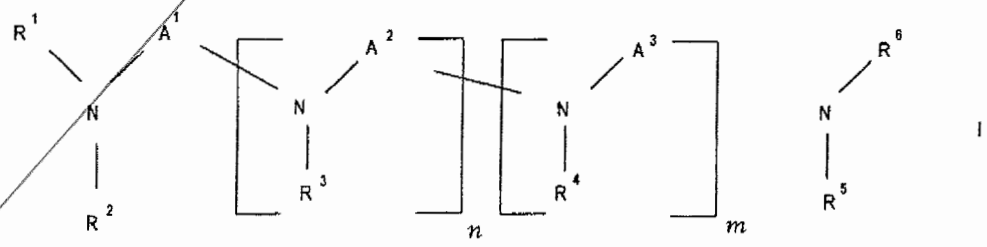
CLAIMS:

1. A method for improving the resistance to one or more of corrosion, oxidation, sludge and deposit formation of lubricating oil used to lubricate engines run on biodiesel fuel comprising adding to the lubricating oil an additive amount of a premix of one or more organic bases, one or more detergents and one or more anti-oxidants.

2. A method for improving the resistance to one or more of corrosion, oxidation, sludge and deposit formation of lubricating oil used to lubricate engines run on biodiesel fuel comprising adding to the biodiesel fuel an additive amount of a premix one or more organic bases, one or more detergents and one or more anti-oxidants.

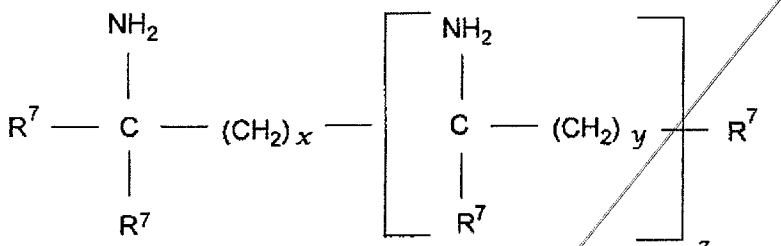
3. A method for improving the resistance to oxidation of biodiesel fuel by adding to the biodiesel fuel an additive amount of a premix of one or more organic bases, one or more detergents and one or more anti-oxidants.

4. The method of claim 1 or 2 wherein the organic base is selected from nitrogen-containing bases of the formula:



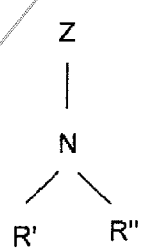
I

~~wherein R^1 to R^6 is a C_1 to C_{30} alkyl group, C_5 to C_8 cycloalkyl group, C_1 to C_{20}~~ alkylcarboxyl group or C_2 to C_8 cyano-alkyl group, A^1 to A^3 are C_2 to C_{12} alkylene group and/or C_6 to C_{12} arylene group, and n and m are numbers ranging from 0 to 30;



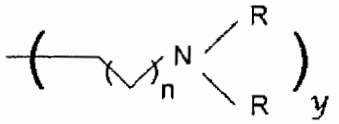
II

wherein R^7 are the same or different on each molecule and are selected from C^1 to C^{10} alkyl, C^5 to C^{10} cycloalkyl, C^7 to C^{10} aryl, C^7 to C^{10} aryl alkyl, C^7 to C^{10} alkylaryl and x is an integer from 0 to 20, y is an integer from 0 to 20 and z is an integer from 0 to 20;



III

wherein R′ and R′′ are the same or different C_1 to C_{30} alkyl, C_3 to C_{30} branched, C_3 to C_{30} unsaturated alkyl, C_6 to C_{30} aryl, C_7 to C_{30} arylalkyl, C_7 to C_{20} alkylaryl, C_5 to C_{30} cycloalkyl or polycycloalkyl, C_5 to C_{30} poly alkyl; and Z can ~~be R or:~~



IV

wherein N can be 1-6 and y can be 1-6 and mixtures thereof.

5. The method of claim 1, 2 or 3 wherein the detergent is selected from alkali, alkaline earth metal or hydrocarbyl-substituted salicylates, phenates, sulfonates, stearates, naphthanates, carboxylates and mixtures thereof.

6. The method of claim 1, 2 or 3 wherein the anti-oxidant is selected from one or more hindered phenolic anti-oxidants, hindered aminic anti-oxidants and oil-soluble metal complex anti-oxidants.

7. The method of claim 1, 2 or 3 wherein the premix contains the organic base, the anti-oxidant and the detergent in a weight ratio of 0.5-10:0.5-10:2-80.

8. The method of claim 4 wherein the premix contains the organic base, the anti-oxidant and the detergent in a weight ratio of 0.5-10:0.5-40:2-80.

9. The method of claim 5 wherein the premix contains the organic base, the anti-oxidant and the detergent in a weight ratio of 0.5-10:0.5-10:2-80.

10. The method of claim 6 wherein the premix contains the organic base, the anti-oxidant and the detergent in a weight ratio of 0.5-10:0.5-10:2-80.

11. The method of claim 1 wherein the premix is added to the lubricating oil in an amount in the range 0.5 to 20 wt% based on the total weight of the lubricating oil.

12. The method of claim 2 wherein the premix is added to the biodiesel fuel in an amount in the range 0.1 to 7 wt% based on the total weight of the biodiesel fuel plus additives.

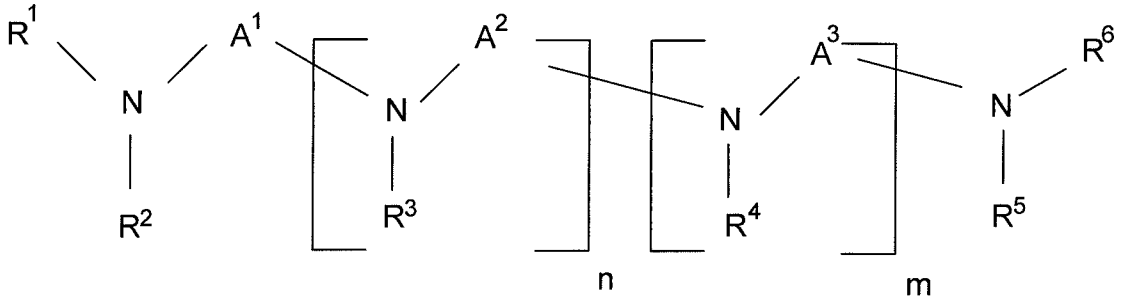
13. The method of claim 3 wherein the premix is added to the biodiesel fuel in an amount in the range 0.1 to 7 wt% based on the total weight of the biodiesel fuel plus additive.

14. An additive premix comprising a combination of one or more organic bases, one or more detergents and one or more anti-oxidants in a weigh ratio of 0.5-10:0.5-10:2-80.

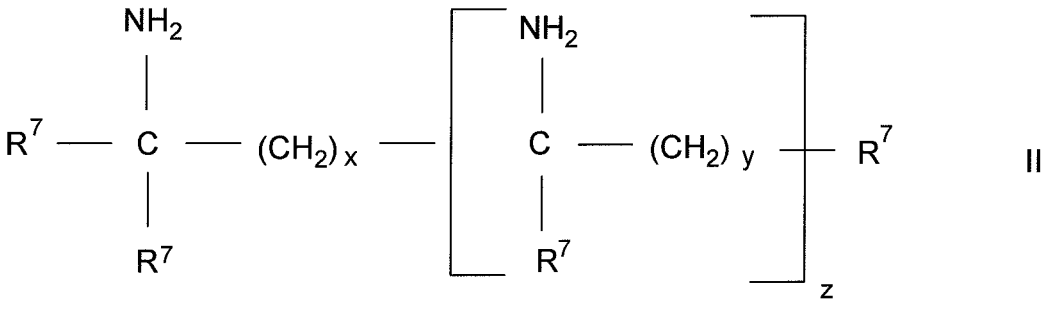
CLAIMS:

1. A method for improving the resistance to one or more of corrosion, oxidation, sludge and deposit formation of lubricating oil used to lubricate engines run on biodiesel fuel comprising adding to the lubricating oil an additive amount of a premix of one or more organic bases, one or more detergents and one or more anti-oxidants,

wherein the premix is formed by weighing and adding either sequentially or simultaneously to a stirred heat vessel at 40 to 160°C the one or more organic bases, the one or more detergents and the one or more anti-oxidants, and mixing in said stirred heat vessel for a time from 30 to 500 minutes wherein the organic base is selected from nitrogen-containing bases of the formula:

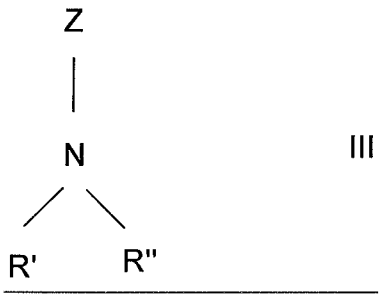


wherein R^1 to R^6 is a H, C_1 to C_{30} alkyl group, C_3 to C_8 cycloalkyl group, C_1 to C_{20} alkylcarboxyl group or C_2 to C_8 cyano-alkyl group, A^1 to A^3 are C_2 to C_{12} alkylene group and/or C_6 to C_{12} arylene group, and *n* and *m* are numbers ranging from 0 to 30;



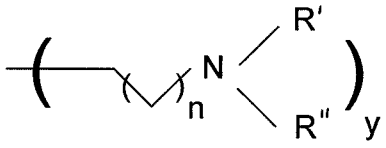
II

wherein R^7 are the same or different on each molecule and are selected from C_1 to C_{10} alkyl, C_5 to C_{10} cycloalkyl, C_7 to C_{10} aryl, C_7 to C_{10} aryl alkyl, C_7 to C_{10} alkylaryl and *x* is an integer from 0 to 20, *y* is an integer from 0 to 20 and *z* is an integer from 0 to 20;



III

wherein R′ and R′′ are the same or different C_1 to C_{30} alkyl, C_3 to C_{30} branched, C_3 to C_{30} unsaturated alkyl, C_6 to C_{30} aryl, C_7 to C_{30} arylalkyl, C_7 to C_{20} alkylaryl, C_5 to C_{30} cycloalkyl or polycycloalkyl, C_5 to C_{30} poly alkyl; and Z can be the following structure:

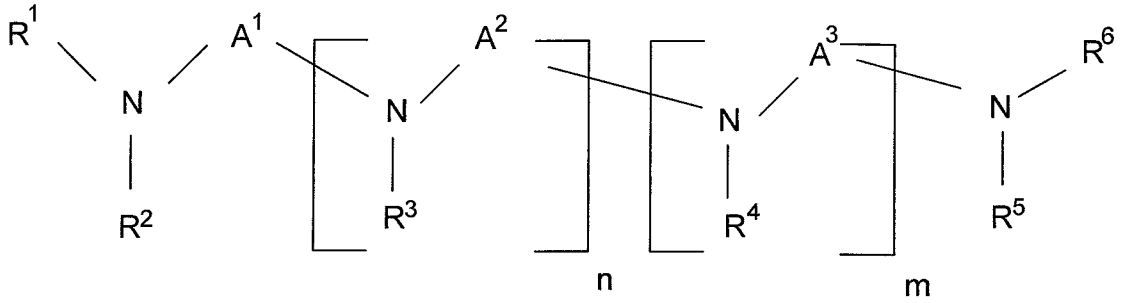


IV

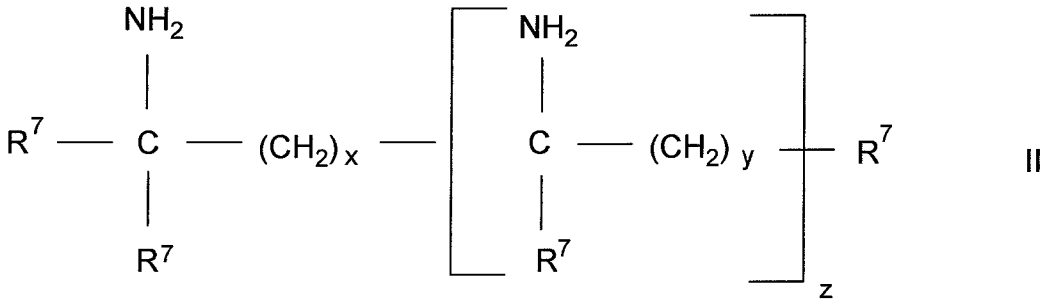
wherein N can be 1-6 and *y* can be 1-6 and mixtures thereof.

2. A method for improving the resistance to one or more of corrosion, oxidation, sludge and deposit formation of lubricating oil used to lubricate engines run on biodiesel fuel comprising adding to the biodiesel fuel an additive amount of a premix of one or more organic bases, one or more detergents and one or more anti-oxidants,

wherein the premix is formed by weighing and adding either sequentially or simultaneously to a stirred heat vessel at 40 to 160°C the one or more organic bases, the one or more detergents and the one or more anti-oxidants, and mixing in said stirred heat vessel for a time from 30 to 500 minutes wherein the organic base is selected from nitrogen-containing bases of the formula:

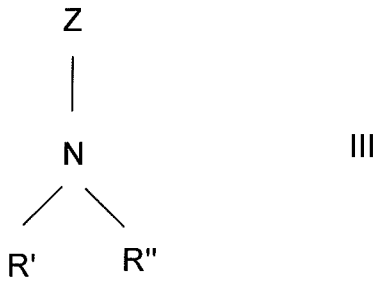


wherein R^1 to R^6 is a H, C_1 to C_{30} alkyl group, C_3 to C_8 cycloalkyl group, C_1 to C_{20} alkylcarboxyl group or C_2 to C_8 cyano-alkyl group, A^1 to A^3 are C_2 to C_{12} alkylene group and/or C_6 to C_{12} arylene group, and *n* and *m* are numbers ranging from 0 to 30;



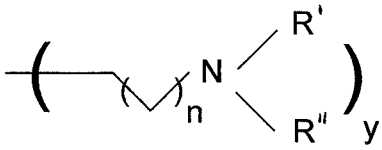
II

wherein R^7 are the same or different on each molecule and are selected from C_1 to C_{10} alkyl, C_5 to C_{10} cycloalkyl, C_7 to C_{10} aryl, C_7 to C_{10} aryl alkyl, C_7 to C_{10} alkylaryl and *x* is an integer from 0 to 20, *y* is an integer from 0 to 20 and *z* is an integer from 0 to 20;



III

wherein R´ and R´´ are the same or different C_1 to C_{30} alkyl, C_3 to C_{30} branched, C_3 to C_{30} unsaturated alkyl, C_6 to C_{30} aryl, C_7 to C_{30} arylalkyl, C_7 to C_{20} alkylaryl, C_5 to C_{30} cycloalkyl or polycycloalkyl, C_5 to C_{30} poly alkyl; and Z can be the following structure:

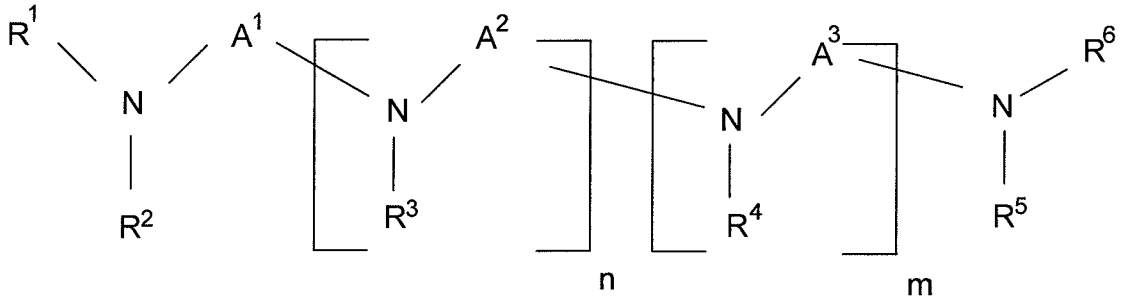


IV

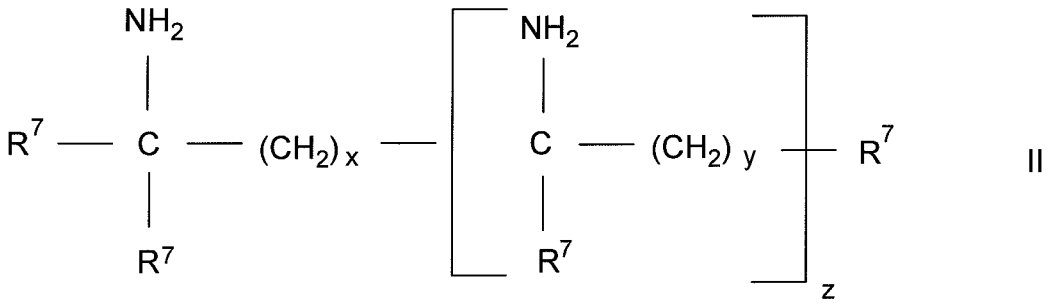
wherein N can be 1-6 and *y* can be 1-6 and mixtures thereof.

3. A method for improving the resistance to oxidation of biodiesel fuel by adding to the biodiesel fuel an additive amount of a premix of one or more organic bases, one or more detergents and one or more anti-oxidants,

wherein the premix is formed by weighing and adding either sequentially or simultaneously to a stirred heat vessel at 40 to 160°C the one or more organic bases, the one or more detergents and the one or more anti-oxidants, and mixing in said stirred heat vessel for a time from 30 to 500 minutes wherein the organic base is selected from nitrogen-containing bases of the formula:



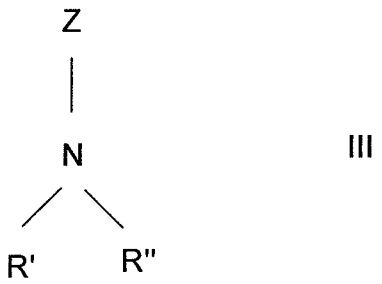
wherein R^1 to R^6 is a H, C_1 to C_{30} alkyl group, C_3 to C_8 cycloalkyl group, C_1 to C_{20} alkylcarboxyl group or C_2 to C_8 cyano-alkyl group, A^1 to A^3 are C_2 to C_{12} alkylene group and/or C_6 to C_{12} arylene group, and *n* and *m* are numbers ranging from 0 to 30;



II

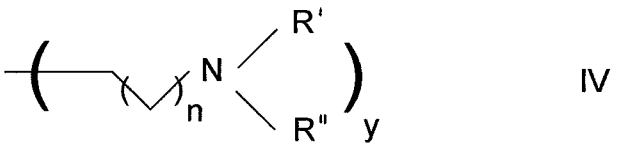
wherein R^7 are the same or different on each molecule and are selected from C_1 to C_{10} alkyl, C_5 to C_{10} cycloalkyl, C_7 to C_{10} aryl, C_7 to C_{10} aryl alkyl, C_7 to C_{10} alkylaryl and

x is an integer from 0 to 20, *y* is an integer from 0 to 20 and *z* is an integer from 0 to 20;



III

wherein R′ and R′′ are the same or different C_1 to C_{30} alkyl, C_3 to C_{30} branched, C_3 to C_{30} unsaturated alkyl, C_6 to C_{30} aryl, C_7 to C_{30} arylalkyl, C_7 to C_{20} alkylaryl, C_5 to C_{30} cycloalkyl or polycycloalkyl, C_5 to C_{30} poly alkyl; and Z can be the following structure:



IV

wherein N can be 1-6 and *y* can be 1-6 and mixtures thereof.

4. The method of claim 1, 2 or 3 wherein the detergent is selected from alkali, alkaline earth metal or hydrocarbyl-substituted salicylates, phenates, sulfonates, stearates, naphthanates, carboxylates and mixtures thereof.

5. The method of claim 1, 2 or 3 wherein the anti-oxidant is selected from one or more hindered phenolic anti-oxidants, hindered aminic anti-oxidants and oil-soluble metal complex anti-oxidants.

6. The method of claim 1, 2 or 3 wherein the premix contains the organic base, the anti-oxidant and the detergent in a weight ratio of 0.5-10:0.5-10:2-80.

7. The method of claim 1 or 2 wherein the premix contains the organic base, the anti-oxidant and the detergent in a weight ratio of 0.5-10:0.5-40:2-80.

8. The method of claim 4 wherein the premix contains the organic base, the anti-oxidant and the detergent in a weight ratio of 0.5-10:0.5-10:2-80.

9. The method of claim 5 wherein the premix contains the organic base, the anti-oxidant and the detergent in a weight ratio of 0.5-10:0.5-10:2-80.

10. The method of claim 1 wherein the premix is added to the lubricating oil in an amount in the range 0.5 to 20 wt% based on the total weight of the lubricating oil.

11. The method of claim 2 wherein the premix is added to the biodiesel fuel in an amount in the range 0.1 to 7 wt% based on the total weight of the biodiesel fuel plus additives.

12. The method of claim 3 wherein the premix is added to the biodiesel fuel in an amount in the range 0.1 to 7 wt% based on the total weight of the biodiesel fuel plus additive.