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GASOLINE COMPOSITION

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ABSTRACT OF THE DISCLOSURE

A motor fuel comprising 1–40 volume percent oxylate and 99–60 volume percent alkylate.

The oxylate consists of tertiary butyl alcohol, isopropyl alcohol, and methyl alcohol. Preferred composition for the oxylate is about 20–90 volume percent tertiary butyl alcohol, 5–40 volume percent isopropyl alcohol, and 5–40 volume percent methyl alcohol.

The alkylate used in the motor fuel composition can be obtained, for example, from sulfuric or hydrofluoric acid alkylation. The oxylate improves the octane of the alkylate gasoline more than expected, and also the oxylate has an unexpectedly high blending octane number in the alkylate over a wide range of percentage amounts of oxylate in the alkylate.

BACKGROUND OF THE INVENTION

The present invention relates to a motor fuel composition comprising hydrocarbons and alcohols. The motor fuel is particularly intended for use in automobiles, but can be used in other engines such as boat engines and aircraft engines. The motor fuel composition of the present invention comprises gasoline which, as is well known, is essentially a hydrocarbon mixture having suitable volatility for operating internal combustion engines with spark ignition. The motor fuel composition can contain other additive per gallon of motor fuel) of lead additive. inhibitors, antioxidants, rust preventatives, and the like. The motor fuel can also contain lead additives. However, one of the advantages of the composition of the present invention is that it provides a relatively high-octane gasoline without the use of lead additives, or with the use of only a relatively small amount (e.g. 1.5 cc. alkyl lead additive per gallon of motor fuel) of lead additive.

The use of alcohols in gasoline-boiling-range hydrocarbons has been suggested in a number of patents.

For example, U.S. Pat. 1,839,362 and U.S. Pat. 2,596,198 suggest the use of methyl alcohol in gasoline.

U.S. Pat. 2,662,817 and U.S. Pat. 2,726,942 disclose the use of methyl alcohol and isopropyl alcohol in gasoline.

U.S. Pat. 2,850,368 discloses the use of isopropyl alcohol and secondary butyl alcohol in gasoline. U.S. Pat. 2,197,378 discloses the use of isopropyl alcohol and n-butyl alcohol in gasoline.

U.S. Pats. 2,365,009, 2,404,094 and 2,408,999 all disclose the use of methyl alcohol, isopropyl alcohol, and tertiary butyl alcohol, amongst a wide range of other possible alcohols, for use in gasoline. The latter three patents are directed to major amounts of alcohol containing a minor or small amount of hydrocarbon component; for example, 95 to 90 volume percent alcohol component with only 5 to 10 volume percent hydrocarbon component.

In addition to the above patents concerned primarily with alcohol-gasoline compositions, there are a number of patents directed to other additives for gasoline. For example, U.S. Pat. 3,083,087 is directed to use of benzyl esters in gasoline; U.S. Pat. 2,874,033 is directed to the use of isopropyl ether plus isopropyl alcohol in gasoline; and

U.S. Pat. 1,399,227 is directed to the use of acetone in gasoline.

U.S. Pat. 3,482,952 is directed to a process for the production of gasoline wherein ether-hydrocarbon gasoline is produced. According to a preferred embodiment of U.S. Pat. 3,482,952 a portion of the hydrocarbon in the ether-hydrocarbon can be alkylate.

SUMMARY OF THE INVENTION

The composition of matter of the present invention is a motor fuel comprising 1–40 volume percent oxylate and 99–60 volume percent alkylate.

The term "oxylate" is used to mean a mixture of tertiary butyl alcohol, isopropyl alcohol, and methyl alcohol.

TABLE I

Component	Broad range, vol. percent	Preferred range, vol. percent	Most preferred range, vol. percent
t-Butyl alcohol	2–90	20–90	40–60
Isopropyl alcohol	2–50	5–40	20–30
Methyl alcohol	2–50	5–40	20–30

The present invention is based upon a number of features. The following features of the present invention can be mentioned.

We have found that the oxylate gives an unexpectedly high blending octane number in alkylate, particularly when compared to the blending octane number for the oxylate in full-boiling-range gasoline stocks; that is, gasoline stocks which tend to boil over a wider boiling range than does alkylate. Alkylate usually boils between about pentane and 370° F.; and about 90 volume percent of a typical alkylate product boils below about 250° F. Full-boiling-range gasoline stocks usually boil between about butane and 430° F.; and the 90 volume percent point for full-boiling-range gasoline stocks is generally considerably above 250° F., for example about 340° F.

For about 5–40 percent oxylate in alkylate, we have found the blending octane number to be about 125, contrasted to a blending octane number of about 110 for oxylate in full-boiling-range gasoline stocks. This incremental amount for the blending octane number of oxylate is alkylate compared to oxylate in full-boiling-range gasoline stocks is not expected; thus, oxylate plus alkylate is a synergistic combination.

Furthermore, as described in more detail in the example below, we have found that even when the percentage amount of oxylate in the alkylate is increased from a few percent up to as high as 20 or 40 percent, the blending octane number for the oxylate stays nearly constant at about 125 instead of decreasing as the percentage amount of oxylate in the motor fuel is increased. Typically, when increasing amounts of an octane appreciator are added to a gasoline stock, the blending octane number progressively decreases for the additive. Thus, in our concurrently filed application entitled "Motor Fuel Composition," the drawing shows a marked decrease for the blending octane number of oxylate (as well as the three individual constituents which make up oxylate) for progressively increasing amounts of the oxylate or any of the individual constituents of oxylate in a typical gasoline stock. Thus, the present invention is based on the further finding that oxylate in alkylate results in an unexpectedly constant high blending octane number for the oxylate with progressively increasing percentage amounts of oxylate in the alkylate.

In addition to the synergistic result obtained by adding the oxylate composition to the alkylate in accordance with the present invention, a third feature of the present invention is that the oxylate is of sufficiently high octane number that it can be used to increase the octane number of alkyalte in much the same way that lead additives and/

or aromatics are used. Thus, oxylate can be used to reduce the concentration of lead additives and/or aromatics in alkylate without sacrificing octane number.

A fourth particular feature of the present invention which can be mentioned is that the oxylate composition used has a relatively high solubility in alkylate and is not extracted from alkylate as easily as methanol or ethanol if the hydrocarbonoxylate mixture comes in contact with water.

A fifth feature of the present invention, which is very important is that we have devised a particularly advantageous process for manufacturing the oxylate for use in gasoline. Instead of starting with feedstocks such as olefins to obtain alcohols, we start with isobutane feedstock, which is present in many refineries in excess amounts, particularly refineries wherein hydrocracking is carried out to produce gasoline-boiling-range hydrocarbons. In our preferred process the isobutane is oxidized to form tertiary butyl alcohol and acetone plus small amounts of methanol and esters. This process is described in more detail in our concurrently filed application entitled "Gasoline Production," U.S. application Ser. No. 163,518, filed June 17, 1971, the disclosure of which application is incorporated by reference into the present application. The effluent from the oxidation step is hydrogenated to obtain an oxylate mixture comprising t-butyl alcohol, isopropyl alcohol, and methyl alcohol.

Thus, with respect to this fifth feature, it can be said in summary that we have devised and developed a process to make large amounts of oxylate in a refinery at relatively low cost for use in a gasoline composition.

The alkylate used in the motor fuel composition of the present invention is obtained by reacting an isoparaffin with an olefin. Preferably at least 90 volume percent of the alkylate product which is blended with the oxylate boils below 300° F., as determined by an ASTM distillation method typically applied to hydrocarbons boiling in the pentane-to-400° F. range. More preferably in the composition of the present invention, at least 90 volume percent of the alkylate boils below 250° F. The initial point of the alkylate is coincident approximately with the boiling point of pentanes, but usually there will be at least a small amount of butanes in the alkylate, such as 5 to 15% butanes. Suitable alkylation processes include cascade sulfuric acid alkylation, DIP alkylation, effluent refrigeration alkylation and HF alkylation processes, such as described in Hydrocarbon Processing, September 1968, pages 164–168. Preferably the alkylate is produced by a sulfuric acid alkylation process.

EXAMPLE

Table II below tabulates data comparing the blending octane number (BON) of oxylate in alkylate to the blending octane number of oxylate in full-boiling-range gasoline.

TABLE II

	BON of oxylate in—	
	Alkylate [1]	Full-boiling-range gasoline [2]
Percent oxylate:		
10	125	110
20	123	105
40	124	100

[1] 90% pt. (ASTM D-86)=238° F.; RON=95.0.
[2] 90% pt. (ASTM D-86)=338° F.; RON=89.5.

To obtain the data for Table II, mixtures of base gasolines and oxylate were prepared and the research octane numbers (RON) (unleaded) of the bases and the mixtures determined. The BON's were calculated with the following formula:

$$BON_{oxy}=\frac{O_F-X_B(O_B)}{X_{oxy}}$$

X_B=Vol. fract. of base
O_B=Octane of base
X_{oxy}=Vol. fract. of oxylate
O_F=RON of blend

Although various embodiments of the invention have been described, it is to be understood that they are meant to be illustrative only and not limiting. Certain features may be changed without departing from the spirit or scope of the present invention. It is apparent that the present invention has broad application to motor fuel compositions containing oxylate in alkylate. Accordingly, the invention is not to be construed as limited to the specific embodiments or examples discussed but only as defined in the appended claims or substantial equivalents of the claims.

What is claimed is:

1. A motor fuel comprising 1 to 40 volume percent oxylate and 99 to 60 percent alkylate, said oxylate containing an amount of t-butyl alcohol in the range from 2 to 90 volume percent, an amount of isopropyl alcohol in the range from 2 to 50 volume percent, and an amount of methyl alcohol in the range from 2 to 50 volume percent; and said alkylate being an olefin-isoparaffin alkylate which boils in the range between about the boiling point of pentane and 370° F.

2. A motor fuel in accordance with Claim 1 wherein the oxylate contains 20 to 90 volume percent tertiary butyl alcohol, 5 to 40 volume percent isopropyl alcohol, and 5 to 40 volume percent methyl alcohol.

3. A motor fuel in accordance with Claim 1 wherein the oxylate contains about 40 to 60 volume percent tertiary butyl alcohol, about 20 to 30 volume percent isopropyl alcohol, and about 20 to 30 volume percent methyl alcohol.

4. A motor fuel in accordance with Claim 1 wherein at least about 90 volume percent of the alkylate boils below 250° F.

5. A motor fuel in accordance with Claim 1 wherein the oxylate is prepared at least in part by a process which comprises oxidizing isobutane to obtain tertiary butyl alcohol, acetone and methyl alcohol, and then hydrogenating the effluent from the oxidation step to obtain a mixture comprising tertiary butyl alcohol, isopropyl alcohol, and methyl alcohol.

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