Patented Aug. 26, 1941

2,253,638

UNITED STATES PATENT OFFICE

2,253,638

TREATING MOTOR FUELS

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No Drawing. Application December 15, 1939, Serial No. 309,347

5 Claims. (Cl. 196—32)

This invention relates to the treatment of hydrocarbon liquids and particularly to the removal of mercaptans from petroleum distillates containing the same in solution.

Petroleum distillates, especially distillates within the gasoline boiling range, obtained by straight distillation or by cracking are not usually suitable for use as motor fuels without purification. Among the undesirable substances present in petroleum distillates are sulfur and its derivatives. Sulfur occurs in petroleum distillates in many different forms, a small proportion occurring in the elemental state, and a comparatively large proportion occurring as hydrogen sulfide, and in the form of organic derivatives of sulfur. The latter are of two types, acidic and neutral. The acidic type includes mercaptans which, together with hydrogen sulfide, are responsible for the unpleasant odor of unrefined petroleum distillates of the gasoline boiling range.

The malodor of unrefined distillates can be removed by the so-called doctor sweetening in which the distillates are treated with a sodium plumbite solution to convert the mercaptans to lead mercaptides, and the latter subsequently oxidized to disulfides by the addition of sulfur. While this method is effective in producing a "sweet" distillate it has the disadvantage of reducing the knock rating of the motor fuel as well as its so-called "lead susceptibility" or response to the addition of lead tetraethyl.

It is therefore an object of the present invention to provide an improved method of removing acidic organic compounds such as mercaptans from petroleum distillates. Another object of the invention is to provide an improved method of removing mercaptans and other acidic organic substances from petroleum distillates without decreasing the knock rating of such distillates. A further object of the invention is to provide an improved method of sweetening petroleum distillates without affecting the lead susceptibility of the distillates toward lead tetraethyl. Other objects and advantages of the invention will become apparent as the description thereof proceeds.

I have discovered that the foreging objects can be attained by treating motor fuel distillates containing mercaptans with an aqueous caustic solution containing urea, or a substituted urea, and preferably a saturated solution of an urea in a 10% (by weight) aqueous solution of sodium or potassium hydroxide. Specific examples of ureas we may employ are: urea, butyl urea, diactyl urea, diethyl diphenyl urea, phenyl urea, mono-o-tolyl urea, diamyl urea, triethyl urea, tetra propyl urea and other symmetrical and unsymmetrical substituted ureas. The concentration of the aqueous caustic alkali may vary within wide limits. However, I prefer to use solutions which are above about 2 normal and preferably between 4 and 10 normal. Although it is preferred to use a saturated solution of the urea, concentrations of from about 1 gram per liter to about 1,000 grams per liter may be employed.

The amount of aqueous alkali solution employed in the extraction is preferably above about 5% by volume and preferably from about 10% to about 60% by volume. It is possible to employ 100% by volume of the aqueous solution, but economically this is not desirable.

Removal of the mercaptans from the petroleum distillates may be carried out by mixing the distillate with a predetermined amount of the aqueous caustic alkali solution containing the urea and separating the aqueous layer containing the removed mercaptans from the upper oily layer which is substantially free of the undesirable sulfur compounds. The treatment may be carried out at temperatures between about 32° F. and about 140° F. although it is preferred to use treating temperatures of from about 60° F. to about 80° F. If the desired reduction in mercaptan content is not obtained by a single extraction, additional improvement may be obtained by extraction in a multi-stage extraction system.

The following test illustrates the effectiveness of my invention in removing mercaptans from a petroleum distillate containing the same. In all of the tests the petroleum distillates were extracted once with saturated solutions of urea in 10% (by weight) aqueous sodium and potassium hydroxide solutions at a temperature of about 80° F. Volume ratios of about five parts of petroleum distillate to about one part of the alkali solutions were employed. The results obtained are summarized in the following table:

Alkali	Alkali conc.	Urea conc.	Mercaptans before ext.	Mercaptans after ext.	Mercaptans removed
	Grs./liter	*Grs./liter*			*Percent*
NaOH	111	0	100	57	43
KOH	109	0	114	56.5	43.5
NaOH	111	500	114	36.5	63.5
KOH	109	500	114	36	64
NaOH	111	1000	114	23	77
KOH	109	1000	100	21	79

The effectiveness of the presence of urea in aqueous alkali solutions in removing mercaptans from petroleum distillates is strikingly demonstrated by the above data.

While I have employed strong bases such as aqueous solutions of sodium and potassium hydroxide various other bases may be used, such as ammonia, the alkaline earth hydroxides, the alkali metal carbonates and others.

The mercaptans extracted from the petroleum distillate by the aqueous caustic solutions may be recovered from the spent caustic by heating the same to its boiling point and blowing with steam. The mixture of steam and mercaptans is condensed and the layers of mercaptans and water separated.

The herein described method is not necessarily limited to the removal of mercaptans from petroleum distillates. It is equally adaptable to the removal of other organic relatively weak acid reacting substances such as phenols, thiophenols, fatty acids and the like from weakly basic or neutral organic liquids which are immiscible with water.

Having fully described my invention what I claim as new and desire to secure by Letters Patent is:

1. The method of removing acid reacting materials from a hydrocarbon liquid containing the same, comprising treating the liquid with an aqueous solution of a strong base containing a substantial amount of an urea dissolved therein under conditions conducive to the extraction of the acid reacting materials from the hydrocarbon liquid, and separating the aqueous solution containing the extracted acid reacting materials from the hydrocarbon liquid substantially free of the undesired acid reacting materials.

2. The method described in claim 1 in which the aqueous solution is a 2 to 10 normal alkali metal hydroxide solution.

3. The method of removing mercaptans from a hydrocarbon distillate containing the same, comprising contacting the hydrocarbon distillate with an aqueous solution of a strong base containing a substantial amount of an urea, separating the mixture into an upper layer comprising substantially the hydrocarbon distillate substantially free of mercaptans and a lower aqueous solution containing dissolved therein the undesired mercaptans.

4. The method of removing mercaptans from a hydrocarbon motor fuel distillate comprising extracting the distillate with about a 10% to about a 50% by volume of an aqueous solution of about 2 to about 10 normal alkali metal hydroxide saturated with urea, under conditions to form two layers, an upper layer comprising the hydrocarbon motor fuel distillate substantially free of mercaptans and a lower aqueous layer containing the undesired mercaptans.

5. The method of preparing a substantially sweet motor fuel distillate comprising extracting a sour motor fuel distillate with a saturated solution of urea in a 10% by weight aqueous solution of an alkali metal hydroxide at a temperature from about 60° F. to about 80° F. and subsequently removing the motor fuel distillate substantially free of mercaptans from the aqueous solution of alkali metal hydroxides saturated with urea and containing a substantial amount of the undesired mercaptans.

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