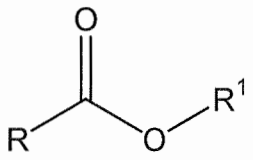
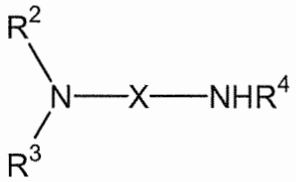
**Claims:**

1. A diesel fuel composition comprising a first additive (i) comprising a quaternary ammonium salt and a second additive (ii) comprising a Mannich reaction product; wherein the quaternary ammonium salt additive (i) is formed by the reaction of a compound of formula (A):



(A)

and a compound formed by the reaction of a hydrocarbyl-substituted succinic acid acylating agent and an amine of formula (B1):



(B1)

selected from N,N-dimethyl-1,3-diaminopropane, N,N-diethyl-1,3-diaminopropane, N,N-dimethylethylenediamine, N,N-diethylethylenediamine, N,N-dibutylethylenediamine, or combinations thereof;

wherein $R^1$ is a C1 to C22 alkyl, aryl or alkylaryl group, and wherein compound (A) is selected from an ester of a carboxylic acid selected from one or more of oxalic acid, phthalic acid, salicylic acid, maleic acid, malonic acid, citric acid, nitrobenzoic acid, aminobenzoic acid and 2, 4, 6-trihydroxybenzoic acid; and

wherein the Mannich reaction product additive (ii) is the product of a Mannich reaction between:

(a) formaldehyde;

(b) a (poly)ethylene polyamine; and

(c) a polyisobutylene-substituted phenol; wherein the polyisobutenyl substituent has a molecular weight of between 300 and 2000.

~~2. A diesel fuel composition according to claim 1 wherein the compound of formula (A) is an ester of a carboxylic acid selected from a substituted aromatic carboxylic acid, an α-hydroxycarboxylic acid and a polycarboxylic acid.~~

32. A diesel fuel composition according to claim 12 wherein the compound of formula (A) is selected from dimethyl oxalate, methyl 2-nitrobenzoate and methyl salicylate.

43. A diesel fuel composition according to ~~any preceding~~ claim 1 or 2 wherein additive (i) is a salt of tertiary amine prepared from dimethylaminopropylamine and a polyisobutylene-substituted succinic anhydride.

54. A diesel fuel composition according to any preceding claim 1 to 3, wherein in the Mannich reaction used to form additive (ii) the molar ratio of component (a) to component (b) is 2.2-1.01:1; the molar ratio of component (a) to component (c) is 1.99-1.01:1 and the molar ratio of component (b) to component (c) is 1:1.01-1.99.

65. A diesel fuel composition according to claim 54, wherein in the reaction used to make the Mannich additive the molar ratio of component (a) to component (b) is 2-1.4:1, the molar ratio of component (a) to component (c) is 1.7-1.1:1 and the molar ratio of component (b) to component (c) is 1:1.1-1.7.

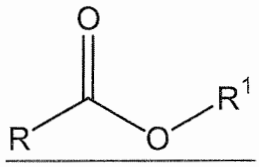
76. A diesel fuel composition according to any preceding claim 1 to 5, wherein the diesel fuel comprises a Fischer Tropsch fuel and/or biodiesel.

87. A diesel fuel composition as claimed in any preceding claim 1 to 6, which further comprises a fuel-borne catalyst which includes a metal selected from iron, cerium, group I and group II metals, platinum, manganese and mixtures thereof.

~~9. An additive package which upon addition to a diesel fuel provides a composition as claimed in any preceding claim.~~

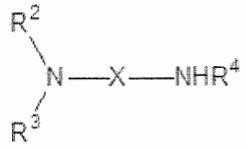
~~10. A method of operating a diesel engine, the method comprising combusting in the engine a composition as claimed in any of claims 1 to 8.~~

~~11~~8. Use of a quaternary ammonium salt additive (i) and a Mannich reaction product additive (ii) in a diesel fuel composition to improve the engine performance of a diesel engine when using said diesel fuel composition, wherein the quaternary ammonium salt additive (i) is formed by the reaction of a compound of formula (A):



(A)

and a compound formed by the reaction of a hydrocarbyl-substituted succinic acid acylating agent and an amine of formula (B1)



(B1)

selected from N,N-dimethyl-1,3-diaminopropane, N,N-diethyl-1,3-diaminopropane, N,N-dimethylethylenediamine, N,N-diethylethylenediamine, N,N-dibutylethylenediamine, or combinations thereof;

wherein $R^1$ is selected from a C1-C22 alkyl, aryl, or alkylaryl group;

said compound (A) is selected from an ester of a carboxylic acid selected from one or more of oxalic acid, phthalic acid, salicylic acid, maleic acid, malonic acid, citric acid, nitrobenzoic acid, aminobenzoic acid and 2, 4, 6-trihydroxybenzoic acid; and

wherein the Mannich reaction product additive (ii) is the product of a Mannich reaction between:

(a) formaldehyde

(b) a (poly)ethylene polyamine; and

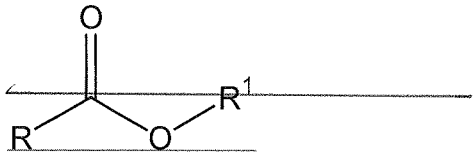
(c) a polyisobutylene-substituted phenol; wherein the polyisobutenyl substituent has a molecular weight of between 300 and 2000, and

wherein said improvement in engine performance is measured by the reduction or prevention of injector deposits, by a reduction in power loss, by an improvement in fuel economy, or by preventing or removing deposits on a vehicle fuel filter.

~~12~~9. The use according to claim ~~11~~8 to provide "keep clean" performance and/or "clean up" performance.

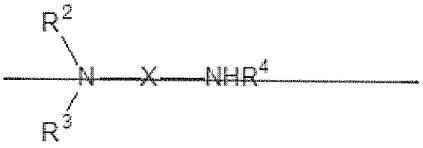
~~13~~10. ~~A~~ The use according to claim ~~11~~ 8 or claim ~~12~~ 9 to improve the performance of a modern diesel engine having a high pressure fuel system and/or to improve the performance of a traditional diesel engine.

~~14. The use according to any one of claims 11 to 13, wherein the quaternary ammonium salt additive (i) is formed by the reaction of a compound of formula (A):~~



~~(A)~~

~~and a compound formed by the reaction of a hydrocarbyl-substituted succinic acid acylating agent and an amine of formula (B1)~~



(B1)

~~selected from N,N-dimethyl-1,3-diaminopropane, N,N-diethyl-1,3-diaminopropane, N,N-dimethylethylenediamine, N,N-diethylethylenediamine, N,N-dibutylethylenediamine, or combinations thereof; wherein compound (A) is selected from an ester of a carboxylic acid selected from one or more of oxalic acid, phthalic acid, salicylic acid, maleic acid, malonic acid, citric acid, nitrobenzoic acid, aminobenzoic acid and 2, 4, 6-trihydroxybenzoic acid; and wherein the Mannich reaction product additive (ii) is the product of a Mannich reaction between:~~

~~(a) formaldehyde~~

~~(b) a (poly)ethylene polyamine; and~~

~~(c) a polyisobutylene-substituted phenol; wherein the polyisobutenyl substituent has a molecular weight of between 300 and 2000.~~