

Claims

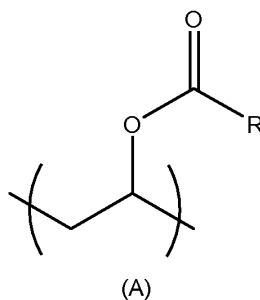
1. A method of improving the low temperature properties of a middle distillate fuel composition comprising:

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- (a) a nitrogen-containing dispersant; and
(b) one or more low temperature property enhancers which are not fumarate vinyl ester copolymers and which are selected from (x) wax antissettling additives; (y) middle distillate flow improvers and mixtures thereof;

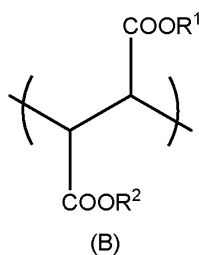
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the method comprising adding to the fuel an additive (c) which is a copolymer comprising units of formula (A):



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and units of formula (B):

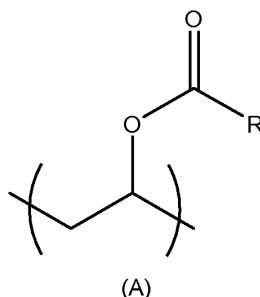


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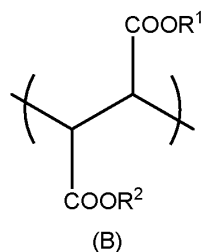
wherein R is an alkyl group and each of R^1 and R^2 is an alkyl group.

2. The use of (c) a copolymer comprising units of formula (A):

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and units of formula (B):



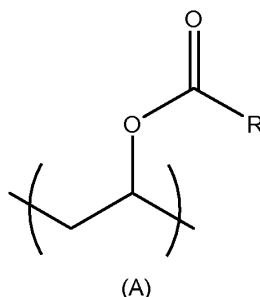
wherein R is an alkyl group and each of R¹ and R² is an alkyl group;

to improve the low temperature properties of a middle distillate fuel composition comprising:

- (a) a nitrogen-containing dispersant; and
- (b) one or more low temperature property enhancers which are not fumarate vinyl ester copolymers and which are selected from (x) wax antisetling additives; (y) middle distillate flow improvers and mixtures thereof.

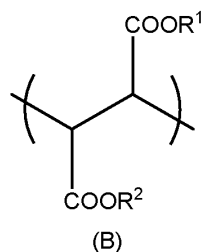
3. An additive composition for improving the low temperature properties of a middle distillate fuel composition the additive composition comprising:

- (b) one or more low temperature property enhancers which are not fumarate vinyl ester copolymers and which are selected from (x) wax antisetling additives; (y) middle distillate flow improvers and mixtures thereof; and
- (c) a copolymer comprising units of formula (A):



(A)

and units of formula (B):



(B)

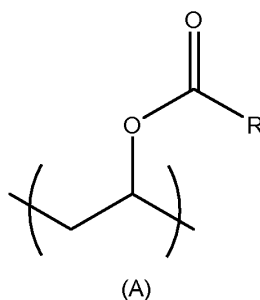
wherein R is an alkyl group and each of R^1 and R^2 is an alkyl group.

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4. A middle distillate fuel composition comprising:

- (a) a nitrogen-containing dispersant;
- (b) one or more low temperature property enhancers which are not fumarate vinyl ester copolymers and which are selected from (x) wax antissettling additives; (y) middle distillate flow improvers and mixtures thereof; and
- (c) a copolymer comprising units of formula (A):

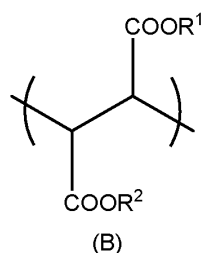
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(A)

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and units of formula (B):



wherein R is an alkyl group and each of R¹ and R² is an alkyl group.

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5. A method, use or composition according to any preceding claim wherein additive (c) is prepared by copolymerising vinyl ester monomers and dialkyl fumarate monomers.

6. A method, use or composition according to any preceding claim wherein R is methyl.

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7. A method, use or composition according to any preceding claim wherein each of R¹ and R² is an alkyl group having less than 18 carbon atoms.

8. A method, use or composition according to any preceding claim wherein component (a) is selected from

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(i) a quaternary ammonium salt additive;

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

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(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;

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

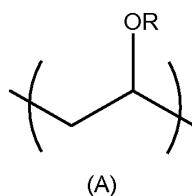
(vi) the reaction product of a hydrocarbyl-substituted dicarboxylic acid or anhydride and an amine compound or salt which product comprises at least one amino triazole group; and

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(vii) a polyalkylene substituted amine.

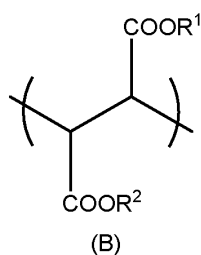
9. A method, use or composition according to any preceding claim wherein component (a) is selected from
- 5 (i) a quaternary ammonium salt additive;
- (ii) the product of a Mannich reaction between an aldehyde, an amine and an optionally substituted phenol; and
- 10 (iii) the reaction product of a carboxylic acid-derived acylating agent and an amine.
10. A method, use or composition according to any preceding claim wherein component (a) is selected from one or more of
- 15 - a quaternary ammonium salt additive formed by reacting methyl salicylate or dimethyl oxalate with the reaction product of a polyisobutylene-substituted succinic anhydride having a PIB number average molecular weight of 700 to 1300 and dimethylaminopropylamine;
- the Mannich reaction product of dodecylphenol, formaldehyde and either ethylene diamine or tetraethylpentamine; and
- 20 - the reaction product of a polyisobutenyl substituted succinic acid/anhydride having a PIB molecular weight (Mn) of 500 to 1300 and a polyethylene polyamine having 1 to 9 amino groups and 1 to 8 ethylene groups.
11. A method, use or composition according to any preceding claim wherein component (b) comprises at least one wax antisetling additive (x) and at least one middle distillate flow improver (y).
- 25 12. A method, use or composition according to any preceding claim wherein component (b) comprises a wax antisetling additive (x) which is the reaction product of (I) a compound containing the segment $-NR^3R^4$ where R^3 represents a group containing from 4 to 44 carbon atoms and R^4 represents a hydrogen atom or a group R^3 , and (II) a carboxylic acid having from 1 to 4 carboxylic acid groups or a reactive equivalent thereof.
- 30 13. A method, use or composition according to any preceding claim wherein component (b) comprises a wax antisetling additive (x) which is the reaction product of di(hydrogenated) tallow amine (I) and phthalic acid or its acid anhydride (II).
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14. A method, use or composition according to any preceding claim wherein component (b) comprises a middle distillate flow improver (y) which is a copolymer of ethylene and an olefinically unsaturated compound.
- 5 15. A method, use or composition according to any preceding claim wherein component (b) comprises a middle distillate flow improver (y) which, in addition to ethylene, contains 1 to 23 mol %, of olefinically unsaturated compounds as co-monomers.
- 10 16. The use of an additive (c) which is a copolymer comprising units of formula (A):



and units of formula (B):

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- 20 wherein R is an alkyl group and each of R¹ and R² is an alkyl group; to ameliorate an antagonistic interaction in a middle distillate fuel composition between (a) a nitrogen-containing dispersant; and (b) one or more low temperature property enhancers which are not fumarate vinyl ester copolymers and which are selected from (x) wax antissettling additives; (y) middle distillate flow improvers and mixtures thereof.