THAT WHICH IS CLAIMED IS:

1. A diesel fuel additive composition comprising:

a reaction product of (a) a hydrocarbyl-substituted acylating agent and (b) a reactant selected from the group consisting of ethylenediamine, diethylene triamine, triethylene tetramine, tetraethylene pentamine, pentaethylene hexamine, ammonia, aminoguanidine bicarbonate, guanidine, piperazine, methylpiperazine, amino-pyrimidine, aminotriazole, and aminotetrazole, C_2-C_3-alkanolamines, N-ethanol-ethylenediamine, hydroxyethyl pyridine~~a nitrogen-containing compound, a hydroxyl-containing compound~~, and water that provides a reaction product selected from the group consisting (1) a mono-amide/mono-acid or metal free mono-acid salt thereof, and (2) ~~a diacid or metal free diacid salt thereof, and (3)~~ mono-ester/mono-acid or metal free mono-acid salt thereof,

wherein the reaction product includes at least ~~about~~ 10 molar percent acid groups based on total moles of the reaction product.

2. The diesel fuel additive composition of claim 1, wherein reactant (b)~~the nitrogen-containing compound~~ is selected from the group consisting of ethylenediamine, diethylene triamine, triethylene tetramine, tetraethylene pentamine, pentaethylene hexamine~~a polyamine~~, ammonia, ~~hydrazine,~~ aminoguanidine bicarbonate, guanidine, piperazine, ~~and~~ methylpiperazine~~derivatives~~, amino-pyrimidine, aminotriazole, and aminotetrazole.

3. The diesel fuel additive composition of claim 1, wherein the hydrocarbyl-substituted acylating agent is selected from the group consisting of hydrocarbyl-substituted malonic anhydride, hydrocarbyl-substituted succinic anhydride, and hydrocarbyl-substituted glutaric anhydride.

4. The diesel fuel additive composition of claim 1, wherein the hydrocarbyl-substituted acylating agent comprises polyisobutenyl-substituted succinic anhydride.

5. The diesel fuel additive composition of claim 1, wherein the hydrocarbyl-substituted acylating agent comprises a C_{14} to C_{28} alkenyl-substituted succinic anhydride.

6. The diesel fuel additive composition of claim 1, wherein the reaction product is derived from not more than ~~about~~ one equivalent of reactant (b) per hydrocarbyl-substituted acylating agent.

~~7. The diesel fuel additive composition of claim 1, wherein the hydroxyl-containing compound is selected from the group consisting of alkanolamines, hydroxyalkyl pyridines, and alcohols.~~

~~8~~7. The diesel fuel additive composition of claim 1, wherein the reaction product contains less than ~~about~~ 60 molar percent of an imide based on total moles of the reaction product.

~~9~~8. A low sulfur diesel fuel comprising the diesel fuel additive composition of claim 1.

~~10~~9. A method for improving the performance of an engine combusting a diesel fuel having 50 ppm by weight or less sulfur, said method comprising:

combining a low sulfur middle distillate fuel with a fuel additive comprising a reaction product of (a) a hydrocarbyl-substituted acylating agent and (b) a reactant selected from the group consisting of ethylenediamine, diethylene triamine, triethylene tetramine, tetraethylene pentamine, pentaethylene hexamine, ammonia, aminoguanidine bicarbonate, guanidine, piperazine, methylpiperazine, amino-pyrimidine, aminotriazole, and aminotetrazole, C_2-C_3-alkanolamines, N-ethanol-ethylenediamine, hydroxyethyl pyridine~~a nitrogen-containing compound, a hydroxyl-containing compound~~, and water that provides a reaction product selected from the group consisting (1) a mono-amide/mono-acid or metal free mono-acid salt thereof, and (2) ~~a diacid or metal free diacid salt thereof, and (3)~~ mono-ester/mono-acid or metal free mono-acid salt thereof, wherein the reaction product includes at least ~~about~~ 10 molar percent acid groups based on total moles of the reaction product; and

combusting the additized fuel in the engine, whereby the performance of the engine is improved relative to the performance of the engine in the absence of the fuel additive.

~~11~~10. The method of claim ~~10~~9, wherein reactant (b) ~~the nitrogen-containing compound~~ is selected from the group consisting of ethylenediamine, diethylene triamine, triethylene tetramine, tetraethylene pentamine, pentaethylene hexamine~~polyamine~~, ammonia, ~~hydrazine,~~ aminoguanidine bicarbonate, guanidine, piperazine, ~~and~~ methylpiperazine~~ derivatives~~, amino-pyrimidine, aminotriazole, and aminotetrazole.

~~12~~11. The method of claim ~~10~~9, wherein the hydrocarbyl-substituted acylating agent is selected from the group consisting of hydrocarbyl-substituted malonic anhydride, hydrocarbyl-substituted succinic anhydride, and hydrocarbyl-substituted glutaric anhydride.

~~13~~12. The method of claim ~~10~~9, wherein the hydrocarbyl-substituted acylating agent comprises polyisobutenyl-substituted succinic anhydride.

~~14~~13. The method of claim ~~10~~9, wherein the hydrocarbyl-subsituted acylating agent comprises a C_{14} to C_{28} alkenyl-substituted succinic anhydride.

~~15~~14. The method of claim ~~10~~9, wherein the reaction product is derived from no more than ~~about~~ one equivalent of reactant (b) per hydrocarbyl-substituted acylating agent.

~~16. The method of claim 10, wherein the hydroxyl-containing compound is selected from the group consisting of alkanolamines, hydroxyalkyl pyridines, and alcohols.~~

~~17~~15. A low sulfur diesel fuel composition suitable for a high pressure compression ignition engine, comprising:

a) a major amount of low sulfur diesel fuel, and

b) a minor amount of additive for reducing injector and fuel system deposits, the additive comprising:

a reaction product of (i) a hydrocarbyl-substituted acylating agent and (ii) a reactant selected from the group consisting of ethylenediamine, diethylene triamine, triethylene tetramine, tetraethylene pentamine, pentaethylene hexamine, ammonia, aminoguanidine bicarbonate, guanidine, piperazine, methylpiperazine, amino-pyrimidine, aminotriazole, and aminotetrazole, C_2-C_3-alkanolamines, N-ethanol-ethylenediamine, hydroxyethyl pyridine~~a nitrogen-containing compound, a hydroxyl-containing compound~~, and water that provides a reaction product selected from the group consisting (1) a mono-amide/mono-acid or metal free mono-acid salt thereof, (2) ~~a diacid or metal free diacid salt thereof, and (3)~~ mono-ester/mono-acid or metal free mono-acid salt thereof,

wherein the reaction product includes at least ~~about~~ 10 molar percent acid groups based on total moles of the reaction product.

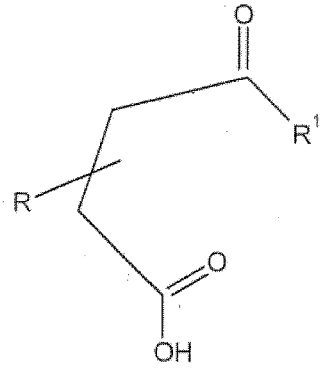
~~18~~16. The diesel fuel composition of claim ~~17~~15, wherein reactant (ii)~~the nitrogen-containing compound~~ is selected from the group consisting of ethylenediamine, diethylene triamine, triethylene tetramine, tetraethylene pentamine, pentaethylene hexamine~~a polyamine~~, ammonia, ~~hydrazine,~~ aminoguanidine bicarbonate, guanidine, piperazine, ~~and~~ methylpiperazine ~~derivatives~~, amino-pyrimidine, aminotriazole, and aminotetrazole.

~~19~~17. The diesel fuel composition of claim ~~17~~15, wherein the reaction product is derived from not more than ~~about~~ one equivalent of reactant (~~b~~ii) per hydrocarbyl-substituted acylating agent.

~~20. The diesel fuel composition of claim 17, wherein the hydroxyl-containing compound is selected from the group consisting of alkanolamines, hydroxyalkyl pyridines, and alcohols.~~

~~21~~18. The diesel fuel composition of claim ~~17~~15, wherein the reaction product contains less than ~~about~~ 60 percent by weight of an imide based on a total weight of the reaction product.

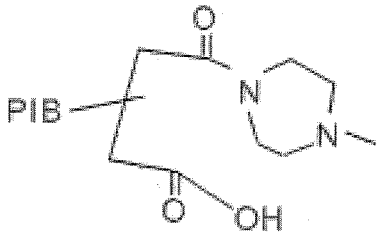
~~22~~19. The diesel fuel composition of claim ~~17~~15, wherein the reaction product comprises at least one compound of the formula (1):



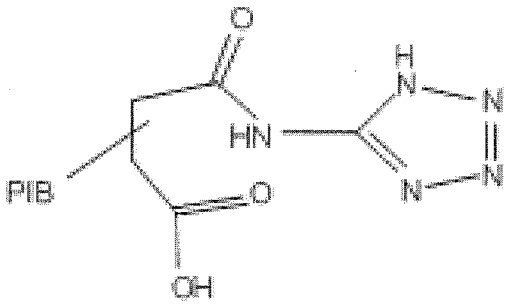
(1)

and ammonia or amine salts thereof, wherein R represents a hydrocarbyl group having 10 or more carbon atoms and R^1 represents ~~OH,~~ an alkoxy group, an amine, a polyamine, or an alkoxyamine moiety~~, provided that R has more than 12 carbon atoms when R^1 is OH~~.

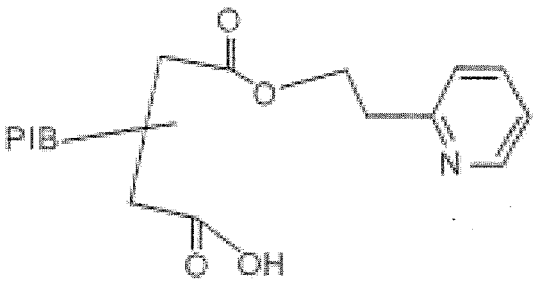
~~23~~20. The diesel fuel composition of claim ~~22~~19, wherein the compound of formula (1) is selected from the group consisting of:



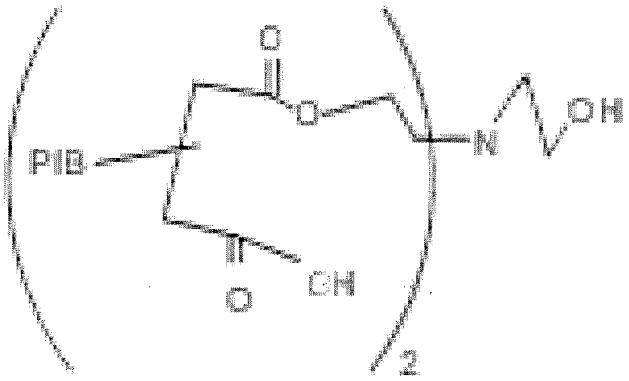
(2)



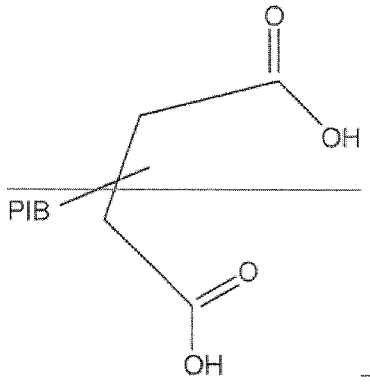
(3);



(4);



(5);



(6).

wherein PIB is a polyisobutylene group.

~~24~~21. A method for increasing fuel economy of a vehicle, comprising combusting the diesel fuel composition of claim ~~17~~15 wherein said fuel economy increase is defined by power recovery, and said power recovery is greater than 50 % as determined by the formula

$$\text{Power recovery} = (DU-CU)/DU$$

where~~in~~ DU is a percent power loss during a dirty-up phase without the additive, CU is the percent power loss during a clean-up phase with the fuel additive, and power is measured according to a Coordinating European Council (CEC) F98-08 DW10 test.

~~25~~22. The method of claim ~~24~~21 wherein the power recovery is greater than ~~about~~ 50%.