CLAIMS

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

obtaining a sample of the hydrocarbon composition;

separating the hydrocarbon sample into a first portion and a second portion, wherein the separating of the hydrocarbon composition comprises filtration, electrophoresis, centrifugation, field-flow fractionation, cyclonic separation, gravimetric separation or a combination thereof;

measuring at least the first portion or the 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,

wherein the measuring comprising analyzing at least one of the portions of the hydrocarbon sample comprises fingerprinting, thermogravimetric analysis, and/or inductively coupled plasma mass spectrum analysis, wherein the measuring further comprises determining the concentration, volume, and/or mass of the first and/or second portion of the hydrocarbon sample;

and estimating the fouling potential expressed as an average fouling propensity of the hydrocarbon sample based on at least one of

Predictive Formula 1:

$$\Delta T_{ave}=a\cdot[TIS]^{b}\cdot\mu^{c}\cdot Res^{d}+f\cdot[TSS]^{g}\cdot\mu^{h}\cdot Res^{i}$$

where a~i ∈ [-1000,1000],

or Predictive Formula 2:

$$\Delta T_{ave}=a+b\cdot[TIS]+c\cdot[TCS]+d\cdot[RIX]\cdot[TCS]+e\cdot[TCS]^{f}+g\cdot RIX^{h}+i\cdot Res+j\cdot Asp+k\cdot RIX^{l}\cdot Res+m\cdot RIX^{n}\cdot Asp$$

where a~n ∈ [-1000,1000], wherein ΔT_{ave} is an average loss of heat transfer in 90 min on a Hot Liquid Process Simulator (HLPS); [TIS] is a percent fraction by volume of toluene insoluble solids, [TSS] is a percent fraction by volume of toluene soluble solids; μ is a viscosity; [Res] is a percent concentration of resins in the sample, [RIX] is a relative instability number, [TCS] is a percent fraction by volume of total centrifugal solids, and [Asp] is a percent concentration of asphaltenes in the sample; and

wherein fingerprinting comprises:

a) calibrating an instrument based on a known asphaltene concentration to determine weighting constant or equivalent;

b) applying the weighting constants or equivalent to output a signal or signals indicative of asphaltenes concentration in the hydrocarbon sample;

wherein the weighting constants or their equivalents are calculated from measuring at least one frequency in the middle infrared absorption in the band of 3800-700 cm^{-1};

wherein the first portion comprises a liquid and the second portion comprises organic or inorganic solids or gels.

2. The method according to claim 1, wherein determining the fouling potential comprises measuring the concentration of the second portion in the hydrocarbon sample.

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 2, wherein the measuring comprises microscopy, UV-vis spectroscopy, light scattering, or acoustic resonance.

5. The method according to claim 1, 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 naphta, alkylbenzene, or a mixture thereof.

8. The method of claim 7, wherein the alkylbenzene comprises toluene, ethylbenzene, xylenes, or a mixture thereof.

9. The method according to claim 1, wherein the separation comprises heating.