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(54) DIESEL FUEL COMPOSITIONS

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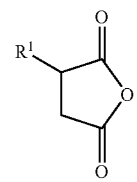
(57) **ABSTRACT**

A diesel fuel composition having a mixture of a major portion of a hydrocarbon-based compression ignition fuel; and a minor portion of an additive having a polyalkylene succinimide dispersant, the dispersant being the reaction product of at least one amine and at least one polyalkylene succinic anhydride of formula I,

I



wherein R^1 is a polyalkenyl radical having a number average molecular weight ranging from about 600 to about 850.

DIESEL FUEL COMPOSITIONS

FIELD OF THE DISCLOSURE

[0001] The present application is directed to diesel fuel compositions, and more specifically, to diesel fuel compositions including a dispersant.

BACKGROUND OF THE DISCLOSURE

[0002] It has long been desired to maximize fuel economy and power in diesel engines while enhancing acceleration, preventing knocking, and preventing hesitation. It has been known to enhance gasoline powered engine performance by employing dispersants to keep valves and fuel injectors clean. However, dispersants used in gasoline are not necessarily effective in diesel fuel. The reasons for this unpredictability lie in the many differences between how diesel engines and gasoline engines operate and the chemical differences between diesel fuel and gasoline.

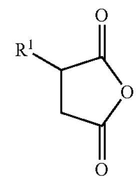
[0003] Over the years, dispersant compositions for diesel fuel have been developed. Dispersant compositions known in the art for use in diesel fuel include compositions comprising polyalkylene succinimides, which are the reaction products of polyalkylene succinic anhydrides and amines. For example, U.S. Pat. No. 5,752,989, issued May 19, 1998 to Henly et al., teaches compositions comprising a mixture of polyalkylene succinimide dispersants and at least one oxygenate carrier selected from the group consisting of polyalkoxylated ether, polyalkoxylated phenol, polyalkoxylated ester and polyalkoxylated amine. U.S. Pat. No. 4,482,356, issued Nov. 13, 1984 to Hanlon ("Hanlon '356"), teaches compositions comprising hydrocarbyl-substituted succinimide and organic nitrate ignition accelerator. U.S. Pat. No. 4,482,357, issued Nov. 13, 1984 to Hanlon ("Hanlon '357"), teaches compositions comprising hydrocarbyl-substituted succinimide, a hydrocarbyl amine having from 3 to 60 carbons and from 1 to 10 nitrogens, and N,N'-disalicylidene-1,2-diaminopropane. U.S. Pat. No. 5,575,823, issued Nov. 19, 1996 to Wallace et al. teaches diesel fuels comprising an ashless dispersant, such as alkenyl succinimides of an amine, and cyclomatic manganese tricarbonyl. The disclosures of these dispersant compositions disclosed by Henly et al., Hanlon '356, Hanlon '357, and Wallace et al., are herein incorporated by reference in their entirety.

[0004] However, diesel fuel compositions that include dispersants, such as succinimide dispersants, often still produce undesirable deposits on diesel engine injectors. Accordingly, improved dispersants which can reduce the amount of deposits are desired.

SUMMARY OF THE DISCLOSURE

[0005] In accordance with the disclosure, one aspect of the present application is directed to a diesel fuel composition having a mixture of a major portion of a hydrocarbon-based compression ignition fuel; and a minor portion of an additive comprising a polyalkylene succinimide dispersant, the dispersant being the reaction product of at least one amine and at least one polyalkylene succinic anhydride of formula I,

I



wherein R^1 is a polyalkenyl radical having a number average molecular weight ranging from about 600 to about 850.

[0006] Another aspect of the present application is directed to a diesel fuel additive comprising a polyalkylene succinimide dispersant, the dispersant being the reaction product of at least one amine and at least one polyalkylene succinic anhydride of formula I above, wherein R^1 is a polyalkenyl radical having a number average molecular weight ranging from about 600 to about 850.

[0007] Another aspect of the present application is directed to a method for the production of a diesel fuel composition, the method comprising providing a major portion of a hydrocarbon-based compression ignition fuel, and providing a minor portion of an additive. The additive comprises a polyalkylene succinimide dispersant, the dispersant being the reaction product of at least one polyamine and at least one polyalkylene succinic anhydride of formula I above, wherein R^1 is a polyalkenyl radical having a number average molecular weight ranging from about 600 to about 850.

[0008] Additional objects and advantages of the disclosure will be set forth in part in the description which follows, and can be learned by practice of the disclosure. The objects and advantages of the disclosure will be realized and attained by means of the elements and combinations particularly pointed out in the appended claims.

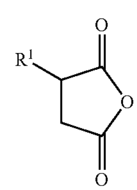
[0009] It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the disclosure, as claimed.

DESCRIPTION OF THE EMBODIMENTS

[0010] The dispersants of the present application are made by reacting a polyalkylene succinic anhydride with an amine to form a polyalkylene succinimide. The polyalkylene portion, or tail, of the polyalkylene succinimide molecule is considered to be nonpolar, while the succinimide is polar. It has been found that varying the molecular weight of the nonpolar polyalkylene portion relative to the weight of the polar portion of the molecule can have an effect on the ability of the dispersant to help reduce injector deposits in diesel fuels.

[0011] The polyalkylene succinic anhydride reactant has the following Formula I:

I

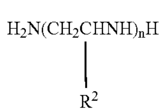


wherein R^1 can be a polyalkenyl radical having a number average molecular weight from about 600 to about 850, and any number therebetween. For example, the number average molecular weight of R^1 may range from about 700 to about 800, such as from about 720 to about 780. In yet other aspects, the number average molecular weight of R^1 is about 750. Unless indicated otherwise, molecular weights in the present specification are number average molecular weights.

[0012] The R^1 polyalkenyl radicals can comprise one or more polymer units chosen from linear or branched alkenyl units. In some aspects, the alkenyl units may have from about 2 to about 10 carbon atoms. For example, the polyalkenyl radical may comprise one or more linear or branched polymer units chosen from ethylene radicals, propylene radicals, butylene radicals, pentene radicals, hexene radicals, octene radicals and decene radicals. In some aspects, the R^1 polyalkenyl radical may be in the form of, for example, a homopolymer, copolymer or terpolymer. In an aspect, the polyalkenyl radical is isobutylene. For example, the polyalkenyl radical may be a homopolymer of polyisobutylene comprising from about 10 to about 60 isobutylene groups, such as from about 20 to about 30 isobutylene groups. The polyalkenyl compounds used to form the R^1 polyalkenyl radicals may be formed by any suitable methods, such as by conventional catalytic oligomerization of alkenes.

[0013] The polyalkylene succinic anhydrides can be made using any suitable method. Suitable methods for forming polyalkylene succinic anhydrides are well known in the art. One example of a known method for forming polyalkylene succinic anhydrides comprises blending polyalkylenes, such as those discussed above, and maleic anhydride. The polyalkylene and maleic anhydride reactants are heated to temperatures of, for example, about 150° C. to about 250° C., optionally, with the use of a catalyst such as chlorine or peroxide. In some aspects, approximately one mol of maleic anhydride can be reacted per mol of polyalkylene, such that the resulting polyalkenyl succinic anhydride has about 0.8 to about 1 succinic anhydride group per polyalkylene substituent. In aspects, the weight ratio of succinic anhydride groups to alkylene groups can range from about 0.5 to about 3.5, such as from about 1 to about 1.1. Another exemplary method of making the polyalkylene succinic anhydrides is described in U.S. Pat. No. 4,234,435, which is incorporated herein by reference in its entirety.

[0014] In some aspects, the amine (to be reacted with the polyalkylene succinic anhydride) can be a linear, branched or cyclic alkyleneamine. For example, the amine can be an ethyleneamine, such as an ethyleneamine of the following Formula II:

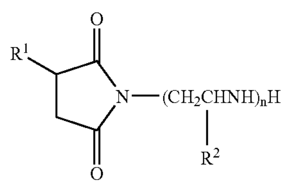


II

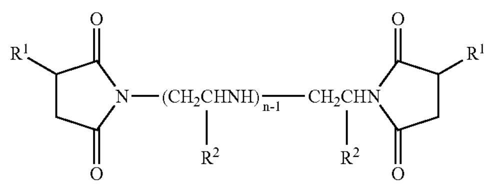
wherein R^2 can be a hydrogen atom, a low molecular weight alkyl group having from about 1 to about 6 carbon atoms, and n can be an integer ranging from about 1 to about 6. In some aspects, R^2 can be a hydrogen atom or an alkyl group having from about 1 to about 2 carbon atoms, and n can be an integer ranging from about 2 to about 4. Representative examples of R^2 alkyl groups include methyl, ethyl, propyl or butyl. Representative examples of suitable ethyleneamines include ethylene diamine, propylene diamine, butylene diamine, diethylene triamine, triethylene tetramine, tetraethylene pentamine, pentaethylene hexamine, dipropylene triamine and tripropylene tetramine. In one aspect, the amine is a linear, branched or cyclic tetraethylene pentamine. The amines can also be a polymer or copolymer of any one of the foregoing ethyleneamines ranging in molecular weight from about 100 to about 600. In some aspects, mixtures of two or more of the above ethyleneamines may be employed.

[0015] In some aspects, the polyalkylene succinic anhydride of Formula I and the amine of Formula II can be reacted together at a mol ratio of about 1 to about 2 mols of polyalkylene succinic anhydride for 1 mol of the amine. For example, the mol ratio can be about 1.5 to about 2 mols of polyalkylene succinic anhydride of Formula I for 1 mol of the amine of Formula II. Examples of suitable polyalkylene succinimides have the Formulas III and IV, where R^1, n and R^2 are as defined above:

III



IV



[0016] Procedures for making the polyalkenyl succinimide are described in U.S. Pat. No. 3,219,666 and U.S. Pat. No. 4,098,585, which are herein incorporated by reference in their entirety.

[0017] In some aspects of the present application, the dispersant products of this application can be used in combination with a diesel fuel soluble carrier. Such carriers can be of various types, such as liquids or solids, e.g., waxes. Examples of liquid carriers include mineral oil and oxygenates, such as liquid polyalkoxylated ethers (also known as polyalkylene glycols or polyalkylene ethers), liquid polyalkoxylated phenols, liquid polyalkoxylated esters, liquid polyalkoxylated amines, and mixtures thereof. Examples of the oxygenate carriers are found in U.S. Pat. No. 5,752,989, issued May 19, 1998 to Henly et. al., the description of which carriers is herein incorporated by reference in its entirety. Additional examples of oxygenate carriers include alkyl-substituted aryl polyalkoxylates described in U.S. Patent Publication No. 2003/0131527, published Jul. 17, 2003 to Colucci et. al., the description of which is herein incorporated by reference in its entirety.

[0018] In other aspects, compositions of the present application may not contain a carrier. For example, some compositions of the present application may not contain mineral oil or oxygenates, such as those oxygenates described above.

[0019] One or more additional optional compounds may be present in the fuel compositions of this application. For example, the fuels may contain conventional quantities of cetane improvers, corrosion inhibitors, cold flow improvers (CFPP additive), pour point depressant, solvents, demulsifiers, lubricity additives, friction modifiers, amine stabilizers, combustion improvers, dispersants other than those described above, antioxidants, heat stabilizers, conductivity improvers, metal deactivators, marker dyes, organic nitrate ignition accelerators, cyclomatic manganese tricarbonyl compounds, and the like. In some aspects, the compositions of the present application may contain about 10 weight percent or less, or in other aspects, about 5 weight percent or less, based on the total weight of the additive concentrate, of one or more of the above additives. Similarly, the fuels may contain suitable amounts of conventional fuel blending components such as methanol, ethanol, dialkyl ethers, and the like.

[0020] In some aspects of the present application, suitable optional organic nitrate ignition accelerators include aliphatic or cycloaliphatic nitrates in which the aliphatic or cycloaliphatic group is saturated, contains up to about 12 carbons and, optionally, may be substituted with one or more oxygen atoms. Examples of organic nitrate ignition accelerators that may be used are methyl nitrate, ethyl nitrate, propyl nitrate, isopropyl nitrate, allyl nitrate, butyl nitrate, isobutyl nitrate, sec-butyl nitrate, tert-butyl nitrate, amyl nitrate, isoamyl nitrate, 2-amyl nitrate, 3-amyl nitrate, hexyl nitrate, heptyl nitrate, 2-heptyl nitrate, octyl nitrate, isooctyl nitrate, 2-ethylhexyl nitrate, nonyl nitrate, decyl nitrate, undecyl nitrate, dodecyl nitrate, cyclopentyl nitrate, cyclohexyl nitrate, methylcyclohexyl nitrate, cyclododecyl nitrate, 2-ethoxyethyl nitrate, 2-(2-ethoxyethoxy)ethyl nitrate, tetrahydrofuranyl nitrate, and the like. Mixtures of such materials may also be used.

[0021] In yet other aspects, the compositions of the present application do not comprise organic nitrate ignition accelerators, such as those organic nitrate ignition accelerators listed above.

[0022] Examples of suitable optional metal deactivators useful in the compositions of the present application are disclosed in U.S. Pat. No. 4,482,357, issued Nov. 13, 1984, the disclosure of which is herein incorporated by reference in its entirety. Such metal deactivators include, for example, salicylidene-o-aminophenol, disalicylidene ethylenediamine, disalicylidene propylenediamine, and N,N'-disalicylidene-1,2-diaminopropane.

[0023] In yet other aspects, the compositions of the present application do not comprise metal deactivators such as those disclosed above. For example, some compositions of the present application may not include salicylidene-o-aminophenol, disalicylidene ethylenediamine, disalicylidene propylenediamine, or N,N'-disalicylidene-1,2-diaminopropane.

[0024] Suitable optional cyclomatic manganese tricarbonyl compounds which may be employed in the compositions of the present application include, for example, cyclopentadienyl manganese tricarbonyl, methylcyclopentadienyl manganese tricarbonyl, indenyl manganese tricarbonyl, and ethylcyclopentadienyl manganese tricarbonyl. Yet other examples of suitable cyclomatic manganese tricarbonyl compounds are disclosed in U.S. Pat. No. 5,575,823, issued Nov. 19, 1996, and U.S. Pat. No. 3,015,668, issued Jan. 2, 1962, both of which disclosures are herein incorporated by reference in their entirety.

[0025] In yet other aspects, the compositions of the present application do not comprise cyclomatic manganese tricarbonyl compounds, such as those disclosed above.

[0026] When formulating the fuel compositions of this application, the additives can be employed in amounts sufficient to reduce or inhibit deposit formation in a diesel engine. In some aspects, the fuels can contain minor amounts of the dispersant that control or reduce formation of engine deposits, for example injector deposits in diesel engines. For example, the diesel fuels of this application can contain, on an active ingredient basis, an amount of the dispersant in the range of about 5 mg to about 200 mg of dispersant per Kg of fuel, such as in the range of about 20 mg to about 120 mg of dispersant per Kg of fuel. In aspects, where a carrier is employed, the fuel compositions can contain, on an active ingredients basis, an amount of the carrier in the range of about 1 mg to about 100 mg of carrier per Kg of fuel, such as about 5 mg to about 50 mg of dispersant per Kg of fuel. The active ingredient basis excludes the weight of (i) unreacted components such as polyalkylene compounds associated with and remaining in the product as produced and used, and (ii) solvent(s), if any, used in the manufacture of the dispersant either during or after its formation but before addition of a carrier, if a carrier is employed.

[0027] The additives of the present application, including the polyalkylene succinimide dispersants, carriers, and optional additives used in formulating the fuels of this invention can be blended into the base diesel fuel individually or in various sub-combinations. In some embodiments, the additive components of the present application can be blended into the diesel fuel concurrently using an additive concentrate, as this takes advantage of the mutual compatibility and convenience afforded by the combination of ingredients when in the form of an additive concentrate. Also, use of a concentrate may reduce blending time and lessen the possibility of blending errors.

[0028] Thus, in certain embodiments, the present application is directed to a diesel fuel additive, comprising a polyalkylene succinimide dispersant, the dispersant being the reaction product of at least one polyamine and at least one polyalkylene succinic anhydride, as described above. The additive may comprise one or more of the additional ingredients listed above. The additive may be packaged and sold separately from diesel fuel in, for example, a concentrated form. The additive can then be blended with diesel fuel by the customer, as desired.

[0029] Certain embodiments of the present application are also directed to methods for the production of a diesel fuel composition. The methods comprise, for example, blending a major portion of a hydrocarbon-based compression ignition fuel and a minor portion of an additive comprising a polyalkylene succinimide dispersant. One or more of the above described carriers and/or optional additives may also be blended into the diesel fuel compositions. A "major portion" is understood to mean greater than or equal to 50% and a "minor portion" is understood to mean less than 50%.

[0030] The diesel fuel compositions of the present application may be applicable to the operation of both stationary diesel engines (e.g., engines used in electrical power generation installations, in pumping stations, etc.) and ambulatory diesel engines (e.g., engines used as prime movers in automobiles, trucks, road-grading equipment, military vehicles, etc.). Accordingly, aspects of the present application are directed to methods for reducing the amount of injector deposits of a diesel engine having at least one combustion chamber and one or more injectors in fluid connection with the combustion chamber. In some aspects, the methods comprise injecting a hydrocarbon-based compression ignition fuel comprising the polyalkylene succinimide dispersant additives of the present application, through the injectors of the diesel engine into the combustion chamber, and igniting the compression ignition fuel. In some aspects, the method may also comprise mixing into the diesel fuel composition at least one of the optional additional ingredients described above.

EXAMPLES

Example Dispersant

[0031] A dispersant according to the present application was prepared by reacting 1 mol of tetraethylenepentamine (TEPA) with 1 mol of polyisobutenylsuccinic anhydride (PIBSA), where the PIBSA was made by reacting polyisobutylene, having a molecular weight of 750, and maleic anhydride.

Comparative Example Dispersant 1

[0032] A dispersant according to the present application was prepared by reacting 1 mol of TEPA with 1 mol of PIBSA, where the PIBSA was made by reacting polyisobutylene, having a molecular weight of 1000, and maleic anhydride.

Comparative Example Dispersant 2

[0033] A dispersant according to the present application was prepared by reacting 1 mol of TEPA with 1.4 mol of PIBSA, where the PIBSA was made by reacting polyisobutylene, having a molecular weight of 550, and maleic anhydride.

Comparative Example Dispersant 3

[0034] A dispersant according to the present application was prepared by reacting 1 mol of TEPA with 1.4 mol of PIBSA, where the PIBSA was made by reacting polyisobutylene, having a molecular weight of 450, and maleic anhydride.

Comparative Example Dispersant 4

[0035] A dispersant according to the present application was prepared by reacting 1 mol of TEPA with 1.4 mol of PIBSA, where the PIBSA was made by reacting polyisobutylene, having a molecular weight of 350, and maleic anhydride.

[0036] The example dispersant and comparative example dispersants 1 to 4, described above, were blended with diesel fuel and tested using the Peugeot XUD9 engine test according to CEC test Protocol CEC F-23-A-01. This test involved use of a PSA XUD 9 A/L four cylinder in-line, four stroke 1.9 liter naturally aspirated, indirect injection diesel engine. The engine was operated for a period of 10 hours under cyclic conditions. The object of this procedure was to provide a means of discriminating between fuels of different injector nozzle cooking propensity. The propensity of the fuel to provoke deposit formation in the fuel injectors was determined by measuring the injector nozzle air flow before and after test operation. The specific diesel fuel used in these tests was low sulfur diesel fuel, having less than 500 PPM sulfur content.

[0037] Results of this test are shown in Table 1 below. The treat rate in the Table indicates the amount of dispersant, in milligrams, per kilogram of diesel fuel. The flow remaining in Table 1 refers to the percentage of flow remaining after the test operation based on initial flows through the injector nozzle before the test operation.

TABLE 1

RUN	ADDITIVE	TREAT RATE (mg/kg)	FLOW REMAINING @0.1 MM	FLOW REMAINING @0.2 MM	FLOW REMAINING @0.3 MM
1	Example Additive 1	60	63.5	73.8	76.2
2	Example Additive 1	60	58.9	66.4	72.3
3	Comparative Additive 1	60	44.0	49.0	56.9
4	Comparative Additive 1	60	44.0	50.6	59.7
5	Example Additive 1	120	90.8	92.3	90.7
5	Example Additive 1	120	83.3	89.2	88.8
6	Comparative Additive 1	120	71.8	82	87.5
7	Comparative Additive 1	120	68.8	75.2	82
8	Comparative Additive 2	120	49.1	57.4	63.7

TABLE 1-continued

RUN	ADDITIVE	TREAT RATE (mg/kg)	FLOW REMAINING @0.1 MM	FLOW REMAINING @0.2 MM	FLOW REMAINING @0.3 MM
9	Comparative Additive 3	120	16.7	—	—
10	Comparative Additive 4	120	10.7	—	—
11	Example Additive 1	30	27.4	32.0	41.9
12	Comparative Additive 1	30	20.2	25.5	34.1

[0038] As shown in Table 1 above, the Example Additive made using polyisobutylene having a molecular weight of 750 has increased remaining flows compared to Comparative Example 1 (made using polyisobutylene with a molecular weight of 1000) and Comparative Examples 2 to 4 (made using polyisobutylene with molecular weights of 550 or less). The increased flows indicate that the Example Additive has increased detergent activity, which resulted in a reduced propensity of the fuel to provoke deposit formation in the fuel injectors.

[0039] For the purposes of this specification and appended claims, unless otherwise indicated, all numbers expressing quantities, percentages or proportions, and other numerical values used in the specification and claims, are to be understood as being modified in all instances by the term "about." Accordingly, unless indicated to the contrary, the numerical parameters set forth in the following specification and attached claims are approximations that can vary depending upon the desired properties sought to be obtained by the present disclosure. At the very least, and not as an attempt to limit the application of the doctrine of equivalents to the scope of the claims, each numerical parameter should at least be construed in light of the number of reported significant digits and by applying ordinary rounding techniques.

[0040] It is noted that, as used in this specification and the appended claims, the singular forms "a,""an," and "the," include plural referents unless expressly and unequivocally limited to one referent. Thus, for example, reference to "an acid" includes two or more different acids. As used herein, the term "include" and its grammatical variants are intended to be non-limiting, such that recitation of items in a list is not to the exclusion of other like items that can be substituted or added to the listed items.

[0041] While particular embodiments have been described, alternatives, modifications, variations, improvements, and substantial equivalents that are or can be presently unforeseen can arise to applicants or others skilled in the art. Accordingly, the appended claims as filed and as they can be amended are intended to embrace all such alternatives, modifications variations, improvements, and substantial equivalents.

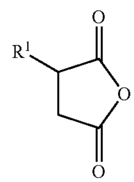
What is claimed is:

1. A diesel fuel composition comprising a mixture of:

a major portion of a hydrocarbon-based compression ignition fuel; and

a minor portion of an additive comprising a polyalkylene succinimide dispersant, the dispersant being the reaction product of at least one amine and at least one polyalkylene succinic anhydride of formula I,

I



wherein R^1 is a polyalkenyl radical having a number average molecular weight ranging from about 600 to about 850.

2. The diesel fuel composition of claim 1, wherein the polyalkenyl radical comprises one or more polymer units chosen from linear or branched alkenyl radicals having about 2 to about 10 carbon atoms.

3. The diesel fuel composition of claim 1, wherein the polyalkenyl radical comprises one or more linear or branched polymer units chosen from ethylene radicals, propylene radicals, butylene radicals, pentene radicals, hexene radicals, octene radicals and decene radicals.

4. The diesel fuel composition of claim 1, wherein the polyalkenyl radical is a polyisobutylene radical.

5. The diesel fuel composition of claim 4, wherein the polyalkenyl radical has a number average molecular weight ranging from about 700 to about 800.

6. The diesel fuel composition of claim 1, wherein the at least one amine is a polyalkyleneamine.

7. The diesel fuel composition of claim 1, wherein the at least one amine has the formula II,

II

$$H_2N(CH_2\underset{\underset{R^2}{|}}{C}HNH)_nH$$

wherein R^2 is a hydrogen atom, an alkyl group having from about 1 to about 6 carbon atoms; and

n is an integer ranging from 1 to 6.

8. The diesel fuel composition of claim 1, wherein the at least one amine is a linear, branched or cyclic ethyleneamine

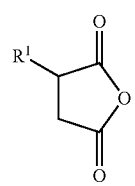
chosen from ethylene diamine, propylene diamine, butylene diamine, diethylene triamine, triethylene tetraamine, tetraethylene pentamine, pentaethylene hexamine, dipropylene triamine, and tripropylene tetraamine.

9. The diesel fuel composition of claim 1, wherein the at least one amine is a linear, branched or cyclic tetraethylene pentamine.

10. The diesel fuel composition of claim 1, wherein the additive comprises at least one additional ingredient chosen from cetane improvers, corrosion inhibitors, cold flow improvers, pour point depressants, solvents, demulsifiers, lubricity additives, friction modifiers, amine stabilizers, combustion improvers, antioxidants, heat stabilizers, conductivity improvers, metal deactivators, organic nitrate ignition accelerators, cyclomatic manganese tricarbonyl compounds, and marker dyes.

11. A diesel fuel additive, comprising:

a polyalkylene succinimide dispersant, the dispersant being the reaction product of at least one polyamine and at least one polyalkylene succinic anhydride of formula I,



I

wherein R^1 is a polyalkenyl radical having a number average molecular weight ranging from about 600 to about 850.

12. The diesel fuel additive of claim 11, wherein the polyalkenyl radical comprises one or more polymer units chosen from linear or branched alkenyl radicals having about 2 to about 10 carbon atoms.

13. The diesel fuel additive of claim 12, wherein the polyalkenyl radical has a number average molecular weight ranging from about 700 to about 800.

14. The diesel fuel additive of claim 11, wherein the at least one amine is a polyalkyleneamine.

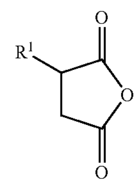
15. The diesel fuel additive of claim 11, wherein the polyalkenyl radical is a polyisobutylene radical, and the at least one amine is a linear, branched or cyclic tetraethylene pentamine.

16. The diesel fuel composition of claim 11, wherein the additive comprises at least one additional ingredient chosen from cetane improvers, corrosion inhibitors, cold flow improvers, pour point depressants, solvents, demulsifiers, lubricity additives, friction modifiers, amine stabilizers, combustion improvers, antioxidants, heat stabilizers, conductivity improvers, metal deactivators, organic nitrate ignition accelerators, cyclomatic manganese tricarbonyl compounds and marker dyes.

17. A method for the production of a diesel fuel composition, the method comprising:

providing a major portion of a hydrocarbon-based compression ignition fuel; and

providing a minor portion of an additive comprising a polyalkylene succinimide dispersant, the dispersant being the reaction product of at least one polyamine and at least one polyalkylene succinic anhydride of formula I,



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wherein R^1 is a polyalkenyl radical having a number average molecular weight ranging from about 600 to about 850.

18. The method of claim 17, wherein the polyalkenyl radical is a polyisobutylene radical having a number average molecular weight ranging from about 700 to about 800 and the at least one amine is a polyalkyleneamine.

19. The method of claim 17, further comprising providing at least one additional ingredient chosen from cetane improvers, corrosion inhibitors, cold flow improvers, pour point depressants, solvents, demulsifiers, lubricity additives, friction modifiers, amine stabilizers, combustion improvers, antioxidants, heat stabilizers, conductivity improvers, metal deactivators, organic nitrate ignition accelerators, cyclomatic manganese tricarbonyl compounds and marker dyes.

20. A method for reducing the amount of injector deposits in a diesel engine having at least one combustion chamber and one or more injectors in fluid connection with the combustion chamber, the method comprising:

injecting the hydrocarbon-based compression ignition fuel of claim 1 through the injectors into the combustion chamber; and

igniting the combustion fuel.

* * * * *