PROCESS OF PURIFYING HYDROCARBON OILS

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FIG. 1

FIG. 2

FIG. 3

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This invention relates to improvements in the purification of hydrocarbon oils, and more particularly to the removal of sulfur or sulfur-containing compounds from natural or first-run naphtha.

The process of the present invention in a preferred form comprises the treatment of corrosive naphtha with caustic alkali that has taken up certain constituents of cracked hydrocarbon distillates. This material I shall refer to as spent caustic. The principal source of supply at this time is the absorption plants utilized for the treatment of gases from the stills in which pressure distillate is being run. In these plants the gases are passed in contact with an absorption oil. The gasoline constituents carried by the gas are absorbed by the oil. The gasoline is removed by steam distillation and is purified by treatment with caustic alkali. The contaminating alkali or spent caustic resulting from this process is the preferred treating agent employed according to our invention.

Spent caustic of similar characteristics may be obtained from other sources. For example, the gases from pressure stills may be passed into contact with the caustic. Gases given off from crude stills during the cracking period ordinarily contain a substantial amount of the desired constituents which may be fixed by alkali. It may be said in general that gases from cracking stills or coils yield such constituents, and that alkali extracts of crude naphtha distillates produced by pressure cracking processes, or analogous materials, yield spent caustic suitable for our purposes.

We have found that spent caustic operates very effectively in the elimination of difficult removable sulfur, sulfur-containing compounds, or other corrosive ingredients. Naphtha from certain crudes will not pass the standard corrosion tests, even after washing with alkali or treatment with doctor solution (sodium plumbite). Acid treatment and re-distillation (distillation with steam) are required in such cases. By the use of spent caustic we obtain an important technical advantage in avoiding the delay and losses incident to these operations.

It is probable that the effectiveness of the spent caustic is due to its content of sulfur compounds, the nature of which is at present obscure. In any event, the spent caustic has the property of freeing naphtha from the detrimental corrosive constituents, which we shall refer to generally as corrosive sulfur. Washing with water removes residual spent caustic.

It is usually necessary to sweeten the distillate that has been treated with the spent caustic, but in some cases this step may be omitted. The sweetening may be accomplished by the use of doctor solution in the ordinary way.

We have found that pressure still naphtha will itself suffice as an agent for putting the naphtha containing corrosive sulfur into condition to respond to sweetening. However, the pressure still naphtha would remain in the finished stock, giving it an objectionable odor. The alkali extract of pressure still naphtha or the like is more efficient than the naphtha itself and imparts no odor to the finished oil.

The naphtha and spent alkali should be brought into very thorough admixture if best results are to be secured. We have found that an elongated mixer of the type described below is well suited for this purpose. As a general rule, the lower the specific gravity of the distillate to be treated, the more thoroughly the alkali solution and the distillate must be mixed and the longer the contact between them must be maintained.

A particularly advantageous apparatus for use in carrying out our process is illustrated in the accompanying drawing, in which Fig. 1 is a diagram of a preferred arrangement of apparatus for carrying out one form of the process; Fig. 2 is a vertical section through a portion of the elongated mixing tube; and Fig. 3 is a transverse section on line III—III of Fig. 2.

Referring to the drawing, reference numerals 1 and 2 denote respectively a tank for receiving oil to be purified and a receptacle for the treating agent. Tank 1 is connected through line 3 with a mixer 4, comprising an elongated chamber or passageway. The receptacle 2 connects with the mixer 4 through line 5. Pumps 6 and 7 may be installed in the lines 3 and 5. A discharge line 8 leads from the mixer to a settling drum 9. A line 10 connects this drum with a continuous treating plant or other suitable means for a final treatment of the naphtha, when such final treatment is required. A draw-off line 11 is connected near the bottom of the drum and may lead back to the receptacle 2, if it is desired to recirculate the treating agent.
Referring more particularly to Figs. 2 and 3, the mixer 4 is subdivided internally by partitions 12 fitted with a short, centrally mounted pipe or nipple 13, provided with perforations 13a. The course of the liquid to be purified and the treating agent through the mixer follows more or less the flow lines shown in Fig. 2. Very thorough admixture is obtained by the successive commingling of the liquids as they pass through the several perforated pipes 13. We have found it desirable in some cases to use a mixer of relatively great length, for instance from about 100 ft. to about 500 ft. or more. The diameter of the mixer may be small, say about 12 inches, but larger or smaller mixers may be used. Suitable valves and other connections may be arranged so as to enable any part of the mixer to be used alone.

From the drum 9 the purified naphtha and the spent caustic solution are drawn off through lines 10 and 11, previously referred to. The spent alkali solution may usually be circulated through the system a number of times. Dilution of the alkali may be avoided by drawing the naphtha from the storage tank at a point considerably above the bottom so as to prevent taking off water that may accumulate in the bottom of the tank.

The use of an exceptionally long mixer, of the type described, is advantageous in a number of refinery operations other than that particularly described above. For example, a better grade of kerosene may be obtained by passing the kerosene together with a caustic solution through the mixer. This insures substantially complete neutralization and the removal of all traces of acid and sludge.

Various changes and alternative arrangements may be made in the preferred embodiments of the invention described above, within the scope of the appended claims, in which it is our intention to claim all novelty inherent in the invention as broadly as the prior art permits.

We claim:
1. Process of purifying an uncracked light hydrocarbon distillate containing difficulty removable corrosive sulfur, comprising bringing the distillate into intimate contact with spent alkali from the treatment of a light fraction obtained by cracking petroleum hydrocarbons.
2. Process of treating an uncracked naphtha containing difficulty removable corrosive sulfur, comprising bringing the naphtha into intimate contact with spent caustic prepared by the alkali treatment of naphtha obtained from gas produced in the distillation of oils under pressure.

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