feed contains less than 10 mass % 400 - 630 degrees F TBP boiling material and the liquid oil product has been cracked in the hydroprocessing step and contains greater than 40 mass % 400 - 630 degrees F TBP boiling material. In one embodiment, the liquid oil product has been cracked in the hydroprocessing step and contains 3-6 mass-% boiling at 260 to 400 degrees F, 6 to 10 mass-% boiling at 400 to 490 degrees F, 20 to 40 mass-% boiling at 490 to 630 degrees F, and 35 to 40 mass-% boiling at 630 to 1020 degrees, and 10 to 27 mass-% boiling at 1020 + degrees F. In yet another embodiment, the hydroprocessing effluent is distilled into fractions and at least one fraction is recycled for additional hydroprocessing to further crack the at least one fraction. In another embodiment, the renewable oil feed is an algae oil extracted from algae biomass.

In an ~~first aspect~~embodiment, there is provided an oleaginous composition comprising oil extracted from biomass comprising a microorganism wherein the composition is hydrotreated and the hydrotreated composition comprises:a) from about 30 weight percent to about 90 weight percent carbon containing compounds selected from the group consisting of C8,C9, C10, C11, C12, C13, C14, C15, C16, C17, and C18 containing compounds; b) from about 30 weight percent to about 70 weight percent carbon containing compounds selected from the group consisting of C8, C9, C10, C11, C12, C13, C14, C15, C16, C17, and C18 containing compounds; or c) from about 10 weight percent to about 80 weight percent carbon containing compounds selected from the group consisting of C9, C10, C11, C12, C13, C14, C15, C16, C17, C18, C19, C20, C21, C22, C23, C24, C25, C26, C27, C28, C29, C30, C31, and C32 containing compounds; wherein weight percent is of the total amount of compounds detectable by mass spectrometry or gas chromatography analysis.

In another embodiment~~aspect~~, there is provided an oleaginous composition comprising oil extracted from biomass comprising a microorganism wherein the composition is hydrotreated and the hydrotreated composition: a) has a reduction of nitrogen of at least 70% as compared to the unhydrotreated composition; b) the hydrotreated composition comprises less than 100 ppm of nitrogen; or c) the unhydrotreated composition has up to 8 weight percent nitrogen, and the hydrotreated composition has less than 1 weight percent nitrogen.

In yet another embodiment~~aspect~~, there is provided an oleaginous composition comprising oil extracted from biomass comprising a microorganism wherein the composition is hydrotreated and the hydrotreated composition comprises a percent mass fraction with a boiling point of from 260 °F to 1020 °F of between about 40% and about 95% as determined by ASTM protocol D7169.

In still another embodiment~~aspect~~, there is provided an oleaginous composition comprising oil extracted from biomass comprising a microorganism wherein the oleaginous composition has: a) at least 60% of its components boiling below about 320 °C (about 608 °F); or b) at least 90% of its components boiling above about 450 °F (about 232.22 °C) as determined by ASTM D7169.

In a further embodiment~~aspect~~, there is provided an oleaginous composition comprising oil extracted from biomass comprising a microorganism wherein the composition is hydrotreated and the hydrotreated composition comprises: from about 70.8 to about 86.6 weight percent Carbon; from about 9.5 to about 14.5 weight percent Hydrogen; or from about 0.0.3 to about 3.6 weight percent Nitrogen.

In still a further ~~aspect~~embodiment, there is provided an oleaginous composition comprising oil extracted from biomass comprising a microorganism wherein the composition is hydrotreated and the hydrotreated composition comprises; a) an area percent of saturated hydrocarbons from about 36.3 to about 75.7; an area percent of unsaturated hydrocarbons from about 0.3 to about 5.5; an area percent of N-aromatics from about 0.1 to about 1.2; and an area percent of oxygen compounds from about 0.7 to about 5.6; or b) an area percent of saturated hydrocarbons from about 43.0 to about 74.0; an area percent of unsaturated hydrocarbons of less than or equal to 0.7; an area percent of aromatics from about 0,7 to about 2.3; and an area percent of oxygen compounds from about 1.4 to about 2.7.

In another ~~aspect~~embodiment, there is provided a method of upgrading renewable oil obtained from biomass, the method comprising: a) providing the renewable oil; b) dissolving at least a portion of the renewable oil in a solvent; and c) upgrading the renewable oil in the solvent by a. method comprising: hydrotreating the renewable oil in the solvent in the presence of a catalyst, at a temperature of from about 300 °C to about 500 °C; a total pressure and/or hydrogen partial pressure of from about 800 psi to about 3000 psi; a space velocity from about 0.1 volume of oil per volume of catalyst per hour to about 10 volume of oil per volume of catalyst per hour; and a hydrogen feed rate of from about 10 m^3H_2/m^3 dissolved oil to about 1700m^3 H_2/m^3 dissolved oil, to obtain a hydrotreating effluent.

In still another ~~aspect~~embodiment, there is provided a hydrotreated effluent made by the process of: a) providing a renewable oil; b) dissolving at least a portion of the renewable oil in a solvent; and c) upgrading the renewable oil in the solvent by a method comprising: hydrotreating the renewable oil in the solvent in the presence of a catalyst, at a temperature of from about 300 °C to about 500 °C; a total pressure and/or hydrogen partial pressure of from about 800 psi to about 3000 psi; a space velocity from about 0.1 volume of oil per volume of catalyst per hour to about 10 volume of oil per volume of catalyst per hour; and a hydrogen feed rate of from about 10 m^3H_2/m^3 dissolved oil to about 800m^3 H_2/m^3 dissolved oil, to obtain the hydrotreating effluent.

One aspect provides a method of upgrading algae oil obtained from biomass comprising algae, the method comprising: a) providing the algae oil; b) dissolving at least a portion of the algae oil in a solvent; and c) upgrading the algae oil in the solvent by a method comprising: hydrotreating the algae oil in the solvent in the presence of a catalyst, at a temperature of from about 300 °C to about 500 °C; a total pressure and/or hydrogen partial pressure of from about 800 psi to about 3000 psi; a space velocity from about 0.1 volume of oil per volume of catalyst per hour to about 10 volume of oil per volume of catalyst per hour; and a hydrogen feed rate of from about 10 m^3H_2/m^3 dissolved oil to about 1700m^3 H_2/m^3 dissolved oil, wherein said catalyst is a large-pore catalyst selected from the group consisting of petroleum residuum and petroleum bitumen hydrotreating catalysts, to obtain a hydrotreating effluent. Another aspect relates to a hydrotreating effluent made by the method disclosed above.

Another aspect relates to a method of upgrading algae oil obtained from biomass comprising algae, the method comprising: a) providing the algae oil; b) dissolving at least a portion of the algae oil in a solvent; c) upgrading the algae oil in the solvent by a method comprising: hydrotreating the algae oil in the solvent in the presence of a catalyst, at a temperature of from about 300 ° C to about 500 ° C; a total pressure and/or hydrogen partial pressure of from about 800 psi to about 3000 psi; a space velocity from about 0.1 volume of oil per volume of catalyst per hour to about 10 volume of oil per volume of catalyst per hour; and a hydrogen feed rate of from about 10 m^3 H_2/m^3 dissolved oil to about 1700 m^3 H_2/m^3 dissolved oil; wherein the catalyst is characterized by having a pore structure comprising macropores in the range of about 1000 Angstroms to about 3000 Angstroms, to obtain a hydrotreating effluent. Yet another aspect relates to a hydrotreating effluent made by the method disclosed above.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] These and other features, aspects, and advantages of the present invention will become better understood with regard to the following description, appended claims and accompanying figures, where:

[0023] **Figure 1** is a photo of oil upgraded product samples from the seven experiments ("runs" 1SEBR, 2SEBR, 3SEBR, 4SEBR, 5SEBR, 6SEBR, and 7SEBR, left to right) of EXAMPLE I of this disclosure, wherein the processes and/or the products may be some but not the only embodiments of the invention.

[0024] **Figure 2** is a distillation curve overlay, of three of the experiments of **Figure 1**, that is, 1 SEBR – 3 SEBR, compared to the algae oil feed.

[0025] **Figure 3** is a distillation curve overlay, of three other of the experiments of **Figure 1**, that is, 4 SEBR – 6 SEBR, compared to the algae oil feed.

[0026] **Figure 4** is a distillation curve overlay, of the one thermal experiment (without catalyst) of **Figure 1**, that is 7 SEBR compared to the algae oil feed.

[0027] **Figure 5** is a bar-graph showing % mass fraction of 6 fractions commonly used in petroleum refining, for the oil products of 1 SEBR – 3 SEBR of **Figure 1** and **Figure 2** compared to algae oil feed.

[0028] **Figure 6** is a graph showing % mass fraction for the 1 SEBR – 3 SEBR oil products and algae oil feed of **Figure 5**.

[0029] **Figure 7** is a bar-graph showing % mass fraction of the 6 fractions commonly used in petroleum refining, for the oil products of 4 SEBR – 6 SEBR of **Figure 1** and **Figure 3** compared to algae oil feed.

[0030] **Figure 8** is a graph showing % mass fraction for the 4 SEBR – 6 SEBR oil products and algae oil feed of **Figure 7**.

[0031] **Figure 9** is a bar-graph showing % mass fraction of 6 fractions, for the oil product of 7 SEBR of **Figure 1** and **Figure 4** compared to algae oil feed.

[0032] **Figure 10** is a graph showing % mass fraction for the 7 SEBR oil product and algae oil feed of **Figure 9**.

[0033] **Figure 11** is a HT GC-MS chromatogram of the algae oil feed of EXAMPLE I and EXAMPLE II.

[0034] **Figure 12** is a HT GC-MS chromatogram of the oil product of 1SEBR.

[0035] **Figure 13** is a HT GC-MS chromatogram of the oil product of 3 SEBR.

[0036] **Figure 14** is a HT GC-MS chromatogram of the oil product of 5 SEBR.

[0037] **Figure 15** is a HT GC-MS chromatogram of the oil product of 7 SEBR.

CLAIMS

1. An oleaginous composition comprising oil extracted from biomass comprising a microorganism wherein the composition is hydrotreated and the hydrotreated composition comprises:

a) from about 30 weight percent to about 90 weight percent carbon containing compounds selected from the group consisting of C8, C9, C10, C11, C12, C13, C14, C15, C16, C17, and C18 containing compounds;

b) from about 30 weight percent to about 70 weight percent carbon containing compounds selected from the group consisting of C8, C9, C10, C11, C12, C13, C14, C15, C16, C17, and C18 containing compounds; or

c) from about 10 weight percent to about 80 weight percent carbon containing compounds selected from the group consisting of C9, C10, C11, C12, C13, C14, C15, C16, C17, C18, C19, C20, C21, C22, C23, C24, C25, C26, C27, C28, C29, C30, C31, and C32 containing compounds;

wherein weight percent is of the total amount of compounds detectable by mass spectrometry or gas chromatography analysis.

2. The oleaginous composition of claim 1, wherein the hydrotreated composition comprises: from about 40 to about 85 weight percent carbon containing compounds selected from the group consisting of C8, C9, C10, C11, C12, C13, C14, C15, C16, C17, and C18 containing compounds; from about 65 to about 85 weight percent carbon containing compounds selected from the group consisting of C8, C9, C10, C11, C12, C13, C14, C15, C16, C17, and C18 containing compounds; from about 70 to about 80 weight percent carbon containing compounds selected from the group consisting of C8, C9, C10, C11, C12, C13, C14, C15, C16, C17, and C18 containing compounds; from about 77 to about 84 weight percent carbon containing compounds selected from the group consisting of C8, C9, C10, C11, C12, C13, C14, C15, C16, C17, and C18 containing compounds; from 77.4 to 83.8 weight percent carbon containing compounds selected from the group consisting of C8, C9, C10, C11, C12, C13, C14, C15, C16, C17, and C18 containing compounds; from 77.3 to 85.5 weight percent carbon containing compounds selected from the group consisting of C8, C9, C10, C11, C12, C13, C14, C15, C16, C17, and C18 containing compounds; or from 80.8 to 86.6 weight percent carbon containing compounds selected from the group consisting of C8, C9, C10, C11, C12, C13, C14, C15, C16, C17, and C18 containing compounds.

3. The oleaginous composition of claim 1, wherein the hydrotreated composition comprises: from about 43 to about 66 weight percent carbon containing compounds selected from the group consisting of C8, C9, C10, C11, C12, C13, C14, C15, C16, C17, and C18 containing compounds; or from about 42.7 to about 65.7 weight percent carbon containing compounds selected from the group consisting of C8, C9, C10, C11, C12, C13, C14, C15, C16, C17, and C18 containing compounds.

4. The oleaginous composition of claim 1, wherein the hydrotreated composition comprises: from about 20 to about 70 weight percent carbon containing compounds selected from the group consisting of C9, C10, C11, C12, C13, C14, C15, C16, C17, C18, C19, C20, C21, C22, C23, C24, C25, C26, C27, C28, C29, C30, C31, and C32 containing compounds; from about 30 to about 60 weight percent carbon containing compounds selected from the group consisting of C9, C10, C11, C12, C13, C14, C15, C16, C17, C18, C19, C20, C21, C22, C23, C24, C25, C26, C27, C28, C29, C30, C31, and C32 containing compounds; or from about 23 to about 46 weight percent carbon containing compounds selected from the group consisting of C9, C10, C11, C12, C13, C14, C15, C16, C17, C18, C19, C20, C21, C22, C23, C24, C25, C26, C27, C28, C29, C30, C31, and C32 containing compounds.

5. The oleaginous composition of claim 1, wherein prior to hydrotreatment, the oleaginous composition is hydrothermally extracted.

6. The oleaginous composition of claim 1, wherein the hydrotreatment is in a semi-batch, batch, or continuous flow reactor.

7. The oleaginous composition of claim 1, wherein the microorganism is an alga.

8. The oleaginous composition of claim 7, wherein the alga is a microalga or a macroalga.

9. The oleaginous composition of claim 8, wherein the microalga is a cyanobacterium.

10. The oleaginous composition of claim 1, wherein the microorganism is a *Desmodesmus* species or a *Spirulina* species.

11. The oleaginous composition of claim 1, wherein the microorganism is a *Nannochloropsis* species.

12. The oleaginous composition of claim 11, wherein the *Nannochloropsis* species is *Nannochloropsis salina*.

13. The oleaginous composition of claim 1 or 5, wherein the solvent used for extraction is a heptane, hexane, methyl isobutyl ketone (MIBK), acetonitrile, ethanol, methyl-t-butyl ether (MTBE), methyl ethyl ketone (MEK), propanol, iso propyl alcohol (IPA), methanol, cyclohexane, toluene (methylbenzene), chloroform (trichloromethane), methylene chloride (dichloromethane), a polar solvent, a non-polar solvent, or a combination of any two or more thereof.

14. The oleaginous composition of claim 13, wherein the solvent used for extraction is hexane, heptane, or methyl isobutyl ketone (MIBK).

15. The oleaginous composition of claim 1, wherein the mass spectrometry is high temperature gas chromatography-mass spectrometry (HT GC-MS), gas chromatography-mass spectrometry (GC-MS), or liquid chromatography mass spectrometry, or the gas chromatography is gas chromatography flame ionization detection (GC FID).

16. An oleaginous composition comprising oil extracted from biomass comprising a microorganism wherein the composition is hydrotreated and the hydrotreated composition:

a) has a reduction of nitrogen of at least 70% as compared to the unhydrotreated composition;

b) the hydrotreated composition comprises less than 100 ppm of nitrogen; or

c) the unhydrotreated composition has up to 8 weight percent nitrogen, and the hydrotreated composition has less than 1 weight percent nitrogen.

17. The oleaginous composition of claim 16, wherein the reduction of nitrogen is at least 75%.

18. The oleaginous composition of claim 16, wherein the reduction of nitrogen is at least 80%.

19. The oleaginous composition of claim 16, wherein the reduction of nitrogen is at least 85%.

20. The oleaginous composition of claim 16, wherein the reduction of nitrogen is at least 90%.

21. The oleaginous composition of claim 17, wherein the reduction of nitrogen is at least 95%.

22. The oleaginous composition of claim 16, wherein the reduction of nitrogen is at least 99%.

23. The oleaginous composition of claim 16, wherein the hydrotreated composition comprises less than 90 ppm of nitrogen.

24. The oleaginous composition of claim 16, wherein the hydrotreated composition comprises less than 80 ppm of nitrogen.

25. The oleaginous composition of claim 16, wherein the hydrotreated composition comprises less than 70 ppm of nitrogen.

26. The oleaginous composition of claim 16, wherein the hydrotreated composition comprises less than 60 ppm of nitrogen.

27. The oleaginous composition of claim 16, wherein the hydrotreated composition comprises less than 50 ppm of nitrogen.

28. The oleaginous composition of claim 16, wherein the hydrotreated composition comprises less than 40 ppm of nitrogen.

29. The oleaginous composition of claim 16, wherein the hydrotreated composition comprises less than 30 ppm of nitrogen.

30. The oleaginous composition of claim 16, wherein the hydrotreated composition comprises less than 20 ppm of nitrogen.

31. The oleaginous composition of claim 16, wherein the hydrotreated composition comprises less than 10 ppm of nitrogen.

32. The oleaginous composition of claim 16, wherein the hydrotreated composition comprises about 15 ppm of nitrogen, about 29 ppm of nitrogen, or about 11 ppm of nitrogen.

33. The oleaginous composition of claim 16, wherein the unhydrotreated composition has up to 7 weight percent nitrogen, and the hydrotreated composition has less than 0.5 weight percent nitrogen.

34. The oleaginous composition of claim 16, wherein the unhydrotreated composition has up to 7 weight percent, up to 6 weight percent, up to 5 weight percent, up to 4 weight percent, up to 3 weight percent, up to 2 weight percent, or up to 1 weight percent nitrogen, and the hydrotreated composition has less than 0.9 weight percent, less than 0.8 weight percent, less than 0.7 weight percent, less than 0.6 weight percent, less than 0.5 weight percent, less than 0.4 weight percent, less than 0.3 weight percent, less than 0.2 weight percent, or less than 0.1 weight percent nitrogen.

35. The oleaginous composition of claim 16, wherein the nitrogen levels are determined by ASTM standard D4629 or elemental analysis.

36. The oleaginous composition of claim 16, wherein prior to hydrotreatment, the oleaginous composition is hydrothermally extracted.

37. The oleaginous composition of claim 16, wherein the hydrotreatment is in a semi-batch, batch, or continuous flow reactor.

38. The oleaginous composition of claim 16, wherein the microorganism is an alga.

39. The oleaginous composition of claim 38, wherein the alga is a microalga or a macroalga.

40. The oleaginous composition of claim 39, wherein the microalga is a cyanobacterium.

41. The oleaginous composition of claim 16, wherein the microorganism is a *Desmodesmus* species or a *Spirulina* species.

42. The oleaginous composition of claim 16, wherein the microorganism is a *Nannochloropsis* species.

43. The oleaginous composition of claim 42, wherein the *Nannochloropsis* species is *Nannochloropsis salina*.

44. The oleaginous composition of claim 16 or 36, wherein the solvent used for extraction is a heptane, hexane, methyl isobutyl ketone (MIBK), acetonitrile, ethanol, methyl-t-butyl ether (MTBE), methyl ethyl ketone (MEK), propanol, iso propyl alcohol (IPA), methanol, cyclohexane, toluene (methylbenzene), chloroform (trichloromethane), methylene chloride (dichloromethane), a polar solvent, a non-polar solvent, or a combination of any two or more thereof.

45. The oleaginous composition of claim 44, wherein the solvent used for extraction is hexane, heptane, or methyl isobutyl ketone (MIBK).

46. An oleaginous composition comprising oil extracted from biomass comprising a microorganism wherein the composition is hydrotreated and the hydrotreated composition comprises a percent mass fraction with a boiling point of from 260 degrees F to 1020 degrees F of between about 40% and about 95% as determined by ASTM protocol D7169.

47. The oleaginous composition of claim 46, wherein the hydrotreated composition comprises a percent mass fraction with a boiling point of from 260 degrees F to 1020 degrees F of between about 60% and about 90%.

48. The oleaginous composition of claim 46, wherein the hydrotreated composition comprises a percent mass fraction with a boiling point of from 260 degrees F to 1020 degrees F of between about 74.4% and about 87.4%.

49. The oleaginous composition of claim 46, wherein the hydrotreated composition comprises a percent mass fraction with a boiling point of from 260 degrees F to 630 degrees F of between about 30% and about 55%.

50. The oleaginous composition of claim 46, wherein the hydrotreated composition comprises a percent mass fraction with a boiling point of from 260 degrees F to 630 degrees F of between about 35.2% and about 51%.

51. The oleaginous composition of claim 46, wherein prior to hydrotreatment, the oleaginous composition is hydrothermally extracted.

52. The oleaginous composition of claim 46, wherein the hydrotreatment is in a semi-batch, batch, or continuous flow reactor.

53. The oleaginous composition of claim 46, wherein the microorganism is an alga.

54. The oleaginous composition of claim 53, wherein the alga is a microalga or a macroalga.

55. The oleaginous composition of claim 54, wherein the microalga is a cyanobacterium.

56. The oleaginous composition of claim 46, wherein the microorganism is a *Desmodesmus* species or a *Spirulina* species.

57. The oleaginous composition of claim 46, wherein the microorganism is a *Nannochloropsis* species.

58. The oleaginous composition of claim 57, wherein the *Nannochloropsis* species is *Nannochloropsis salina*.

59. The oleaginous composition of claim 46 or 51, wherein the solvent used for extraction is a heptane, hexane, methyl isobutyl ketone (MIBK), acetonitrile, ethanol, methyl-t-butyl ether (MTBE), methyl ethyl ketone (MEK), propanol, iso propyl alcohol (IPA), methanol, cyclohexane, toluene (methylbenzene), chloroform (trichloromethane), methylene chloride (dichloromethane), a polar solvent, a non-polar solvent, or a combination of any two or more thereof.

60. The oleaginous composition of claim 59 wherein the solvent used for extraction is hexane, heptane, or methyl isobutyl ketone (MIBK).

61. An oleaginous composition comprising oil extracted from biomass comprising a microorganism wherein the oleaginous composition has: a) at least 60% of its components boiling below about 320 degrees Celsius (about 608 degrees Fahrenheit); or b) at least 90% of its components boiling above about 450 degrees Fahrenheit (about 232.22 degrees Celsius) as determined by ASTM D7169.

62. An oleaginous composition comprising oil extracted from biomass comprising a microorganism, wherein the oleaginous composition has at least 65% of its components boiling below about 320 degrees Celsius.

63. An oleaginous composition comprising oil extracted from biomass comprising a microorganism, wherein the oleaginous composition has at least 70% of its components boiling below about 320 degrees Celsius.

64. An oleaginous composition comprising oil extracted from biomass comprising a microorganism, wherein the oleaginous composition has at least 75% of its components boiling below about 320 degrees Celsius.

65. An oleaginous composition comprising oil extracted from biomass comprising a microorganism, wherein the oleaginous composition has at least 80% of its components boiling below about 320 degrees Celsius.

66. An oleaginous composition comprising oil extracted from biomass comprising a microorganism, wherein the oleaginous composition has at least 85% of its components boiling below about 320 degrees Celsius.

67. An oleaginous composition comprising oil extracted from biomass comprising a microorganism, wherein the oleaginous composition has at least 90% of its components boiling below about 320 degrees Celsius.

68. An oleaginous composition comprising oil extracted from biomass comprising a microorganism, wherein the oleaginous composition has at least 95% of its components boiling below about 320 degrees Celsius.

69. An oleaginous composition comprising oil extracted from biomass comprising a microorganism, wherein the oleaginous composition has at least 99% of its components boiling below about 320 degrees Celsius.

70. An oleaginous composition comprising oil extracted from biomass comprising a microorganism, wherein the oleaginous composition has at least 85% of its components boiling above about 475 degrees Fahrenheit.

71. An oleaginous composition comprising oil extracted from biomass comprising a microorganism, wherein the oleaginous composition has at least 80% of its components boiling above about 500 degrees Fahrenheit.

72. An oleaginous composition comprising oil extracted from biomass comprising a microorganism, wherein the oleaginous composition has at least 75% of its components boiling above about 550 degrees Fahrenheit.

73. The oleaginous composition of any one of claims 61 to 72, wherein the oleaginous composition has been hydrotreated.

74. The oleaginous composition of claim 62, wherein prior to hydrotreatment, the oleaginous composition is hydrothermally extracted.

75. The oleaginous composition of any one of claims 61 to74, wherein the percentage of components is determined by ASTM protocol D7169.

76. The oleaginous composition of claim 73, wherein the hydrotreatment is in a semi-batch, batch, or continuous flow reactor.

77. The oleaginous composition of any one of claims 61 to 76, wherein the microorganism is an alga.

78. The oleaginous composition of claim 77, wherein the alga is a microalga or a macroalga.

79. The oleaginous composition of claim 78, wherein the microalga is a cyanobacterium.

80. The oleaginous composition of any one of claims 61 to 76, wherein the microorganism is a *Desmodesmus* species or a *Spirulina* species.

81. The oleaginous composition of any one of claims 61 to 76, wherein the microorganism is a *Nannochloropsis* species.

82. The oleaginous composition of claim 81, wherein the *Nannochloropsis* species is *Nannochloropsis salina*.

83. The oleaginous composition of any one of claims 61 to 76, wherein the solvent used for extraction is a heptane, hexane, methyl isobutyl ketone (MIBK), acetonitrile, ethanol, methyl-t-butyl ether (MTBE), methyl ethyl ketone (MEK), propanol, iso propyl alcohol (IPA), methanol, cyclohexane, toluene (methylbenzene), chloroform (trichloromethane), methylene chloride (dichloromethane), a polar solvent, a non-polar solvent, or a combination of any two or more thereof.

84. The oleaginous composition of claim 83, wherein the solvent used for extraction is hexane, heptane, or methyl isobutyl ketone (MIBK).

85. An oleaginous composition comprising oil extracted from biomass comprising a microorganism wherein the composition is hydrotreated and the hydrotreated composition comprises: from about 70.8 to about 86.6 weight percent Carbon; from about 9.5 to about 14.5 weight percent Hydrogen; or from about 0.03 to about 3.6 weight percent Nitrogen.

86. The oleaginous composition of claim 85, further comprising less than or equal to about 0.76 weight percent Sulfur.

87. The oleaginous composition of claim 85, further comprising less than or equal to about 2.6 weight percent Oxygen by difference.

88. The oleaginous composition of claim 85, wherein prior to hydrotreatment, the oleaginous composition is hydrothermally extracted.

89. The oleaginous composition of claim 85, wherein the hydrotreatment is in a semi-batch, batch or continuous flow reactor.

90. The oleaginous composition of claim 85, wherein the microorganism is an alga.

91. The oleaginous composition of claim 90, wherein the alga is a microalga or a macroalga.

92. The oleaginous composition of claim 91, wherein the microalga is a cyanobacterium.

93. The oleaginous composition of claim 85, wherein the microorganism is a *Desmodesmus* species or a *Spirulina* species.

94. The oleaginous composition of claim 85, wherein the microorganism is a *Nannochloropsis* species.

95. The oleaginous composition of claim 94, wherein the *Nannochloropsis* species is *Nannochloropsis salina*.

96. The oleaginous composition of claim 85 or 88, wherein the solvent used for extraction is a heptane, hexane, methyl isobutyl ketone (MIBK), acetonitrile, ethanol, methyl-t-butyl ether (MTBE), methyl ethyl ketone (MEK), propanol, iso propyl alcohol (IPA), methanol, cyclohexane, toluene (methylbenzene), chloroform (trichloromethane), methylene chloride (dichloromethane), a polar solvent, a non-polar solvent, or a combination of any two or more thereof.

97. The oleaginous composition of claim 96, wherein the solvent used for extraction is hexane, heptane, or methyl isobutyl ketone (MIBK).

98. A oleaginous composition comprising oil extracted from biomass comprising a microorganism wherein the composition is hydrotreated and the hydrotreated composition comprises: a) an area percent of saturated hydrocarbons from about 36.3 to about 75.7; an area percent of unsaturated hydrocarbons from about 0.3 to about 5.5; an area percent of N-aromatics from about 0.1 to about 1.2; and an area percent of oxygen compounds from about 0.7 to about 5.6; or b) an area percent of saturated hydrocarbons from about 43.0 to about 74.0; an area percent of unsaturated hydrocarbons of less than or equal to 0.7; an area percent of aromatics from about 0.7 to about 2.3; and an area percent of oxygen compounds from about 1.4 to about 2.7.

99. The oleaginous composition of claim 98, wherein prior to hydrotreatment, the oleaginous composition is hydrothermally extracted.

100. The oleaginous composition of claim 98, wherein the hydrotreatment is in a semi-batch, batch, or continuous flow reactor.

101. The oleaginous composition of claim 98, wherein the microorganism is an alga.

102. The oleaginous composition of claim 101, wherein the alga is a microalga or a macroalga.

103. The oleaginous composition of claim 102, wherein the microalga is a cyanobacterium.

104. The oleaginous composition of claim 98, wherein the microorganism is a *Desmodesmus* species or a *Spirulina* species.

105. The oleaginous composition of claim 98, wherein the microorganism is a *Nannochloropsis* species.

106. The oleaginous composition of claim 105, wherein the *Nannochloropsis* species is *Nannochloropsis salina*.

107. The oleaginous composition of claim 98 or 99, wherein the solvent used for extraction is a heptane, hexane, methyl isobutyl ketone (MIBK), acetonitrile, ethanol, methyl-t-butyl ether (MTBE), methyl ethyl ketone (MEK), propanol, iso propyl alcohol (IPA), methanol, cyclohexane, toluene (methylbenzene), chloroform (trichloromethane), methylene chloride (dichloromethane), a polar solvent, a non-polar solvent, or a combination of any two or more thereof.

108. The oleaginous composition of claim 107, wherein the solvent used for extraction is hexane, heptane, or methyl isobutyl ketone (MIBK).

109. A method of upgrading renewable oil obtained from biomass, the method comprising:

a) providing the renewable oil;

b) dissolving at least a portion of the renewable oil in a solvent; and

c) upgrading the renewable oil in the solvent by a method comprising: hydrotreating the renewable oil in the solvent in the presence of a catalyst, at a temperature of from about 300 degrees C to about 500 degrees C; a total pressure and/or hydrogen partial pressure of from about 800 psi to about 3000 psi; a space velocity from about 0.1 volume of oil per volume of catalyst per hour to about 10 volume of oil per volume of catalyst per hour; and a hydrogen feed rate of from about 10 m^3 H_2/m^3 dissolved oil to about 1700m^3 H_2/m^3 dissolved oil, to obtain a hydrotreating effluent.

110. The method of claim 109, wherein prior to step a), step b), and step c) the renewable oil was not refined-bleached-deodorized (RBD).

111. The method of claim 109, wherein the method further comprises, separating a hydrotreated oil from the hydrotreating effluent; and further upgrading the hydrotreated oil by sending the hydrotreated oil or a fraction thereof to one or more of an FCC unit, a hydrocracking unit, a hydroisomerization unit, a dewaxing unit, a naphtha reformer, or a unit utilizing Ni/Mo, Co/Mo, Ni/W, a precious metal, a noble metal, a group VIII catalyst, or a zeolitic catalyst.

112. The method of claim 109, wherein the solvent is naphtha, diesel, kerosene, light gasoil, heavy gasoil, resid, heavy crude, dodecane, a cyclic solvent, an aromatic solvent, a hydrocarbon solvent, crude oil, any product obtained after distillation of crude oil and/or the further refining of crude oil fractions, or any combination thereof.

113. The method of claim 109, wherein the space velocity is from about 0.1 volume of oil per volume of catalyst per hour to about 6 volume of oil per volume of catalyst per hour; from about 0.2 volume of oil per volume of catalyst per hour to about 5 volume of oil per volume of catalyst per hour; from about 0.6 volume of oil per volume of catalyst per hour to about 3 volume of oil per volume of catalyst per hour; or about 1.0 volume of oil per volume of catalyst per hour.

114. The method of claim 109, wherein the hydrogen feed rate is from about 100 m^3 H_2/m^3 dissolved oil to about 1400 m^3 H_2/m^3 dissolved oil; from about 100 m^3 H_2/m^3 dissolved oil to about 1000 m^3 H_2/m^3 dissolved oil; from about 100 m^3 H_2/m^3 dissolved oil to about 800 m^3 H_2/m^3 dissolved oil; from about 200 m^3 H_2/m^3 dissolved oil to about 500m^3 H_2/m^3 dissolved oil; or about 600 m^3 H_2/m^3 dissolved oil.

115. The method of claim 109, wherein the total pressure and/or hydrogen partial pressure is from about 1000 psi to about 2000 psi, about 1500 psi to about 2000 psi; or selected from the group consisting of: 1000 psi to 1100 psi, 1100 psi to 1200 psi, 1200 psi to 1300 psi, 1300 psi to 1400 psi, 1400 psi to 1500 psi, 1500 psi to 1600 psi, 1600 psi to 1700 psi, 1700 psi to 1800 psi, 1800 psi to 1900 psi, 1900 psi to 2000 psi, 2000 psi to 2100 psi, 2100 psi to 2200 psi, 2200 psi to 2300 psi, 2300 psi to 2400 psi, 2400 psi to 2500 psi, 2500 psi to 2600 psi, 2600 psi to 2700 psi, 2700 psi to 2800 psi, 2800 psi to 2900 psi, and 2900 psi to 3000 psi.

116. The method of claim 109, wherein the temperature is in a range selected from a group consisting of: 300 to 310, 310 to 320, 320 to 330, 330 to 340, 340 to 350, 350 to 360, 360 to 370, 370 to 380, 380 to 390, 390 to 400, 400 to 410, 410 to 420, 420 to 430, 430 to 440, 440 to 450, 450 to 460, 460 to 470, 470 to 480, 480 to 490, and 490 to 500 degrees C.

117. The method of claim 109, wherein the catalyst is a large-pore catalyst selected from the group consisting of petroleum residuum/bitumen hydrotreating catalysts.

118. The method of claim 109, wherein the catalyst comprises Ni/Mo and/or Co/Mo on an alumina or a silica-alumina support.

119. The method of claim 109, wherein the catalyst is characterized by having a pore structure comprising macro-pores and characterized by BET surface areas in the range of about 10 m^2/g to about 350 m^2/g or about 150 m^2/g to about 250 m^2/g; micropores in the average diameter range of about 50 Angstroms to about 200 Angstroms; or macropores in the range of about 1000 Angstroms to about 3000 Angstroms.

120. The method of claim 109, wherein the method further comprises, either prior to step b) or after step b), thermally treating the renewable oil prior to hydrotreating, by raising the renewable oil to a temperature in the range of about 300 to about 600 degrees C, and holding at about that temperature for a hold time in the range of 0 minutes to about 8 hours, about 0.25 to about 8 hours, or about 0.5 to about 2 hours.

121. The method of claim 120, wherein the thermal treatment is conducted at less than 1000 psi.

122. The method of claim 120, wherein the thermal treatment is conducted in a range of about atmospheric to about 300 psi.

123. The method of claim 120, wherein no hydrogen is added to the thermal treatment process.

124. The method of claim 120, wherein the method further comprising fluid-catalytic-cracking (FCC) the hydrotreated oil.

125. The method of claim 109, wherein the biomass is algal biomass.

126. The method of claim 125, wherein the algal biomass comprises microalga and/or macroalga.

127. The method of claim 126, wherein the microalga is a cyanobacterium.

128. The method of claim 126, wherein the microalga is a *Desmodesmus*, *Spirulina*, or *Nannochloropsis* species.

129. The method of claim 128, wherein the *Nannochloropsis* species is *Nannochloropsis salina*.

130. A hydrotreating effluent made by any one of claims 1 to 129.

131. A hydrotreated effluent made by the process of:

a) providing a renewable oil obtained from a biomass;

b) dissolving at least a portion of the renewable oil in a solvent; and

b) upgrading the renewable oil in the solvent by a method comprising: hydrotreating the renewable oil in the solvent at a temperature of from about 300 degrees C to about 500 degrees C; a total pressure and/or hydrogen partial pressure of from about 800 psi to about 3000 psi; a space velocity from about 0.1 volume of oil per volume of catalyst per hour to about 10 volume of oil per volume of catalyst per hour; and a hydrogen feed rate of from about 10 m^3 H_2/m^3 dissolved oil to about 800m^3 H_2/m^3 dissolved oil, to obtain the hydrotreating effluent.

132. The method of claim 131, wherein prior to step a), step b), and step c) the renewable oil was not refined-bleached-deodorized (RBD).

133. The method of claim 131, wherein the method further comprises, separating a hydrotreated oil from the hydrotreating effluent; and further upgrading the hydrotreated oil by sending the hydrotreated oil or a fraction thereof to one or more of an FCC unit, a hydrocracking unit, a hydroisomerization unit, a dewaxing unit, a naphtha

reformer, or a unit utilizing Ni/Mo, Co/Mo, Ni/W, a precious metal, a noble metal, a group VIII catalyst, or a zeolitic catalyst.

134. The method of claim 131, wherein the solvent is naphtha, diesel, kerosene, light gasoil, heavy gasoil, resid, heavy crude, dodecane, a cyclic solvent, an aromatic solvent, a hydrocarbon solvent, crude oil, any product obtained after distillation of crude oil and/or the further refining of crude oil fractions, or any combination thereof.

135. The method of claim 131, wherein the space velocity is from about 0.1 volume of oil per volume of catalyst per hour to about 6 volume of oil per volume of catalyst per hour; from about 0.2 volume of oil per volume of catalyst per hour to about 5 volume of oil per volume of catalyst per hour; from about 0.6 volume of oil per volume of catalyst per hour to about 3 volume of oil per volume of catalyst per hour; or about 1.0 volume of oil per volume of catalyst per hour.

136. The method of claim 131, wherein the hydrogen feed rate is from about 100 m^3 H_2/m^3 dissolved oil to about 1400 m^3 H_2/m^3 dissolved oil; from about 100 m^3 H_2/m^3 dissolved oil to about 1000 m^3 H_2/m^3 dissolved oil; from about 100 m^3 H_2/m^3 dissolved oil to about 800 m^3 H_2/m^3 dissolved oil; from about 200 m^3 H_2/m^3 dissolved oil to about 500m^3 H_2/m^3 dissolved oil; or about 600 m^3 H_2/m^3 dissolved oil.

137. The method of claim 131, wherein the total pressure and/or hydrogen partial pressure is from about 1000 psi to about 2000 psi, about 1500 psi to about 2000 psi; or selected from the group consisting of: 1000 psi to 1100 psi, 1100 psi to 1200 psi, 1200 psi to 1300 psi, 1300 psi to 1400 psi, 1400 psi to 1500 psi, 1500 psi to 1600 psi, 1600 psi to 1700 psi, 1700 psi to 1800 psi, 1800 psi to 1900 psi, 1900 psi to 2000 psi, 2000 psi to 2100 psi, 2100 psi to 2200 psi, 2200 psi to 2300 psi, 2300 psi to 2400 psi, 2400 psi to 2500 psi, 2500 psi to 2600 psi, 2600 psi to 2700 psi, 2700 psi to 2800 psi, 2800 psi to 2900 psi, and 2900 psi to 3000 psi.

138. The method of claim 131, wherein the temperature is in a range selected from a group consisting of: 300 to 310, 310 to 320, 320 to 330, 330 to 340, 340 to 350, 350 to 360, 360 to 370, 370 to 380, 380 to 390, 390 to 400, 400 to 410, 410 to 420, 420 to 430, 430 to 440, 440 to 450, 450 to 460, 460 to 470, 470 to 480, 480 to 490, and 490 to 500 degrees C.

139. The method of claim 131, wherein the catalyst is a large-pore catalyst selected from the group consisting of petroleum residuum/bitumen hydrotreating catalysts.

140. The method of claim 131, wherein the catalyst comprises Ni/Mo and/or Co/Mo on an alumina or a silica-alumina support.

141. The method of claim 131, wherein the catalyst is characterized by having a pore structure comprising macro-pores and characterized by BET surface areas in the range of about 10 m^2/g to about 350 m^2/g or about 150 m^2/g to about 250 m^2/g; micropores in the average diameter range of about 50 Angstroms to about 200 Angstroms; or macropores in the range of about 1000 Angstroms to about 3000 Angstroms.

142. The method of claim 131, wherein the method further comprises, either prior to step b) or after step b), thermally treating the renewable oil prior to hydrotreating, by raising the renewable oil to a temperature in the range of about 300 to about 600 degrees C, and holding at about that temperature for a hold time in the range of 0 minutes to about 8 hours, about 0.25 to about 8 hours, or about 0.5 to about 2 hours.

143. The method of claim 142, wherein the thermal treatment is conducted at less than 1000 psi.

144. The method of claim 142, wherein the thermal treatment is conducted in a range of about atmospheric to about 300 psi.

145. The method of claim 142, wherein no hydrogen is added to the thermal treatment process.

146. The method of claim 142, wherein the method further comprising fluid-catalytic-cracking (FCC) the hydrotreated oil.

147. The method of claim 131, wherein the biomass is algal biomass.

148. The method of claim 147, wherein the algal biomass comprises microalga and/or macroalga.

149. The method of claim 148, wherein the microalga is a cyanobacterium.

150. The method of claim 148, wherein the microalga is a *Desmodesmus*, *Spirulina*, or *Nannochloropsis* species.

151. The method of claim 150, wherein the *Nannochloropsis* species is *Nannochloropsis salina*.

CLAIMS

1. A method of upgrading algae oil obtained from biomass comprising algae, the method comprising:

a) providing the algae oil;

b) dissolving at least a portion of the algae oil in a solvent;

c) upgrading the algae oil in the solvent by a method comprising: hydrotreating the algae oil in the solvent in the presence of a catalyst, at a temperature of from about 300 °C to about 500 °C; a total pressure and/or hydrogen partial pressure of from about 800 psi to about 3000 psi; a space velocity from about 0.1 volume of oil per volume of catalyst per hour to about 10 volume of oil per volume of catalyst per hour; and a hydrogen feed rate of from about 10 m^3 H_2/m^3 dissolved oil to about 1700 m^3 H_2/m^3 dissolved oil; wherein said catalyst is a large-pore catalyst selected from the group consisting of petroleum residuum and petroleum bitumen hydrotreating catalysts, to obtain a hydrotreating effluent.

2. The method of claim 1, wherein prior to step a), step b), and step c) the algae oil was not refined-bleached-deodorized (RBD).

3. The method of claim 1, wherein the method further comprises, separating a hydrotreated oil from the hydrotreating effluent; and further upgrading the hydrotreated oil by sending the hydrotreated oil or a fraction thereof to one or more of an FCC unit, a hydrocracking unit, a hydroisomerization unit, a dewaxing unit, a naphtha reformer, or a unit utilizing Ni/MO, Co/MO, Ni/W, a precious metal, a noble metal, a group VIII catalyst, or a zeolitic catalyst.

4. The method of claim 1, wherein the solvent is naphtha, diesel, kerosene, light gasoil, heavy gasoil, resid, heavy crude, dodecane, a cyclic solvent, an aromatic solvent, a hydrocarbon solvent, crude oil, any product obtained after distillation of crude oil and/or the further refining of crude oil fractions, or any combination thereof.

5. The method of Claim 1, wherein the solvent is heavy gasoil, resid, heavy crude, crude oil, or any combination thereof.

6. The method of claim 1, wherein said total pressure and/or hydrogen partial pressure is in the range of about 1500 psi to about 2000 psi.

7. The method of claim 1, wherein the total pressure and/or hydrogen partial pressure is selected from the group consisting of: 2000 psi to 2100 psi, 2100 psi to 2200 psi, 2200 psi to 2300 psi, 2300 psi to 2400 psi, 2400 psi to 2500 psi, 2500 psi to 2600 psi, 2600 psi to 2700 psi, 2700 psi to 2800 psi, 2800 psi to 2900 psi, and 2900 psi to 3000 psi.

8. The method of any of claims 1-7, wherein the catalyst comprises Ni/MO and/or Co/Mo on an alumina or a silica-alumina support.

9. The method of Claim 1, wherein the catalyst is characterized by having a pore structure comprising macropores and characterized by BET surface area in the range of about 10 m^2/g to about 350 m^2/g or about 150 m^2/g to about 250 m^2/g; micropores in the average diameter range of about 50 Angstroms to about 200 Angstroms; or macropores in the range of about 1000 Angstroms to about 3000 Angstroms.

10. The method claim 1, wherein the method further comprises, either prior to step b) or after step b), thermally treating the algae oil prior to hydrotreating, by raising the algae oil to a temperature in the range of about 300 to about 600 °C, and holding at about that temperature for a hold time in the range of 0 minutes to about 8 hours, about 0.25 to about 8 hours, or about 0.5 to about 2 hours, wherein no hydrogen is added to the thermal treatment process.

11. The method of claim 10, wherein the thermal treatment is conducted in the range of about atmospheric to about 300 psi.

12. The method of claim 10, wherein the method further comprising separating a hydrotreated oil from the hydrotreating effluent and fluid-catalytic-cracking (FCC) the hydrotreated oil.

13. The method of any of claims 1 – 12, wherein the biomass comprises microalga and/or macroalga.

14. The method of claim 13, wherein the microalga is a cyanobacterium.

15. The method of claim 13, wherein the microalga is a *Desmodesmus* species, *Spirulina* species, *Nannochloropsis* species, or *Nannochloropsis salina*.

16. The hydrotreating effluent made by the method of any one of claims 1, 2, 4-11, and 13 - 15.

17. A method of upgrading algae oil obtained from biomass comprising algae, the method comprising:

a) providing the algae oil;

b) dissolving at least a portion of the algae oil in a solvent;

c) upgrading the algae oil in the solvent by a method comprising: hydrotreating the algae oil in the solvent in the presence of a catalyst, at a temperature of from about 300 ° C to about 500 ° C; a total pressure and/or hydrogen partial pressure of from about 800 psi to about 3000 psi; a space velocity from about 0.1 volume of oil per volume of catalyst per hour to about 10 volume of oil per volume of catalyst per hour; and a hydrogen feed rate of from about 10 m^3 H_2/m^3 dissolved oil to about 1700 m^3 H_2/m^3 dissolved oil; wherein the catalyst is characterized by having a pore structure comprising macropores in the range of about 1000 Angstroms to about 3000 Angstroms, to obtain a hydrotreating effluent.

18. The method of claim 17, wherein the algae oil comprises oxygen, nitrogen, nitrogen-containing aromatics (N-aromatics), sterols, and material having a boiling point greater than 1020 °F, and wherein the catalyst is $NiMo/Al_2O_3$ catalyst having a pore structure with BET surface area in the range of 150 – 250 m^2/g, micropores in the average diameter range of 50 – 200 Angstroms, and said macropores in the range of 1000 – 3000 Angstroms.

19. The hydrotreating effluent made by the method of any of claims 17 and 18.