SUMMARY OF THE ~~INVENTION~~DISCLOSURE

The present ~~invention~~disclosure is directed to a method for preparing an unsulfurized, carboxylate-containing additive for lubricating oils, said method comprising:

a) neutralization of a mixture of at least two alkyl phenols using an alkaline earth base in the presence of a promoter, to produce a mixture of alkyl phenates, wherein the mixture of at least two alkyl phenols comprises at least a first alkyl phenol wherein the alkyl group is derived from an isomerized alpha olefin and a second alkyl phenol wherein the alkyl group is derived from a branched chain olefin;

(b) carboxylation of the mixture of alkyl phenates obtained in step (a) using carbon dioxide under carboxylation conditions sufficient to convert at least 20 mole% of the starting alkyl phenols to alkyl salicylate; and

(c) removal of at least about 10% of the starting mixture of at least two alkyl phenols from the product produced in step (b) to produce said additive.

In a first aspect, there is provided a lubricating oil additive produced by the method as defined above.

In a second aspect, there is provided a lubricating oil composition comprising; (a) a major part of a base oil of lubricating viscosity; and (b) from about 1% to about 30% of the lubricating oil additive as defined above.

In a third aspect, there is provided a concentrate comprising: (a) from 20% to 80% of an organic diluent; and (b) the lubricating oil additive as defined above.

In a fourth aspect, there is provided an additive package comprising the lubricating oil additive as defined above and further comprising at least one of the following: (a) a metal-containing detergent; (b) an ashless dispersant; (c) an oxidation inhibitor; (d) a rust inhibitor; (e) a demulsifier; (f) an extreme pressure agent; (g) a friction modifier; (h) a multifunctional additive; (i) a viscosity index improver; (j) a pour point depressant; and (k) a foam inhibitor.

DETAILED DESCRIPTION OF THE INVENTION

In its broadest aspect, the present invention provides an unsulfurized, carboxylate-containing additive comprising alkyl phenol, alkaline earth metal alkyl phenate, and alkaline earth metal single-aromatic-ring alkyl salicylate useful for improving low temperature performance, BN retention, corrosion performance, bulk oxidation, high temperature deposit control, black sludge control, thermal oxidation stability, and other properties of a lubricating oil.

7. The method of Claim 6 wherein the branched chain olefin is a propylene oligomer having from about 9 to 18 carbon atoms.

8. The method of Claim 7 wherein the propylene oligomer is a propylene tetramer.

9. The method of Claim 6 wherein the branched chain olefin is a butylene oligomer having from about 8 to about 24 carbon atoms.

10. The method of Claim 5 wherein the branched chain olefin is derived from a highly isomerized normal alpha olefin.

11. The method of Claim 10 wherein the highly isomerized normal alpha olefin has from about 10 to18 carbon atoms and 60-80 wt% branching.

12. The method of Claim 1 wherein the alkyl group on the first alkylphenol is derived from an isomerized alpha olefin having 15 – 80 wt% branching and from about 20 to 28 carbon atoms.

13. The method of Claim 12 wherein the alkyl group on the first alkylphenol is derived from an isomerized alpha olefin having from about 20 to 24 carbon atoms.

14. The method of Claim 12 wherein the alkyl group on the first alkylphenol is derived from an isomerized alpha olefin having 20-50 wt% branching and from about 20 to 28 carbon atoms.

15. The method of Claim 1, wherein said alkyl salicylate comprises single-aromatic-ring alkyl salicylate and double-aromatic-ring alkyl salicylate wherein the mole ratio of single aromatic-ring alkyl salicylate to double-aromatic-ring alkyl salicylate is at least 8:1.

16. The method of Claim 1, wherein, in said removal step (c), at least about 30% of the starting alkyl phenols is removed from the product produced in step (b) to produce said additive.

17. The method of Claim 1, wherein, in said removal step (c), said starting alkyl phenols are removed by distillation.

18. The method of Claim 17, wherein said distillation is carried out at temperatures ranging from about 150°C to about 250 °C and at pressures from about 0.1 to about 4 mbar.

19. The method of Claim 18, wherein said distillation is carried out at temperatures ranging from about 190°C to about 230°C and at pressures from about 0.5 to about 3 mbar.

20. The method of Claim 1, wherein, in said neutralization step; (a) said neutralization operation is carried out in the presence of at least one carboxylic acid containing from one to four carbon atoms, and in the absence of alkali base, dialcohol, and monoalcohol; and (b) said neutralization operation is carried out at a temperature of at least 200°C; (c) the pressure is reduced gradually below atmospheric in order to remove the water of reaction, in the absence of any solvent that may form an azeotrope with water; (d) said alkyl phenols contain up to 85% of linear alkyl phenol in mixture with at least 15% of branched alkyl phenol in which the branched alkyl radical contains at least nine carbon atoms; and (e) the quantities of reagents used correspond to the following molar ratios: (1) alkaline earth base/alkyl phenol of 02:1 to 0.7:1; and (2) carboxylic acid/alkyl phenol of from 0.01:1 to 0.5:1.

21. A lubricating oil additive produced by the method according to Claim 1.

22. A lubricating oil composition comprising; (a) a major part of a base oil of lubricating viscosity; and (b) from about 1% to about 30% of the lubricating oil additive according to claim 21.

23~~25~~. A lubricating oil composition according to Claim 22~~24~~ wherein the lubricating oil is an automotive engine oil.

2426. A concentrate comprising: (a) from 20% to 80% of an organic diluent; and (b) the lubricating oil additive according to Claim 2123.

2527. An additive package comprising the lubricating oil additive according to Claim 2123 and further comprising at least one of the following: (a) a metal-containing detergent; (b) an ashless dispersant; (c) an oxidation inhibitor; (d) a rust inhibitor; (e) a demulsifier; (f) an extreme pressure agent; (g) a friction modifier; (h) a multifunctional additive; (i) a viscosity index improver; (j) a pour point depressant; and (k) a foam inhibitor.