CLAIMS

1. A method of determining fouling potential of a hydrocarbon composition comprising:

obtaining a sample of the hydrocarbon composition;

measuring at least a first portion or a second portion of the hydrocarbon sample, the first portion and the second portion having different chemical compositions, the first portion comprising a liquid and the second portion comprising organic or inorganic solids or gels.

2. The method according to claim 1, wherein determining the fouling potential comprises separating the hydrocarbon sample into the first portion and the second portion.

3. The method according to claim 2, further comprising separating the second portion into at least a third portion and a fourth portion wherein the third portion comprises a composition soluble or dispersible in a solvent, and the fourth composition comprises a composition insoluble or undispersable in the solvent, and comparing the amount of the third portion and/or the fourth portion relative to the amount of the sample of hydrocarbon composition.

4. The method according to claim 3, wherein the second portion is separated into at least the third and the fourth portions with a solvent-based separation.

5. The method according to claim 4, wherein the second portion is separated at least into the third and the fourth portions by extraction with one or more polar or nonpolar solvents, dispersants, acids, bases, or combinations thereof.

6. The method according to claim 5, wherein the solvent comprises an aromatic hydrocarbon solvent.

7. The method according to claim 6, wherein the solvent comprises an aromatic hydrocarbon solvent selected from benzene, aromatic naphta0, alkylbenzene, or a mixture thereof.

8. The method of claim 6, wherein the alkylbenzene comprises toluene, ethylbenzene, xylenes, or a mixture thereof.

9. The method according to any of claims 1-8, further comprising analyzing the hydrocarbon sample or at least one of the portions of the hydrocarbon sample.

10. A method of reducing fouling potential in a hydrocarbon composition comprising:

obtaining a sample of the hydrocarbon composition;

determining a fouling potential by measuring at least a first portion and a second portion of the hydrocarbon sample, the first portion and the second portion having different chemical compositions, the first portion comprising a liquid and the second portion comprising organic or inorganic solids or gels; and

modifying the production, transportation, storage, processing, and/or distribution of the hydrocarbon composition to reduce fouling potential.

11. The method according to claim 10, wherein determining the fouling potential comprises separating the first portion and a second portion.

12. The method according to claim 11, further comprising separating the second portion into at least a third portion and a fourth portion wherein the third portion comprises a composition soluble or dispersible in a solvent, and the fourth composition comprises a composition insoluble or undispersable in the solvent, and comparing the amount of the third portion and/or the fourth portion relative to the amount of the sample of hydrocarbon composition.

13. The method according to claim 12, wherein the second portion is separated into at least the third and the fourth portions with a solvent-based separation.

14. The method according to claim 13, wherein the second portion is separated at least into the third and the fourth portions by extraction with one or more polar or nonpolar solvents, dispersants, acids, bases, or combinations thereof.

15. The method according to claim 14, wherein the solvent comprises an aromatic hydrocarbon solvent.

16. The method according to claim 15, wherein the solvent comprises an aromatic hydrocarbon solvent selected from benzene, aromatic naphta, alkylbenzene, or a mixture thereof.

17. The method according to claim 16, wherein the alkylbenzene comprises toluene, ethylbenzene, xylenes, or a mixture thereof.

18. The method according to any of claims 10, 11, and 12-17, further comprising analyzing the hydrocarbon sample or at least one of the portions of the hydrocarbon sample.

19. A system for using predictive analytics in control of a hydrocarbon refining process comprising:

a memory, wherein the memory stores computer-readable instructions; and

a processor communicatively coupled with the memory, wherein the processor executes the computer-readable instructions stored on the memory, the computer-readable instructions causing the processor to:

receive an analysis of a hydrocarbon sample,

develop one or more predictive models of the hydrocarbon refining process for the hydrocarbon entering the refining process based on the analysis of the crude oil; and

control aspects of the hydrocarbon refining process as the hydrocarbon entering the refining process moves through the refining process based on the one or more predictive models,

wherein the analysis is obtained by the following steps:

obtaining a sample of the hydrocarbon composition;

determining a fouling potential by measuring at least a first portion or a second portion of the hydrocarbon sample, the first portion and the second portion having different chemical compositions, the first portion comprising a liquid and the second portion comprising organic or inorganic solids or gels.

20. The system according to claim 19, wherein determining the fouling potential comprises separating the first portion and a second portion.

21. The system according to claim 20, further comprising separating the second portion into at least a third portion and a fourth portion wherein the third portion comprises a composition soluble or dispersible in a solvent, and the fourth composition comprises a composition insoluble or undispersable in the solvent, and comparing the amount of the third portion and/or the fourth portion relative to the amount of the sample of hydrocarbon composition.

22. The system according to claim 21, wherein the second portion is separated into at least the third and the fourth portions with a solvent-based separation.

23. The system according to claim 22, wherein the second portion is separated at least into the third and the fourth portions by extraction with one or more polar or nonpolar solvents, dispersants, acids, bases, or combinations thereof.

24. The system according to claim 23, wherein the solvent comprises an aromatic hydrocarbon solvent.

25. The system according to claim 24, wherein the solvent comprises an aromatic hydrocarbon solvent selected from benzene, aromatic naphta, alkylbenzene, or a mixture thereof.

26. The system according to claim 25, wherein the alkylbenzene comprises toluene, ethylbenzene, xylenes, or a mixture thereof.

27. A non-transitory, computer-readable medium storing instructions that, when executed by a computer processor, cause the computer processor to perform a method useful in a crude oil refinement process, the method comprising:

receive an analysis of a hydrocarbon sample, wherein the hydrocarbon sample is representative of an amount of hydrocarbon entering a refining process, wherein the analysis is obtained by the following steps:

obtaining a sample of the hydrocarbon composition;

determining a fouling potential by measuring at least a first portion or a second portion of the hydrocarbon sample, the first portion and the second portion having different chemical compositions, the first portion comprising a liquid and the second portion comprising organic or inorganic solids or gels;

develop one or more predictive models of the hydrocarbon refining process for the hydrocarbon entering the refining process based on the analysis of the hydrocarbon sample; and

dynamically control aspects of the hydrocarbon refining process as the hydrocarbon entering the refining process moves through the refining process based on the one or more predictive models.

28. A method of obtaining hydrocarbon composition with reduced fouling potential comprising:

obtaining a sample of two or more different hydrocarbon compositions, and for each sample,

determining a fouling potential by measuring at least a first portion or a second portion of the hydrocarbon sample, the first portion and the second portion having different chemical compositions, the first portion comprising a liquid and the second portion comprising organic or inorganic solids or gels; and

blending the two or more hydrocarbons in a ratio based on their individual fouling potentials or the fouling potential of the resulted blend to give a blended hydrocarbon composition with reduced fouling potential.

29. The method according to claim 28, wherein determining the fouling potential comprises separating the first portion and a second portion.

30. The method according to claim 29, further comprising separating the second portion into at least a third portion and a fourth portion wherein the third portion comprises a composition soluble or dispersible in a solvent, and the fourth composition comprises a composition insoluble or undispersable in the solvent, and comparing the amount of the third portion and/or the fourth portion relative to the amount of the sample of hydrocarbon composition.

31. The method according to claim 30, wherein the second portion is separated into at least the third and the fourth portions with a solvent-based separation.

32. The method according to claim 31, wherein the second portion is separated at least into the third and the fourth portions by extraction with one or more polar or nonpolar solvents, dispersants, acids, bases, or combinations thereof.

33. The method according to claim 32, wherein the solvent comprises an aromatic hydrocarbon solvent.

34. The method according to claim 33, wherein the solvent comprises an aromatic hydrocarbon solvent selected from benzene, aromatic naphta, alkylbenzene, or a mixture thereof.

35. The method according to claim 34, wherein the alkylbenzene comprises toluene, ethylbenzene, xylenes, or a mixture thereof.