CLAIMS:

~~1. A method for characterizing petroleum or other hydrocarbon compositions,~~ comprising:

separating a first plurality of compounds in a first hydrocarbon sample using a first gas chromatography separation;

determining a composition and a first weight for each of the separated first plurality of compounds using mass spectrometry, the ions for mass spectrometry being formed by a soft ionization method;

separating a second plurality of compounds in a second hydrocarbon sample using a second gas chromatography separation, the second gas chromatography separation including at least a first separation stage and a second separation stage, the second hydrocarbon sample being derived from the same hydrocarbon source as the first hydrocarbon sample;

determining a second weight for each of the separated second plurality of compounds;

assigning the separated second plurality of compounds to a plurality of compound classes;

determining a relative weight for each of the separated second plurality of compound classes based on the second weights of the assigned compounds for each compound class;

normalizing the first weight for each of at least a portion of the separated first plurality of compounds, based on the determined relative weights for the plurality of compound classes, to generate a normalized weight for each compound, the normalizing of a first weight for a compound being based on at least a compound class corresponding to a determined composition for the compound; and

developing a model of composition for the hydrocarbon source based on at least the normalized weights for the separated first plurality of compounds.

2. The method of claim 1, further comprising:

~~obtaining an initial sample from the hydrocarbon source; and~~

splitting the initial sample into at least the first hydrocarbon sample and the second hydrocarbon sample.

3. The method of claim 1, wherein the second weight for each of the separated second plurality of compounds is determined by flame ionization detection.

4. The method of claim 1, wherein the separated second plurality of compounds are assigned to compound classes based at least in part on a number of naphthene rings in a compound, a number of aromatic rings in a compound, or a combination thereof.

5. The method of claim 1, further comprising identifying and quantifying a composition for one or more paraffin compounds in the separated second plurality of compounds.

6. The method of claim 1, wherein the second hydrocarbon sample comprises one or more additional compounds different from the second plurality of compounds, the method further comprising:

calculating a combined weight for the separated second plurality of compounds based on the determined second weights; and

calculating a weight percentage for the second plurality of compounds in the second hydrocarbon sample based on the combined weight for the separated second plurality of compounds, a weight of the second hydrocarbon sample, a weight of a reference sample, and a reference weight of a third plurality of compounds separated from the reference sample using the second gas chromatography separation.

7. The method of claim 1, wherein the model of composition is further based on one or more additional measured properties of a sample derived from the hydrocarbon source.

8. The method of claim 1, wherein developing the model of composition comprises assigning the plurality of compounds in the first hydrocarbon sample to a plurality of Z-classes.

9. The method of claim 1, wherein the final boiling point of the first hydrocarbon sample is about 1050°F (566°C) or less.

10. A method for characterizing petroleum or other hydrocarbon compositions, comprising:

separating a first plurality of compounds in a first hydrocarbon sample using a first gas chromatography separation, each compound in the first plurality of compounds being within a retention normal-paraffin index window;

determining compositions for the separated first plurality of compounds using mass spectrometry, the ions for mass spectrometry being formed by a soft ionization method;

separating a second plurality of compounds in a second hydrocarbon sample using a second gas chromatography separation, the second gas chromatography separation including at least a first separation stage and a second separation stage, the second hydrocarbon sample being derived from the same hydrocarbon source as the first hydrocarbon sample, each compound in the second plurality of compounds corresponding to a compound in the first plurality of compounds, where each compound in the second plurality of compounds is within the same retention normal-paraffin index window as the corresponding compound in the first plurality of compounds;

determining relative weights for the separated second plurality of compounds;

correlating the first plurality of compounds with the second plurality of compounds; and

developing a model of composition for the hydrocarbon source based on the correlation of the first plurality of compounds with the second plurality of compounds, and based on combining the determined compositions for the first plurality of compounds to provide a total composition.

11. The method of claim 10, wherein the normalizing of a first weight for a compound is further based on a retention window corresponding to the determined compound.

12. The method of claim 10, further comprising:

obtaining an initial sample from the hydrocarbon source; and

splitting the initial sample into at least the first hydrocarbon sample and the second hydrocarbon sample.

13. The method of claim 10, wherein correlating the first plurality of compounds with the second plurality of compounds comprises correlating the order of exit of the

separated first plurality of compounds from the first gas chromatography separation with the order of exit of the separated second plurality of compounds from the second gas chromatography separation.

14. The method of claim 10, wherein correlating the first plurality of compounds with the second plurality of compounds comprises correlating the order of exit of the separated first plurality of compounds from the first gas chromatography separation with the order of exit of the separated second plurality of compounds from the first separation stage of the second gas chromatography separation.

15. The method of claim 10, wherein developing the model of composition further comprises normalizing at least a portion of the model of composition based on one or more additional measured properties of a sample derived from the hydrocarbon source.

16. The method of claim 10, wherein developing the model of composition comprises assigning the plurality of compounds in the first hydrocarbon sample to a plurality of compound classes.

17. The method of claim 10, wherein developing the model of composition comprises assigning the plurality of compounds in the first hydrocarbon sample to a plurality of Z-classes.

18. The method of claim 10, wherein the final boiling point of the first hydrocarbon sample is about 1050°F (566°C) or less.

CLAIMS:

1. A method for characterizing petroleum or other hydrocarbon compositions, comprising:

separating a first plurality of compounds in a first hydrocarbon sample using a first gas chromatography separation;

determining a composition and a first weight for each of the separated first plurality of compounds using field ionization time of flight mass spectrometry;

separating a second plurality of compounds in a second hydrocarbon sample using a second gas chromatography separation, the second gas chromatography separation including at least a first separation stage and a second separation stage, the second hydrocarbon sample being derived from the same hydrocarbon source as the first hydrocarbon sample;

determining a second weight for each of the separated second plurality of compounds; wherein the second weight for each of the separated second plurality of compounds is determined by flame ionization detection;

assigning the separated second plurality of compounds to a plurality of compound classes;

determining a relative weight for each of the separated second plurality of compound classes based on the second weights of the assigned compounds for each compound class;

correlating the first plurality of compounds with the second plurality of compounds; and

normalizing the first weight for each of at least a portion of the separated first plurality of compounds, based on the determined relative weights for the plurality of compound classes, to generate a normalized weight for each compound, the normalizing of a first weight for a compound being based on at least a compound class corresponding to a determined composition for the compound; and

developing a model of composition for the hydrocarbon source based on at least the normalized weights for the separated first plurality of compounds.

2. The method of claim 1, further comprising:

obtaining an initial sample from the hydrocarbon source; and

splitting the initial sample into at least the first hydrocarbon sample and the second hydrocarbon sample.

3. The method of claim 1, wherein the separated second plurality of compounds are assigned to compound classes based at least in part on a number of naphthene rings in a compound, a number of aromatic rings in a compound, or a combination thereof.

4. The method of claim 1, further comprising identifying and quantifying a composition for one or more paraffin compounds in the separated second plurality of compounds.

5. The method of claim 1, wherein the second hydrocarbon sample comprises one or more additional compounds different from the second plurality of compounds, the method further comprising:

calculating a combined weight for the separated second plurality of compounds based on the determined second weights; and

calculating a weight percentage for the second plurality of compounds in the second hydrocarbon sample based on the combined weight for the separated second plurality of compounds, a weight of the second hydrocarbon sample, a weight of a reference sample, and a reference weight of a third plurality of compounds separated from the reference sample using the second gas chromatography separation.

6. The method of claim 1, wherein the model of composition is further based on one or more additional measured properties of a sample derived from the hydrocarbon source.

7. The method of claim 1, wherein developing the model of composition comprises assigning the plurality of compounds in the first hydrocarbon sample to a plurality of Z-classes.

8. The method of claim 1, wherein the final boiling point of the first hydrocarbon sample is about 1050°F (566°C) or less.

9. The method of claim 1, wherein the normalizing of a first weight for a compound is further based on a retention window corresponding to the determined compound.

10. The method of claim 1, wherein correlating the first plurality of compounds with the second plurality of compounds comprises correlating the order of exit of the separated first plurality of compounds from the first gas chromatography separation with the order of exit of the separated second plurality of compounds from the second gas chromatography separation.

11. The method of claim 1, wherein correlating the first plurality of compounds with the second plurality of compounds comprises correlating the order of exit of the separated first plurality of compounds from the first gas chromatography separation with the order of exit of the separated second plurality of compounds from the first separation stage of the second gas chromatography separation.

12. The method of claim 1, wherein developing the model of composition further comprises normalizing at least a portion of the model of composition based on one or more additional measured properties of a sample derived from the hydrocarbon source.

13. The method of claim 1, wherein developing the model of composition comprises assigning the plurality of compounds in the first hydrocarbon sample to a plurality of compound classes.

14. The method of claim 1, wherein developing the model of composition comprises assigning the plurality of compounds in the first hydrocarbon sample to a plurality of Z-classes.

15. The method of claim 1, wherein the final boiling point of the first hydrocarbon sample is about 1050°F (566°C) or less.