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3,109,719

ANTI-STALLING MOTOR FUEL

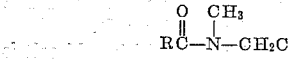
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10 Claims. (Cl. 44—66)

This invention relates to a volatile gasoline composition of improved anti-stalling properties containing a salt of an aliphatic primary amine and an N-acyl sarcosine. More particularly, it involves the discovery that specific primary amine-N-acyl sarcosine salts are effective anti-stalling, anti-icing gasoline additives.

In a commonly assigned, copending application Serial No. 811,535, filed May 7, 1959, now U.S. Patent No. 3,055,746, it is disclosed that salts of hydrocarbyl monocarboxylic acids and aliphatic primary amines of prescribed chain length are effective anti-stalling, anti-icing additives for gasoline. In another commonly assigned, copending application Serial No. 68,626, filed November 14, 1960, it is disclosed that amine salts of specific ether acids, namely, aryloxy substituted aliphatic monocarboxylic acids are effective anti-stalling, anti-icing gasoline additives. The subject invention involves the discovery that specific salts of aliphatic primary amines and N-acyl sarcosines impart anti-stalling properties to volatile gasolines.

The gasoline fuel composition of this invention comprises a substantial concentration of volatile components and 0.001 to 0.1 weight percent of an aliphatic primary amine-N-acyl sarcosine salt having the general formula



wherein R is an aliphatic hydrocarbyl radical containing 6–22 carbon atoms and R′ is an aliphatic hydrocarbyl radical containing 2–16 carbon atoms. The presence of the amine-acyl sarcosine salt in prescribed concentration imparts outstanding anti-icing and anti-stalling properties to volatile gasoline compositions.

When internal combustion engines are operated on a gasoline fuel having the desired volatility characteristics for cold weather driving, a stalling problem is encountered during the warm up period, particularly under cool, humid atmospheric conditions. It has been generally recognized that the cause of repeated engine stalling in cool, humid weather is the formation of ice in the carburetor. Gasoline evaporating in the carburetor has a sufficient refrigerating effect to condense and freeze moisture present in the air. Ice particles deposit on the metal surfaces of the carburetor and partially or completely block the air passage between the carburetor throat and the carburetor throttle valve with resulting stalling, particularly when the engine is idling.

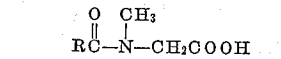
The amine-acyl sarcosine salts of this invention are particularly useful in highly volatile fuels having a Reid vapor pressure above about 9 which are particularly prone to engine stalling due to ice formation under cool, humid conditions. Stated another way, the additives of the invention are particularly useful in winter gasoline employed in northern portions of the country since they have Reid vapor pressures between about 9 and 13.5, depending on the area.

The amine-acyl sarcosine salts employed as anti-stalling gasoline additives are usually solids and are simply prepared by mixing equimolar portions of a C_2–C_{16} aliphatic primary amine with an N-acyl sarcosine. The resulting salts are stable and gasoline-soluble.

Since salts formed with aliphatic primary amines containing more than 16 carbon atoms are ineffective anti-

stalling additives, it is necessary for the aliphatic hydrocarbyl primary amine to contain a maximum of 16 carbon atoms. Examples of amines used in forming effective amine N-acyl sarcosine salts are ethylamine, isopropylamine, n-butylamine, 2-ethylhexylamine, t-octylamine, laurylamine, n-decylamine, isononylamine and a mixture of tertiary alkyl primary amines containing 11–14 carbon atoms sold under the tradename Primene 81R. The effective amines are represented by the general formula $R'NH_2$ in which R′ is an aliphatic hydrocarbyl radical containing 2–16 carbon atoms.

The N-acyl sarcosine employed in preparing the effective anti-stalling gasoline additives are represented by the formula



wherein R is an aliphatic hydrocarbyl radical containing 6–22 carbon atoms and preferably 10–20 carbon atoms. Examples of acyl sarcosines used in preparing the amine salts are the following: N-lauroyl sarcosine, N-oleoyl sarcosine, N-myristoyl sarcosine, N-stearoyl sarcosine, N-2-ethylhexanoyl sarcosine, N-decanoyl sarcosine and N-cocoyl sarcosine wherein cocoyl denotes the mixture of fatty acids derived from coconut oil comprising mainly lauric, myristic, palmitic and capric acids.

The amine-N-acyl sarcosine salts effective as anti-stalling and anti-icing additives in volatile gasolines are exemplified by the following: the n-butylamine salt of lauroyl sarcosine, t-octylamine salt of lauroyl sarcosine, t-C_{11}–C_{14} alkylamine salt of lauroyl sarcosine, n-butylamine of oleoyl sarcosine, t-octylamine salt of oleoyl sarcosine, t-C_{11}–C_{14} alkylamine salt of oleoyl sarcosine, isononylamine salt of myristoyl sarcosine and t-octylamine salt of cocoyl sarcosine.

The amine-N-acyl sarcosine salts having the prescribed formula are effective anti-stalling additives when employed in concentrations of 0.001 to 0.1 weight percent of the gasoline. The preferred salt concentration falls in the range of 0.001 to 0.02 weight percent. Concentrations of the order of 4–32 pounds of amine-N-acyl sarcosine salt per thousand barrels of gasoline equivalent to concentrations of 0.0015 to 0.012 weight percent have proven particularly effective in forming fuels of excellent anti-stalling properties.

The action of the amine-N-acyl sarcosines as anti-stalling, anti-icing additives was evaluated in carburetor icing demonstrator apparatus consisting of a vacuum pump equipped so that cooled, moisture-saturated air from an ice "tower" is drawn through a simple glass tube gasoline carburetor. The gasoline sample is placed in a sample bottle and is drawn into the glass carburetor through a hypodermic needle which is usually 20 gauge. Evaporation of the gasoline in the glass tube further cools the cold, moist air with resulting ice formation on the throttle plate. The formation of ice on the throttle plate causes an engine to stall and it has been found that this condition is equivalent to a pressure drop across the throttle plate of about 0.5 inch of mercury, and the time to reach this pressure drop is recorded. The vacuum pump is adjusted to give a vacuum of 1.8 inches mercury and the test is run until a pressure of 2.3 inches mercury has been reached or is run for 300 seconds. Since with most fuels this pressure drop is reached in 1–4 minutes, 300 seconds is the maximum time for a run. A recording of 300 seconds indicates no stall within the test period. Each fuel is run four times in succession and the average is reported. If the differences between runs are great, the glass tube carburetor and test throttle are washed with alcohol and the runs repeated. A leaded winter grade premium gasoline having a Reid vapor pressure of about

13 gives a stall in about 45–65 seconds in this test. Additives which raise the stalling time to over 150 seconds and preferably over 200 seconds are regarded as effective anti-stalling, anti-icing additives.

The base fuel employed to evaluate the effectiveness of amine-N-acyl sarcosine salts as anti-stalling, anti-icing additives was a winter grade premium gasoline having an octane rating of about 100 and containing 3 cc. of TEL per gallon. The base fuel which had a 50% ASTM distillation point of 210 and a Reid vapor pressure of about 13 pounds was ideally suited for testing the effect of additives on the stalling characteristics of the fuel because of its high vapor pressure. This base fuel had an average stalling time of 60 seconds in the afore-described stalling test.

In the above-described test, aliphatic primary amines containing 2–16 carbon atoms were ineffective in improving the anti-stalling, anti-icing properties of the base fuel. For example, the addition of 16 pounds per thousand barrels (0.006 weight percent) of a t-C_{11}–C_{14} alkyl primary amine mixture (Primene 81R) gave a gasoline having an average stalling time of about 61 seconds, essentially the same value obtained with a base fuel. The addition of N-acyl sarcosines to the above base fuel resulted in a minor improvement in the anti-stalling properties of the base fuel. For example, the addition of 16 pounds per thousand barrels (0.006 weight percent) of N-lauroyl sarcosine and of N-cocoyl sarcosine to the above base fuel gave gasolines having average stalling times of 122 and 90 seconds respectively.

In the following table there is shown the effectiveness of amine-N-acyl sarcosine salts of prescribed formula as anti-stalling, anti-icing additives.

Action of Amine-N-Acyl Sarcosine Salts as Anti-Icing Additives

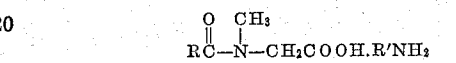
Amine salts	Concentration, wt. percent	Stalling time, seconds
n-butylamine-lauroyl sarcosine	0.003	219
Do	0.006	300
t-octylamine-lauroyl sarcosine	0.003	220
Do	0.006	300
Primene 81R-lauroyl sarcosine	0.006	245
t-octylamine-cocoyl sarcosine	0.003	300
Do	0.006	300
n-butylamine-oleoyl sarcosine	0.006	281
t-octylamine-oleoyl sarcosine	0.006	261
Primene 81R-oleoyl sarcosine	0.006	276
Primene JMT-lauroyl sarcosine	0.003	67
Do	0.006	65
Primene JMT-oleoyl sarcosine	0.003	69
Do	0.006	79

The data in the foregoing table show the outstanding effectiveness of amine-N-acyl sarcosine salts of prescribed formula as anti-stalling, anti-icing gasoline additives. The data also clearly prove the highly specific action of amine-acyl sarcosine salts as anti-stalling gasoline additives. The sudden and dramatic decrease in effectiveness when a primary amine containing a mixture of t-C_{18}–C_{24} alkyl amines is used in place of a similar amine containing a mixture of C_{11}–C_{14} alkyl amines is particularly surprising and unexpected. The salts of N-acyl sarcosines and amines containing more than 16 carbon atoms do not enhance the anti-stalling properties of gasoline and actually produce fuels inferior in anti-stalling properties to gasolines containing the N-acyl sarcosines alone which have average stalling times in the neighborhood of 90–120.

In addition to the above demonstrated anti-icing property of the prescribed amine-N-acyl sarcosine salts, these salts are also helpful in improving the anti-corrosive properties of the gasoline fuel.

I claim:

1. A gasoline containing 0.001 to 0.1 weight percent of an amine-N-acyl sarcosine salt having the general formula



wherein R is an aliphatic hydrocarbyl radical containing 6–22 carbon atoms and R′ is an aliphatic hydrocarbyl radical containing 2–16 carbon atoms, said salt imparting improved anti-stalling, anti-icing properties to said gasoline.

2. A gasoline according to claim 1 having a Reid vapor pressure above about 9.

3. A gasoline according to claim 1 in which said salt is present in a concentration between 0.001 and 0.02 weight percent.

4. A gasoline according to claim 1 in which said salt is n-butylamine-lauroyl sarcosine salt.

5. A gasoline according to claim 1 in which said salt is a t-octylamine-lauroyl sarcosine salt.

6. A gasoline according to claim 1 in which said salt is a t-C_{11}–C_{14} alkylamine-lauroyl sarcosine salt.

7. A gasoline according to claim 1 in which said salt is a t-octylamine-cocoyl sarcosine salt.

8. A gasoline according to claim 1 in which said salt is an n-butylamine-oleoyl sarcosine salt.

9. A gasoline according to claim 1 in which said salt is a t-octylamine-oleoyl sarcosine salt.

10. A gasoline according to claim 1 in which said salt is a t-C_{11}–C_{14} alkylamine-oleoyl sarcosine salt.

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