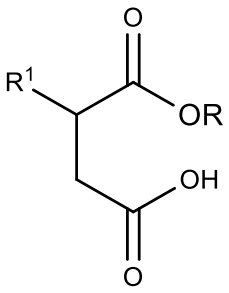
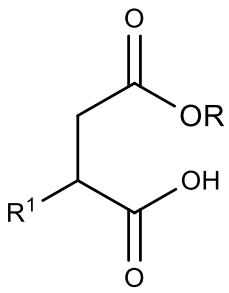
found that certain esters of polycarboxylic acids and alcohols are particularly effective as detergents, especially in modern diesel engines having a high pressure fuel system.

SUMMARY

In one aspect of the present disclosure, there is provided a diesel fuel composition comprising as an additive an ester compound which is the reaction product of an optionally substituted polycarboxylic acid or an anhydride thereof and an alcohol of formula ROH, wherein R is an optionally substituted hydrocarbyl group; and the additive includes compounds having the formula (C1) or (C2):



(C1)



(C2);

wherein R^1 is an alkyl or alkenyl group having 20 to 24 carbon atoms or a polyisobutenyl group having a number average molecular weight of from 240 to 5000, provided that when R^1 is a polyisobutenyl group having a number average molecular weight of from 240 to 5000, R is an unsubstituted alkyl, alkenyl or aryl group, an aryl-substituted alkyl group, or an alkyl-substituted or alkenyl-substituted aryl group.

In another aspect, there is provided a method of combatting deposits in a modern diesel engine having a pressure in excess of 1350 bar, the method comprising combusting in the engine a diesel fuel composition comprising as an additive the reaction product of an optionally substituted polycarboxylic acid or an anhydride thereof and an alcohol of formula ROH, wherein R is an optionally substituted hydrocarbyl group.

In yet another aspect of the present disclosure, there is provided a use of an ester compound as a detergent additive in a diesel fuel composition in a modern diesel engine having a pressure in excess of 1350 bar; wherein the ester compound is the reaction product of an optionally substituted polycarboxylic acid or an anhydride thereof and an alcohol of formula ROH, wherein R is an optionally substituted hydrocarbyl group.

In a further aspect, there is provided a use of an ester additive as defined herein in a modern diesel engine having a pressure in excess of 1350 bar to reduce the treat rate of one or more further additives selected from lubricity improvers, corrosion inhibitors and cold flow improvers whilst maintaining performance.

DETAILED DESCRIPTION

According to a first aspect of the present invention there is provided a diesel fuel composition comprising as an additive an ester compound which is the reaction product of an optionally substituted polycarboxylic acid or an anhydride thereof and an alcohol of formula ROH wherein R is an optionally substituted hydrocarbyl group.

According to a second aspect of the present invention there is provided a method of combatting deposits in a diesel engine, the method comprising combusting in the engine a diesel fuel composition comprising as an additive an ester compound which is the reaction product of an optionally substituted polycarboxylic acid or an anhydride thereof and an alcohol of formula ROH, wherein R is an optionally substituted hydrocarbyl group.

According to a third aspect of the present invention there is provided the use of an ester compound as a detergent additive in a diesel fuel composition in a diesel engine; wherein the ester compound is the reaction product of an optionally substituted polycarboxylic acid or an anhydride thereof and an alcohol of formula ROH, wherein R is an optionally substituted hydrocarbyl group.

The method of the second aspect preferably involves combusting in the engine a composition of the first aspect.

Preferred features of the first, second and third aspects of the invention will now be described. Any feature of any aspect may be combined with any feature of any other aspect as appropriate.

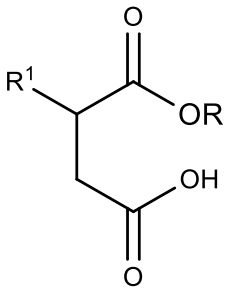
The present invention relates to a composition, a method and a use involving a fuel additive. This additive is the reaction product of an optionally substituted polycarboxylic acid or an anhydride thereof and an alcohol of formula ROH. The additive may be referred to herein as "the additive of the present invention" or as "the ester additive".

The ester additive may comprise a single compound. In some embodiments mixtures containing more than one ester additive may be used. References herein to "an additive" of the invention or "the additive" include mixtures comprising two or more such compounds.

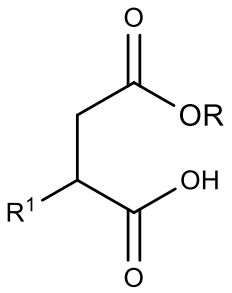
Compounds of this type are known in the art and are described, for example in US2993773. However, they have not previously been used as detergents in diesel fuels.

Claims

1. A diesel fuel composition comprising as an additive an ester compound which is the reaction product of an optionally substituted polycarboxylic acid or an anhydride thereof and an alcohol of formula ROH, wherein R is an optionally substituted hydrocarbyl group; and the additive includes compounds having the formula (C1) or (C2):



(C1)



(C2);

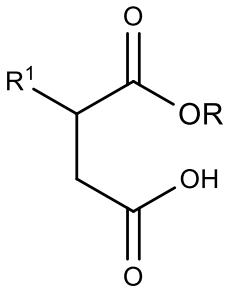
wherein R^1 is an alkyl or alkenyl group having 20 to 24 carbon atoms or a polyisobutenyl group having a number average molecular weight of from 240 to 5000, provided that when R^1 is a polyisobutenyl group having a number average molecular weight of from 240 to 5000, R is an unsubstituted alkyl, alkenyl or aryl group, an aryl-substituted alkyl group, or an alkyl-substituted or alkenyl-substituted aryl group.

2. A method of combatting deposits in a modern diesel engine having a pressure in excess of 1350 bar, the method comprising combusting in the engine a diesel fuel composition comprising as an additive the reaction product of an optionally substituted polycarboxylic acid or an anhydride thereof and an alcohol of formula ROH, wherein R is an optionally substituted hydrocarbyl group.

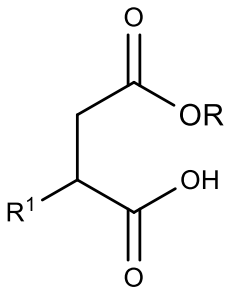
3. Use of an ester compound as a detergent additive in a diesel fuel composition in a modern diesel engine having a pressure in excess of 1350 bar; wherein the ester compound is the reaction product of an optionally substituted polycarboxylic acid or an anhydride thereof and an alcohol of formula ROH, wherein R is an optionally substituted hydrocarbyl group.

4. A method or use according to claim 2 or 3 wherein the optionally substituted polycarboxylic acid or anhydride thereof is a hydrocarbyl substituted succinic acid or a hydrocarbyl substituted succinic anhydride.

5. A method or use according to claim 4 wherein the additive includes compounds having the formula (C1) or (C2):



(C1)



(C2)

wherein R^1 is an optionally substituted alkyl or alkenyl group.

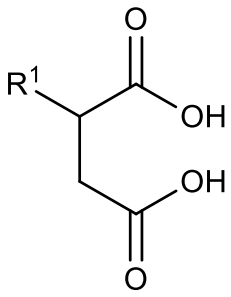
6. A composition, method or use according to any preceding claim wherein R is an unsubstituted alkyl group having 2 to 40 carbon atoms.

7. A composition, method or use according to any preceding claim wherein the alcohol of formula ROH is selected from benzyl alcohol, tetradecanol, butanol, 2-butanol, isobutanol, octanol, 2-ethylhexanol, hexanol, cyclohexanol, cyclooctanol, 2-propylheptanol, isopropanol and 2-ethyl-1-butanol.

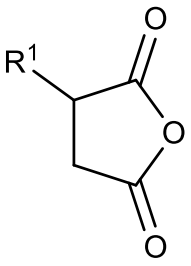
8. A composition, method or use according to any preceding claim wherein the polycarboxylic acid or anhydride thereof includes an optionally substituted alkyl or alkenyl group having 6 to 100 carbon atoms, preferably 6 to 50 carbon atoms.

9. A composition, method or use according to any preceding claim wherein the optionally substituted polycarboxylic acid or hydrocarbyl substituted anhydride and alcohol of formula ROH are reacted in a molar ratio of from 1.5:1 to 1:1.5.

10. A composition, method or use according to any preceding claim wherein the additive comprises the reaction product of a succinic acid or anhydride of formula (A3) or (A4):



(A3)

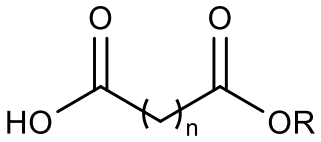


(A4)

and an alcohol of formula ROH; wherein R is an unsubstituted alkyl group having 2 to 20 carbon atoms; and R^1 is an alkyl or alkenyl group having 6 to 36 carbon atoms or a polyisobutenyl group having a number average molecular weight of from 200 to 1300.

11. A composition, method or use according to any preceding claim wherein the additive comprises the reaction product of a succinic acid or anhydride having a C_{20} to C_{24} alkyl or alkenyl substituent and an alcohol selected from butanol and 2-ethylhexanol.

12. A composition, method or use according to any preceding claim wherein the additive includes compounds having the formula (E):



(E)

wherein n is from 1 to 50.

13. A method or use according to any of claims 2 to 12 which achieves “keep clean” performance.

14. A method or use according to any of claims 2 to 13 which achieves “clean up” performance.

15. A method according to any of claims 2 and 4 to 14 wherein the deposits are injector deposits.

16. A method according to claim 15 wherein the deposits are internal diesel injector deposits.

17. A composition, method or use according to any preceding claim wherein the diesel fuel composition comprises less than 50 ppm sulphur by weight.

18. A composition, method or use according to any preceding claim wherein the diesel fuel composition comprises biodiesel.

19. A composition, method or use according to any preceding claim wherein the diesel fuel composition comprises one or more further detergents 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.

20. A composition, method or use according to any preceding claim wherein the diesel fuel composition comprises a mixture of two or more ester additives.

21. A method or use according to any of claims 2 to 20 which achieves an improvement in performance 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.

22. A method or use according to claim 21 which provides an improvement in performance in modern diesel engines having a high pressure fuel system and provides an improvement in performance in traditional diesel engines.

23. Use according to any of claims 3 to 21 which provides one or more further benefits selected from lubricity benefits, corrosion inhibition and cold flow improvement.

24. A composition according to any of claims 1, 6 to 12 and 17 to 20 which further comprises one or more further additives selected from lubricity improvers, corrosion inhibitors and cold flow improvers.

25. Use of an ester additive as defined in any preceding claim in a modern diesel engine having a pressure in excess of 1350 barto reduce the treat rate of one or more further additives selected from lubricity improvers, corrosion inhibitors and cold flow improvers whilst maintaining performance.