils boiling up to about 900° F. Such distillates include fractions conventionally employed in the manufacture of gasolines, kerosenes, diesel fuels, turbo-jet engine fuels, heating oils, lubricating oils, transformer oils, hydrocarbon solvents and similar products. The solvents of the invention are especially attractive for the treatment of cracked petroleum distillates, since it has been found that they are effective for the removal of not only acid oils but also sulfur contaminants from such oils. The process thus provides a method for simultaneously sweetening and removing acid oils from cracked distillates.

In carrying out the process of the invention, the oil to be treated and the ethylene glycol monoalkylamine ether are contacted under conditions to form separate raffinate and extract phases. Although it is preferred to carry out this contacting in a countercurrent extraction tower fitted with plates, trays or the like or in one filled with a suitable packing such as Raschig rings or stoneware saddles, other conventional contacting systems are also applicable. In some cases it may, for example, be preferred to carry out the contacting in one or more mixer-settler vessels. The contacting temperature employed in carrying out the process may be varied over a considerable range depending upon whether an aqueous or an anhydrous solvent is employed and further depending upon the extent to which it is desired to extract aromatic hydrocarbons from the feed stream. When aqueous ethylene glycol monoalkylamine ethers are employed and it is desired to effect a highly selective removal of acid oils alone from the distillate being treated, the contacting temperature will preferably fall in the range between about 60° F. and about 150° F. Use of an aqueous solvent at higher temperatures, between about 150° and about 300° F., results in the removal of both acid oils and aromatics. The anhydrous solvents have been found effective between about 60 and 150° F. but may also be used at somewhat higher temperatures. The contacting temperature used will thus normally range between about 60° and about 300° F.

The amount of solvent employed in carrying out the process will generally range between about 0.1 to about 5.0 volumes per volume of oil to be treated. Variations within this range will depend upon the quantity of aromatic extract which it is desired to recover and the extract purity desired. Solvent-to-feed ratios of from about 0.5 to about 2 volumes per volume have been found to be particularly effective and are preferred.

The ethylene glycol monoalkylamine ethers employed as solvents in accordance with the invention may be recovered from the extract and raffinate phases formed in treating petroleum distillates by water washing, fractionation or other methods conventionally employed in solvent extraction processes. It is generally preferred to water wash both phases in order to separate the hydrocarbons from the solvent and then remove the water added by flashing it at a temperature between about 220° F. and about 350° F. At these temperatures the solvents are stable and a highly effective separation can be made. The solvents can be periodically or continuously regenerated by vacuum distillation, providing, of course, that there is a sufficient difference between the boiling point of the ethylene glycol monoalkylamine ether used and the initial or final boiling point of the distillate treated. In order to provide such a difference in boiling points, it is generally preferred to employ the polyethylene glycol monoalkylamine ethers when treating naphthas and to use the monoethylene glycol monoalkylamine ethers for the treating of middle distillates, gas oils and the like. Other methods for removing impurities from the spent solvents, the use of a second solvent to extract impurities from the ethers, for example, may also be used.

The exact nature and objects of the invention can be more clearly understood by referring to the following detailed description of a preferred embodiment of the process and to the accompanying drawing illustrating that preferred embodiment.

Referring to the drawing, a petroleum distillate containing acid oils and boiling in the range between about 100° F. and about 900° F., a cracked gas oil boiling between 450° F. and 620° F. for example, is introduced into the system through line **1** and into extraction tower **2**. Tower **2** is preferably a countercurrent liquid-liquid extraction tower adapted to promote intimate contact between the gas oil feed stream and an anhydrous monoethylene glycol monopropylamine ether stream introduced into the upper portion of the tower through line **3**. It is preferred that the tower be fitted with trays of the type conventionally employed in phenol extraction and similar liquid-liquid extraction processes. The gas oil and monoethylene glycol monopropylamine ether streams are introduced into tower **2** at rates to give a solvent to feed ratio of about 1 to 1. The gas oil and ether streams flow countercurrently to one another within the contacting tower. A raffinate phase consisting essentially of gas oil free of acid oils and having entrained and dissolved therein a small amount of ethylene glycol monopropylamine ether is withdrawn overhead from tower **2** through line **4** and passed into washing zone **5**. A stream of water is introduced into the upper part of the washing zone through line **6** in order to wash solvent from the oil. Essentially solvent-free product oil is withdrawn from the washing zone through line **7**. This stream is free of acid oils, has a substantially better odor than the feed stream, is doctor pass, and contains fewers aromatics than did the gas oil feed. The water used in washing the raffinate is withdrawn from vessel **5** through line **8**.

An extract stream consisting of monoethylene glycol monopropylamine ether containing acid oils, aromatics and other materials extracted from the gas oil feed is withdrawn from contacting zone **2** through line **9** and passed into settling zone **10**. Water and solvent from line **8** are also introduced into the settling zone. Dilution of the extract phase in settling zone **10** by the wash water introduced through line **8** results in a decreased solubility for aromatic hydrocarbons. Separate aromatic and aqueous solvent phases are therefore formed within the settling zone. It is preferred that the amount of wash water employed in vessel **5** constitute about 25% of the volume of the extract phase withdrawn from the contacting vessel **2**. Dilution of the extract phase to this extent will result in the separation of essentially all of the aromatics from the extract. These aromatics are withdrawn from the settling zone through line **11** and may subsequently be employed as a fuel constituent, as a solvent base, as a starting material for the manufacture of chemicals or in other applications. Acid oils present in the extract phase remain in the aqueous solvent and therefore the aromatics withdrawn through line **11** have a substantially better odor than did the feed gas oil. This improvement in odor is of great importance if the aromatics are to be used as a fuel constituent or as a solvent base.

The aqueous monoethylene glycol monopropylamine layer formed in settling zone **10** is withdrawn from the bottom of the zone through line **12** and introduced into the coil of furnace **13** where it is heated to a temperature of about 350° F. The heated solution is then introduced by means of line **14** into atmospheric distillation column **15**. In column **15** water is flashed from the solvent and taken overhead through line **16**. The ethylene glycol monopropylamine, which has a boiling point of about 450° F., is withdrawn from the distillation column in an anhydrous state through line **17**. The

major portion of this anhydrous solvent is recycled through line **18** and reintroduced into contacting zone **2**. In order to maintain the acid oils content of the solvent at an acceptable level, however, a minor proportion of the anhydrous solvent, about 10% for example, is taken off from line **17** through line **19** and introduced at a temperature of about 320° F. into vacuum tower **20**. Tower **20** is operated at a pressure of about 50 mm. of mercury. At this pressure and temperature the monoethylene glycol monopropylamine ether is vaporized and taken overhead through line **21**. The overhead stream is condensed in condenser **22** and the condensate is passed through line **23** into line **18** through which it is recycled. Acid oils are withdrawn from vacuum tower **20** as a bottoms product through line **24**. This stream may be subsequently separated into phenols, thiophenols, cresols, xylenols and the like by known methods and employed for a variety of purposes.

It will be understood that a number of modifications may be made in the process described above without departing from the scope of the present invention. In lieu of using an anhydrous solvent, for example, an aqueous solvent containing from about 1 to about 50% water may be contacted with the feed stream at a temperature of from about 150 to about 300° F. Upon separation of the extract and raffinate phases formed in this contacting step, the extract layer may be cooled to reduce the solubility for aromatics and precipitate an aromatics layer in the settling zone. The solvent freed of aromatics may then be processed in the manner described above in order to separate out the acid oils. By controlling the contacting temperature and water content of the solvent as discussed heretofore, the process may also be carried out so that substantially no aromatic hydrocarbons will be extracted from the distillate treated. Other modifications of the process described above may also be employed and will be obvious to those skilled in the art.

The process of the present invention may be still further illustrated by reference to the following examples.

EXAMPLE 1

A light cracked gas oil boiling between 376 and 638° F. was extracted with anhydrous monoethylene glycol monopropylamine ether in accordance with the invention. Inspections of the gas oil were as follows:

Copper number	9.2
Aromatics, vol. percent	53
Olefins, vol. percent	8
Saturates	39
ASTM Distillation:	
IBP, ° F.	376
5%	440
10%	458
50%	530
90%	606
95%	620
FBP, ° F	638

Contacting of this gas oil with ethylene glycol monopropylamine ether was carried out in a single-stage batch extraction vessel. A 1 to 1 solvent-to-feed ratio was used and the contacting temperature was 80° F. Upon separation of the extract and raffinate phases formed and removal of solvent from these phases, it was found that 9 vol. percent of the feed gas oil had been carried into the extract phase. The raffinate phase, after removal of the solvent, contained 91 vol. percent of the feed and was found to be essentially free of acid oils, pyrrole nitrogen and mercaptan sulfur.

EXAMPLE 2

In order to compare the results obtained in the preceding example with those obtained when conventional solvents are used, an untreated sample of the same gas oil treated in Example 1 was extracted with diethylene glycol. The conditions employed were the same as those in Example 1 except that a solvent-to-oil ratio of 2 to 1 was used. Despite this use of twice as much of the diethylene glycol as of the monoethylene glycol monopropylamine ether, it was found that the diethylene glycol did not extract any more of the aromatics from the feed than did the monoethylene glycol monopropylamine ether. The relative volumes of raffinate and extract recovered were essentially the same as in the former case, 90% and 10% respectively. It thus appears that the monoethylene glycol monopropylamine ether has about the same selectivity for aromatics as does diethylene glycol but that the capacity of the former is nearly twice that of the conventional solvent. This surprisingly high capacity constitutes an important advantage for the monoethylene glycol monopropylamine ether over conventional solvents. In addition, it was found that the acid oils content of the diethylene glycol-treated raffinate was not appreciably changed and that the raffinate was not doctor pass, indicating that diethylene glycol does not possess the selectivity for acid oils and sulfur compounds which distinguishes the solvents of the invention.

EXAMPLE 3

The hydrocarbons recovered from the raffinate phases in the preceding examples and the hydrocarbon phase obtained by caustic washing of a sample of the same gas oil were tested for their copper number, their aromatics content and their odor. The odor test was carried out by a 40 member panel and each sample was given a rating based upon an arbitrary scale. The difference in rating necessary for significance was determined statistically. The results of these tests and similar tests upon the untreated gas oil are shown in the following table.

Table I

IMPROVEMENT COPPER NO. AND ODOR BY TREATMENT WITH SOLVENTS

Samples	Copper No. (Potentiometric)	Aromatics, Vol. Percent	Odor Test		
			Aver. Score	Necessary Difference for Significance [1]	Rating
Diethylene Glycol Treated Oil	6.7	48	−0.36		3rd
Caustic Treated Oil	2	53	+0.08	0.31	1st
Untreated Oil	9.2	53	+0.28		1st
Monoethylene Glycol Monopropylamine Ether, Treated Oil	[2] <0.1	49.5	+0.75		1st
Caustic Treated Oil	2	53	−0.36	0.20	2nd
Untreated Oil	9.2	53	−0.39		2nd

[1] At 95% confidence level.
[2] 0.1 is limit of accuracy of test.

From the above table it can be seen that the hydrocarbons obtained by treatment of a gas oil with monoethylene glycol monopropylamine ether had a copper number of less than 0.1, as compared to a copper number of 6.7 for the diethylene glycol treated sample, a copper number of 2 for the caustic treated sample and a copper number of 9.2 for the original gas oil. This difference in copper number is significant and clearly indicates that the process of the invention results in a product which is much less corrosive than that obtained in conventional extraction processes. The odor test results show that caustic treating and treatment with diethylene glycol produced a product having an odor little or no better than that of the untreated oil. Extraction with the monoethylene glycol monopropylamine ether, however, resulted in an appreciable improvement in odor. Since the aromatics contents of all of the samples were about the same, it is apparent that the odor improvement obtained by use of the solvent of the invention was due primarily to a more complete extraction of acid oils rather than due merely to the removal of aromatic hydrocarbons.

EXAMPLE 4

The extract phase obtained by treating a gas oil boiling between 412° F. and 656° F. with anhydrous monoethylene glycol monopropylamine ether as in Example 1 was diluted with about 25 volume percent water in order to separate out the hydrocarbons contained therein. This hydrocarbon phase was recovered and analyzed. It was found that the hydrocarbons in the extract consisted of about 95% aromatics, were free of thiophenols, and contained only traces of phenols. This fraction is an excellent solvent for DDT and similar materials requiring high aromatic solvents and thus forms an attractive by-product of the process of the invention.

EXAMPLE 5

Samples of a heavy catalytically cracked naphtha boiling between 350° F. and 433° F. were treated with aqueous solutions of diethylene glycol monopropylamine ether containing from 10 to 30% water by weight. Contacting of the solvent solutions and naphtha was carried out in single stage extraction vessels at temperatures of from 80 to 150° F. and with solvent to feed ratios of from 0.25:1 to 1:1. The acid oils contents of the treated samples were then determined by ultra violet absorption and compared with that of the untreated naphtha. Alkylated phenols, cresols, xylenols and the like were reported together as "phenols," while thiophenols were reported separately. A sample treated with diethylene glycol monopropylamine which had been regenerated by vacuum distillation was also tested. The results of these tests are shown in Table II below.

Table II

REMOVAL OF PHENOLS AND THIOPHENOLS FROM NAPHTHA

Treat	Solvent/Feed Ratio	H_2O in Solvent, Wt. Percent	Temp., ° F.	Phenols Content, Wt. Percent	Phenols Reduction, Percent	Thiophenols Content, Wt. Percent	Thiophenols Reduction, Percent
Feed				0.324		0.079	
A	0.25/1	10	80	0.037	89	Nil	100
B	1/1	10	80	0.015	96	Nil	100
C	0.25/1	20	80	0.082	75	Nil	100
D	0.25/1	30	80	0.090	71	Nil	100
E	0.75/1	30	80	0.037	89	Nil	100
F	1/1	30	80	0.030	91	Nil	100
G	0.25/1	30	125	0.104	68	Nil	100
H	0.25/1	30	150	0.120	63	Nil	100
I (Regen. Solvent)	1/1	30	80	0.040	88	Nil	100

From the above table it can be seen that the reduction in phenols, cresols and xylenols, expressed as phenols, ranged between 63 and 96% and that thiophenols were completely removed from the naphtha in every case. The regenerated solvent showed essentially the same affinity for acid oils as did the fresh solvent under the same treating conditions. The data in the table also show that increasing the contacting temperature does not improve the extraction of acid oils from naphtha and instead results in a slightly decreased affinity of the aqueous solvents for acid oils. Increases in temperature do increase the affinity of the solvents for aromatic hydrocarbons. It should be understood, however, that acid oils are extracted by the solvents in preference to aromatics regardless of the conditions employed and that aromatics in the extract can therefore be controlled as desired without affecting the selective removal of acid oils. In single batch treats using a solvent-to-feed ratio of 0.5:1 and a temperature of 80° F. it has been found that the aromatics content of the extract, based upon the feed, will range from about 10 vol. percent when anhydrous diethylene glycol monopropylamine ether is used to about 0.5 vol. percent or less when a solution of diethylene glycol monopropylamine ether containing 30% water by volume is used. The data in Table II also illustrate the effect of solvent-to-feed ratio in using the solvents for the removal of acid oils.

EXAMPLE 6

Samples of two heavy catalytically cracked naphthas were tested to determine their total nitrogen and pyrrole nitrogen contents. Other samples of the same naphthas were then extracted with 50 vol. percent batch treats of aqueous diethylene glycol monopropylamine ether solution containing 30% water by weight and the nitrogen contents of the hydrocarbon phases recovered from the raffinates were determined and compared with those of the untreated naphtha. The results of these determinations are shown in Table III.

Table III

REMOVAL OF NITROGEN FROM NAPHTHA

	Total Nitrogen		Pyrrole Nitrogen	
	Wt. Percent	Percent Reduction	Optical Density [1]	Percent Reduction
Naphtha A	0.023		[2] 0.092	
Treated Naphtha A	0.018	20	0.052	43
Naphtha B			[3] 0.47	
Treated Naphtha B			0.31	34

[1] Light absorption of the color complex formed by pyrrole compounds with p-dimethyl aminobenzaldehyde in phosphoric-acetic acid solution measured at 542 mm. on a Beckman DU-Spectrophotometer.
[2] 100:1 dilution.
[3] 20:1 dilution.

As shown by the above data, the treatment of petroleum distillates with ethylene glycol monoalkylamine

ethers in accordance with the invention removes nitrogen compounds, as well as acid oils, from the distillates treated. This removal of nitrogen compounds is of importance, since it is known that such compounds promote the formation of sludge in gasolines and many other petroleum distillate products.

EXAMPLE 7

A cracked naphtha containing 29 milligrams of mercaptan sulfur per 100 milliliters was treated with a 50 volume percent treat of an aqueous diethylene glycol monopropylamine ether solution containing 30 weight percent water. Analysis of the extract and raffinate phases showed that the raffinate contained only 0.1 milligrams of mercaptan sulfur per 100 milliliters and that the extract contained 62 milligrams per 100 milliliter. The treated distillate was thus considerably better than "Doctor Pass," about 0.5 milligrams per 100 milliliters by the potentiometric copper number method employed. The effectiveness of the solvents for sweetening cracked distillates as well as for removing acid oils from such distillates is thus further demonstrated.

EXAMPLE 8

A spent solution of aqueous diethylene glycol monopropylamine ether was regenerated by vacuum distillation to remove water, acid oils, and high boiling materials accumulated therein as a result of extended use. Comparative inspections of the fresh and regenerated anhydrous diethylene glycol monopropylamine ether are shown in Table IV.

Table IV

INSPECTIONS OF FRESH AND REGENERATED SOLVENT

	No. of NH_2 Groups Per Molecule	R.I.	Sp. Gr. at 77° F.	Mercaptan Sulfur
Fresh Solvent	1.02	1.4653	1.051	Nil
Regenerated Solvent	1.04	1.4662	1.050	0.6

From Table IV it can be seen that the properties of the regenerated solvent were not materially different from those of the fresh diethylene glycol monopropylamine ether. It is shown in Table II that the regenerated solvent showed essentially the same affinity for phenols and thiophenols as did the fresh solvent.

What is claimed is:

1. An improved process for removing acid oils from a petroleum distillate boiling between about 100° F. and about 900° F. which comprises contacting said distillate with an ethylene glycol monoalkylamine ether having the formula

$$HO-(CH_2CH_2O)_x(CH_2)_y-NH_2$$

where x is a digit from 1 to 4 inclusive and y is a digit from 1 to 5 inclusive.

2. A process as defined by claim 1 wherein said ether is a monoethylene glycol monoalkylamine ether.

3. A process as defined by claim 1 wherein said ether is a polyethylene glycol monoalkylamine ether.

4. A process as defined by claim 1 wherein said distillate is contacted with said ether at a temperature in the range of from about 60 to about 300° F.

5. A process as defined by claim 1 wherein said ether is anhydrous.

6. A process as defined by claim 1 wherein said ether contains from about 1 to about 50% water.

7. A process as defined by claim 1 wherein said distillate is contacted with from about 0.1 to about 5 volumes of said ether per volume of distillate.

8. A process as defined by claim 1 wherein said distillate is a cracked distillate.

9. A process as defined by claim 1 wherein said ether is monoethylene glycol monopropylamine ether.

10. A process as defined by claim 1 wherein said ether is diethylene glycol monopropylamine ether.

11. An improved process for removing acid oils from a petroleum distillate boiling between about 100° F. and about 900° F. which comprises contacting said distillate, at a temperature of from about 60 to about 300° F. and under conditions to form separate raffinate phases, with from about 0.1 to about 5 volumes of an ethylene glycol monoalkylamine ether having the formula

$$HO(CH_2CH_2O)_x(CH_2)_yNH_2$$

where x is a digit from 1 to 4 inclusive and y is a digit from 1 to 5 inclusive; separating said phases; recovering a hydrocarbon fraction of substantially reduced acid oils content from said raffinate phase; and recovering acid oils from said extract phase.

12. A process as defined by claim 11 wherein said distillate is contacted with from about 0.5 to about 2 volumes of said ether per volume of distillate.

13. A process as defined by claim 11 wherein said distillate is a cracked distillate.

14. A process as defined by claim 11 wherein said distillate is contacted with said ether at a temperature between about 60° and about 150° F.

15. A process as defined by claim 11 wherein said distillate is contacted with an anhydrous solution of said ether and a highly aromatic hydrocarbon fraction is recovered from the extract phase.

16. A process as defined by claim 11 wherein said distillate is contacted with an aqueous solution of said ether containing from about 1 to about 50% water.

17. A process as defined by claim 11 wherein said ether is monoethylene glycol monopropylamine ether.

18. A process as defined by claim 11 wherein said ether is diethylene glycol monopropylamine ether.

19. A process as defined by claim 11 wherein said ether is triethylene glycol monobutylamine ether.

20. A process for removing acid oils from a cracked petroleum naphtha boiling above about 200° F. which comprises treating the same with an aqueous solution of a polyethylene glycol monoalkylamine ether containing from 7 to 13 carbon atoms per molecule in the absence of substantial quantities of caustic.

21. A process for the removal of alkylated phenols, cresols, xylenols and thiophenols from a cracked petroleum fraction boiling between about 200° F. and about 430° F. which comprises contacting said fraction with an aqueous solution of a polyethylene glycol monoalkylamine ether containing from 7 to 13 carbon atoms per molecule in the absence of substantial quantities of caustic.

22. A process in accordance with claim 21 wherein said aqueous solution contains from 50 to 90% by volume of polyethylene glycol monoalkylamine ether.

23. A process in accordance with claim 22 wherein said polyethylene glycol monoalkylamine ether is diethylene glycol monopropylamine ether.

24. A process in accordance with claim 23 wherein said petroleum fraction boils in the range between about 300° F. and about 430° F.

25. A process for the extraction of acid oils from a cracked petroleum naphtha boiling in the range between about 200° F. and about 430° F. which comprises contacting said naphtha in the absence of substantial quantities of caustic with an aqueous solution of diethylene glycol monopropylamine ether containing from 50 to 90% by volume of said ether under conditions to form an extract phase and a raffinate phase, separating said phases, and recovering substantially acid oils-free naphtha from said raffinate phase.

26. A process in accordance with claim 25 wherein said naphtha fraction is contacted with said aqueous solution

at a tempearture in the range between about 60° F. and about 150° F.

27. A process in accordance with claim 26 wherein said naphtha fraction is a catalytically cracked fraction boiling in the range between about 300° F. and about 430° F.

28. A process in accordance with claim 27 wherein said naphtha fraction is contacted with from about ¼ to about 1 volume of said aqueous solution per volume of naphtha.

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