CLAIMS

1. A method for reducing fouling in a hydrocarbon refining process comprising providing a crude hydrocarbon for a refining process; and adding to the hydrocarbon an additive combination comprising:

(A) a polyalkenyl-substituted carboxylic acid or anhydride, and
(B) an overbased metal hydrocarbyl-substituted hydroxybenzoate detergent dispersed in diluent,

where the mass:mass ratio of (A) to (B) is in the range of 10:1 to 1:10, preferably 3:1 to 1:3, and the treat rate of the additive combination is in the range of 5 to 1000 ppm by mass.

2. The method of claim 1 where, in (A), the polyalkenyl substiuent has from 8 to 400, preferably 12 to 100, more preferably 16 to 64, carbon atoms.

3. The method of claim 1 or claim 2 where, in (A), the polyalkenyl substituent has a number average molecular weight of from 350 to 1000, preferably from 500 to 1000.

4. The method of any of claims 1 to 3 where (A) is a succinic acid anhydride.

5. The method of claim 4 where (A) is a polyisobutene succinic acid anhydride.

6. The method of any of claims 1 to 5 where, in (B), the metal is calcium.

7. The method of any of claims 1 to 6 where, in (B), the hydrocarbyl-substituted hydroxybenzoate is a salicylate.

8. The method of any of claims 1 to 7 where, in (B), the hydrocarbyl group has from 8 to 400, preferably 12 to 100, more preferably 16 to 64, carbon atoms.

9. The method of any of claims 1 to 8 where, in (B), the detergent has a TBN in the range of 150 to 500.

10. The method of any of claims 1 to 9 wherein the fouling is particulate-induced fouling.

11. A system for refining hydrocarbons comprising:

(C) at least one crude hydrocarbon refinery component; and

(D) crude hydrocarbon in fluid communication with the at least one refinery component, the crude hydrocarbon containing an additive combination comprising:

(A) a polyalkenyl-substituted carboxylic acid or anhydride, and

(B) an overbased metal hydrocarbyl-substituted hydroxybenzoate detergent dispersed in diluent,

where the mass:mass ratio of (A) to (B) is in the range of 10:1 to 1:10, preferably 3:1 to 1:3, and the treat rate of the additive combination is in the range of 5 to 1000 ppm by mass..

12. The system of claim 11 where, in (A), the polyalkenyl substiuent has from 8 to 400, preferably 12 to 100, more preferably 16 to 64, carbon atoms.

13. The system of claim 11 or claim 12 where, in (A), the polyalkenyl substituent has a number average molecular weight of from 350 to 1000, preferably from 500 to 1000.

14. The system of any of claims 11 to 13 where (A) is a succinic acid anhydride.

15. The system of claim 14 where (A) is a polyisobutene succinic acid anhydride.

16. The system of any of claims 11 to 15 where, in (B), the metal is calcium.

17. The system of any of claims 11 to 16 where, in (B), the hydrocarbyl-substituted hydroxybenzoate is a salicylate.

18. The system of any of claims 11 to 17 where, in (B), the hydrocarbyl group has from 8 to 400, preferably 12 to 100, more preferably 16 to 64, carbon atoms.

19. The system of any of claims 11 to 18 where, in (B), the detergent has a TBN in the range of 150 to 500.

20. The system of claim 11 to 19 where the refinery component is selected from a heat exchanger, a furnace, a crude preheater, a coker preheater, a FCC slurry bottom, a debutaniser exchanger, a debutaniser tower, a feed/effluent exchanger, a furnace air preheater, a flare compressor, a steam cracker, a steam reformer, a distillation column, a fractionation column, a scrubber, a reactor, a liquid-jacketed tank, a pipeshill, a coker, and a visbreaker.