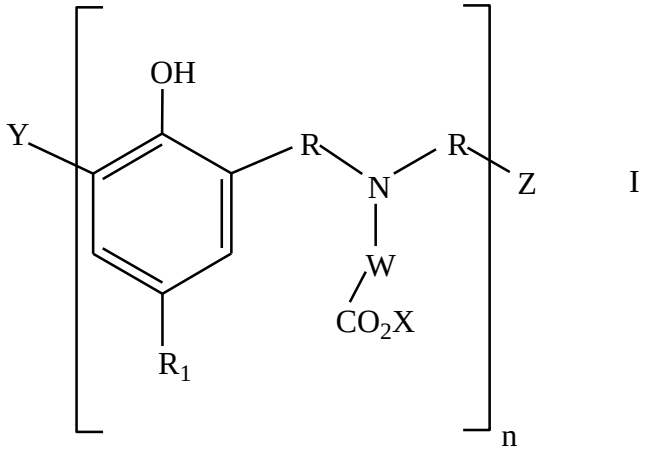
CLAIMS

What is claimed is:

1. A lubricating oil composition contaminated with at least about 0.3 wt% of a biodiesel, based on the total weight of the lubricating oil composition, wherein the lubricating oil composition comprises:

a. at least 40 wt% of a base oil of lubricating viscosity by weight of the lubricating oil composition; and

b. a Mannich condensation product, wherein the Mannich condensation product is of the formula 7



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Formula 7

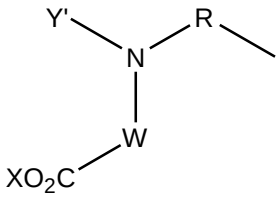
wherein each R is independently -CHR'-, wherein R' is branched or linear alkyl having one to 10 carbon atoms, cycloalkyl having from 3 carbon atoms to 10 carbon atoms, aryl having from 6 carbon atoms to 10 carbon atoms, alkaryl having from 7 carbon atoms to 20 carbon atoms, or aralkyl having from 7 carbon atoms to 20 carbon atoms, R_1 is a polyisobutyl group derived from polyisobutene containing at least about 70 wt. % methylvinylidene isomer and having a number average molecular weight in the range of about 400 to about 2,500;

X is hydrogen, an alkali metal ion, or alkyl having one carbon atom to 6 carbon atoms;

W is $-[CHR'']-_m$, wherein each R'' is independently H, alkyl having one carbon atom to 15 carbon atoms, or a substituted-alkyl having one carbon atom to 10 carbon atoms and one or more substituents selected from the group consisting of amino, amido, benzyl, carboxyl, hydroxyl, hydroxyphenyl, imidazolyl, imino, phenyl, sulfide, or thiol; and m is an integer from one to 4;

Y is hydrogen, alkyl having one carbon atom to about 10 carbon atoms, -CHR'OH, wherein R' is as defined above,

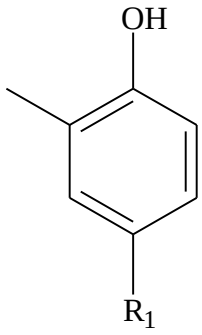
or of formula 8:



Formula 8

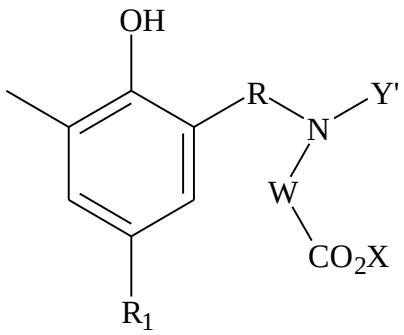
wherein Y' is -CHR'OH, wherein R' is as defined above; and R, X, and W are as defined above;

Z is hydroxyl, a hydroxyphenyl group of the formula 9:



Formula 9

or of formula 10:



Formula 10

wherein R, R_1, Y', X, and W are as defined above,

and n is an integer from 0 to 20, with the proviso that when n = 0, Z must be of formula 10 as defined above.

2. The lubricating oil composition of Claim 1, wherein the Mannich condensation product is prepared by the condensation of:

a. a polyisobutyl-substituted hydroxyaromatic compound, wherein the polyisobutyl group is derived from polyisobutene containing at least about 70 wt. % methylvinylidene isomer and has a number average molecular weight of from about 400 to about 2,500,

b. an aldehyde,

c. an amino acid or ester derivative thereof, and

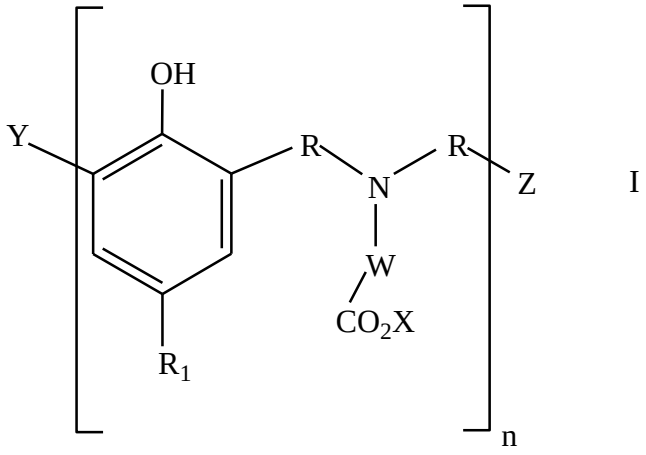
d. an alkali metal base.

3. The lubricating oil composition of Claim 2, wherein the aldehyde is formaldehyde or paraformaldehyde, the alkali metal base is an alkali metal hydroxide and the amino acid is glycine.

4. The lubricating oil composition of Claim 1 further comprising at least one dispersant.
5. The lubricating oil composition of Claim 4, wherein the dispersant is post-treated.
6. The lubricating oil of claim 4, wherein the dispersant is a polysuccinimide.
7. The lubricating oil composition of Claim 1 further comprising at least one additive selected from the group consisting of antioxidants, antiwear agents, detergents, rust inhibitors, demulsifiers, friction modifiers, multi-functional additives, visosity index improvers, pour point depressants, foam inhibitors, metal deactivators, dispersants, corrosion inhibitors, lubricity improvers, thermal stability improvers, anti-haze additives, icing inhibitors, dyes, markers, static dissipaters, biocides and combinations thereof.
8. The lubricating oil composition of Claim 1, wherein the sulfated ash content of the lubricating oil composition is at most 2.0 wt.%, based on the total weight of the lubricating oil composition.
9. The lubricating oil composition of Claim 1, wherein the biodiesel fuel comprises an alkyl ester of a long chain fatty acid, wherein the long chain fatty acid comprises from 12 carbon atoms to 30 carbon atoms.
10. The lubricating oil composition of Claim 1, wherein the amount of the biodiesel fuel or decomposition products thereof is present in the lubricating oil composition at from 0.3 wt.% to 20 wt.%, based on the total weight of the lubricating oil composition.
11. The lubricating oil composition of Claim 1, wherein the base oil has a kinematic viscosity from 4 cSt to 20 cSt at 100 °C.
12. A method of lubricating a diesel engine fueled at least in part with a biodiesel fuel which comprises operating the engine with a lubricating oil composition contaminated with at least about 0.3 wt% of a biodiesel fuel, based on the total weight of the lubricating oil composition, wherein the lubricating oil composition comprises:

    a. a at least 40 wt% of a of base oil of lubricating viscosity by weight of the lubricating oil composition; and

    b. a Mannich condensation product, wherein the Mannich condensation product is of the formula 7



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X is hydrogen, an alkali metal ion, or alkyl having one carbon atom to 6 carbon atoms;

W is –[CHR'']-$_m$, wherein each R'' is independently H, alkyl having one carbon atom to 15 carbon atoms, or a substituted-alkyl having one carbon atom to 10 carbon atoms and one or more substituents selected from the group consisting of amino, amido, benzyl, carboxyl, hydroxyl, hydroxyphenyl, imidazolyl, imino, phenyl, sulfide, or thiol; and m is an integer from one to 4;

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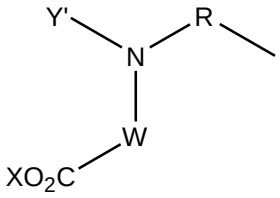

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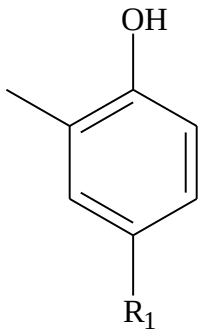
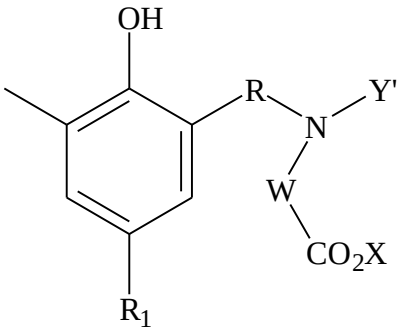


Formula 9

or of formula 10:



Formula 10

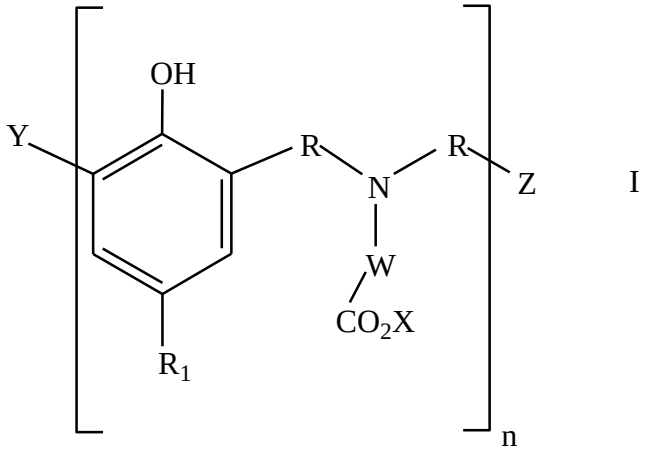
wherein R, R_1, Y', X, and W are as defined above,

and n is an integer from 0 to 20, with the proviso that when n = 0, Z must be of formula 10 as defined above.

13. A method of inhibiting viscosity increase in a diesel engine fueled at least in part figwith a biodiesel fuel which comprises operating the engine with a lubricating oil composition contaminated with at least about 0.3 wt% of a biodiesel fuel, based on the total weight of the lubricating oil composition, wherein the lubricating oil composition comprises:

a. at least 40 wt% of a base oil of lubricating viscosity by weight of the lubricating oil composition; and

b. a Mannich condensation product, wherein the Mannich condensation product is of the formula 7



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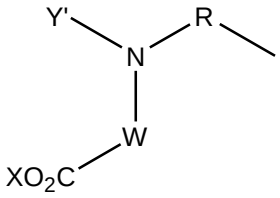

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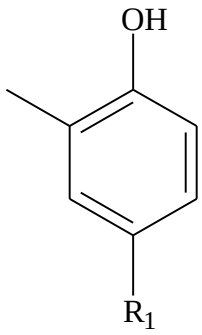

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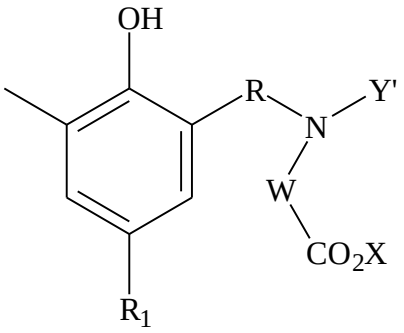

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wherein R, R_1, Y', X, and W are as defined above,

and n is an integer from 0 to 20, with the proviso that when n = 0, Z must be of formula 10 as defined above.

14. Use of the Mannich condensation product in the lubricating oil composition according to any one of claims 1 to 11 to prevent or inhibit viscosity increase of the lubricating oil composition.