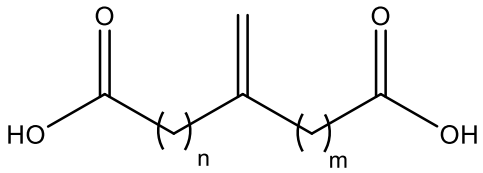
Claims

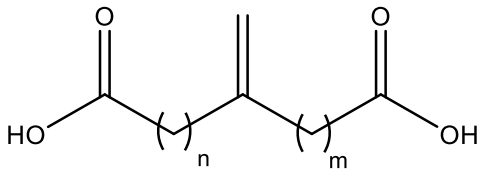
1. A diesel fuel composition comprising as an additive the reaction product of a polycarboxylic acid compound of formula (I):



(I)

or an anhydride thereof; and an alcohol having at least 5 carbon atoms; wherein each of n and m may be 0 or a positive integer and n + m is at least 1.

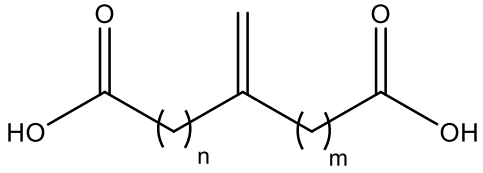
2. A method of improving the performance of an engine, the method comprising combusting in the engine a fuel composition comprising as an additive the reaction product of a polycarboxylic acid compound of formula (I):



(I)

or an anhydride thereof; and an alcohol having at least 5 carbon atoms; wherein each of n and m may be 0 or a positive integer and n + m is at least 1; wherein the engine is a diesel engine or a direct injection spark ignition engine.

3. The use of the reaction product of a polycarboxylic acid compound of formula (I):



(I)

or an anhydride thereof; and an alcohol having at least 5 carbon atoms; wherein each of n and m may be 0 or a positive integer and n + m is at least 1; as an additive for a fuel composition to improve the performance of an engine combusting said fuel composition, wherein the engine is a diesel engine or a direct injection spark ignition engine.

4. A composition, method or use according to any preceding claim wherein the polycarboxylic acid or anhydride thereof is selected from itaconic acid, itaconic anhydride, 2-methylene glutaric acid, 2-methylene glutaric anhydride, 2-methylene adipic acid, 2-methylene adipic anhydride and isomers and/or mixtures thereof.

5. A composition, method or use according to any preceding claim wherein the polycarboxylic acid is itaconic acid.

6. A composition, method or use according to any preceding claim wherein the alcohol is a compound of formula $H-(OR)_nOR^1$, wherein R is an optionally substituted alkylene group, R^1 is an optionally substituted hydrocarbyl group; and n is 0 or a positive integer.

~~6.~~7. A composition, method or use according to claim 6 wherein the alcohol is selected from:

- alkanols of formula $CH_3(CH_2)_xOH$ or an isomer thereof wherein x is from 4 to 23, preferably from 9 to 19;
- branched or cyclic alkyl alcohols in which n is 0;
- alkenyl alcohols in which n is 0;
- glycol ethers in which n is not 0.

~~7.~~8. A composition, method or use according to claim 6 wherein the alcohol is selected from ~~an~~

- an alcohol of formula R^1OH wherein R^1 is a (preferably branched) alkyl group having 8 to 30 carbon atoms;
- an alcohol of formula R^1OH wherein R^1 is an alkenyl group having 8 to 30 carbon atoms; and
- an alcohol of formula $H-(OR)_n-OR^1$ wherein n is from 1 to 24, R is ethylene, propylene or isopropylene, and R^1 is an unsubstituted alkyl group having 8 to 30, preferably 12 to 24, carbon atoms.

~~8.~~9. A composition, method or use according to any preceding claim wherein the alcohol is selected from hexanol, octanol, nonanol, decanol, dodecanol, tetradecanol, cetyl alcohol, stearyl alcohol, 2-ethyl-1-butanol, 2-ethyl-1-hexanol, 2-ethyl-1-heptanol, 2-propylheptanol, 2-ethyl-1-decanol, 2-hexyl-1-decanol, 2-octyl-1-decanol, 2-hexyl-1-dodecanol, 2-octyl-1-

dodecanol, 2-decyl-1-tetradecanol, isotridecanol, cyclohexanol, cyclooctanol, benzyl alcohol, citronellol, oleyl alcohol, 9-decen-1-ol, cis-3-hexen-1-ol, trans-2-hexen-1-ol, 5-hexen-1-ol, 6-methyl-5-hepten-2-ol, 1-octen-3-ol, trans-2-octen-1-ol, 10-undecen-1-ol and compounds of formula $CH_3(CH_2)_xO(CH_2CH(CH_3)O)_yH$ or an isomer thereof wherein x is from 10 to 15, and y is from 10 to 20.

~~9.~~10. A composition, method or use according to any preceding claim wherein the polycarboxylic acid compound and the alcohol are reacted in a molar ratio of from 2:1 to 1:2.

~~10.~~11. A composition, method or use according to any preceding claim wherein the additive has an acid value of from 0.6 to 9.7 mmol H+/g, preferably from 1.3 to 7.1 mmol H+/g, more preferably from 1.6 to 6.2 mmol H+/g.

~~11.~~12. A composition, method or use according to any preceding claim wherein the fuel composition is a diesel fuel composition, which optionally comprises one or more further additives selected from:

(i) a quaternary ammonium salt additive;

(ii) the product of a Mannich reaction between an aldehyde, an amine and an optionally substituted phenol;

(iii) the reaction product of a carboxylic acid-derived acylating agent and an amine;

(iv) the reaction product of a carboxylic acid-derived acylating agent and hydrazine;

(v) a salt formed by the reaction of a carboxylic acid with di-n-butylamine or tri-n-butylamine;

(vi) the reaction product of a hydrocarbyl-substituted dicarboxylic acid or anhydride and an amine compound or salt which product comprises at least one amino triazole group; and

(vii) a substituted polyaromatic detergent additive; and

(viii) partial esters of substituted succinic acids.

~~12.~~13. A composition, method or use according to claim 11 wherein the diesel fuel composition further comprises a quaternary ammonium salt additive; preferably wherein the quaternary ammonium salt additive is the reaction product of a nitrogen-containing species having at least one tertiary amine group and a quaternising agent wherein the nitrogen containing species is the reaction product of a hydrocarbyl-substituted acylating agent and a compound comprising at least one tertiary amine group and a primary amine, secondary amine or alcohol group; preferably wherein the quaternising agent is an ester quaternising agent.

~~13.~~14. A ~~composition,~~ method or use according to any ~~preceding claim~~ of claims 2 to 11 wherein the fuel composition is a gasoline fuel composition, which optionally comprises one or more further additives selected from:

(p) hydrocarbyl – substituted polyoxyalkylene amines or polyetheramines;
(q) acylated nitrogen compounds which are the reaction product of a carboxylic acid-derived acylating agent and an amine;
(r) hydrocarbyl-substituted amines wherein the hydrocarbyl substituent is substantially aliphatic and contains at least 8 carbon atoms;
(s) Mannich base additives comprising nitrogen-containing condensates of a phenol, aldehyde and primary or secondary amine;
(t) aromatic esters of a polyalkylphenoxyalkanol;
(u) an additional quaternary ammonium salt additive; and
(v) tertiary hydrocarbyl amines having a maximum of 30 carbon atoms.

~~14.~~15. A method or use according to any of claims 2 to 13 which combats deposits in the engine.

~~15.~~16. A method or use according to any of claims 2 to ~~14~~ 13 or 15 wherein the engine is a diesel engine, preferably a modern diesel engine having a high pressure fuel system with a pressure in excess of 1350 bar.

~~16.~~17. A method or use according to claim ~~15~~ 16 wherein the improvement in performance is selected from one or more of:

- a reduction in power loss of the engine;
- a reduction in external diesel injector deposits;
- a reduction in internal diesel injector deposits;

- an improvement in fuel economy;
- a reduction in fuel filter deposits;
- a reduction in emissions; and
- an increase in maintenance intervals.

~~17.~~18. A method or use according to any of claims 2 to ~~16~~ 13 or 15 to 17 which combats internal diesel injector deposits.

~~18.~~19. A method or use according to any of claims 2 to ~~17~~ 13 or 15 to 18 which achieves a maximum exhaust temperature deviation of less ~~that~~ than 30ºC in the DW10C test.

~~19.~~20. A method or use according to any of claims 2 to 11 or 14 wherein the engine is ~~a gasoline engine, preferably~~ a direct injection spark ignition engine.

~~20.~~21. A method or use according to claim ~~19~~ 20 wherein the improvement in performance is selected from one or more of:

- improved fuel economy
- reduced maintenance
- less frequent overhaul or replacement of injectors
- improved driveability
- improved power
- improved acceleration

~~21.~~22. A method or use according to any of claims 2 to ~~20~~ 21 which achieves “keep clean” performance.

~~22.~~23. A method or use according to any of claims 2 to ~~21~~ 22 which achieves “clean up” performance.