CLAIMS

What is claimed is:

1. A process for producing a purified biodiesel from a feedstock containing unsaponifiable material, said method comprising:

;

   a. reacting the feedstock in a transesterification reactor with an alcohol to produce a crude biodiesel;
   b. separating the unsaponifiable material from the crude biodiesel to produce a purified biodiesel; and
   c. recovering at least a portion of the unsaponifiable material.

2. The process of claim 1 wherein the unsaponifiable material includes at least one of the following valuable chemicals: sterols, steryl esters, steryl glucosides, terpenes, tocopherols, vitamins, myriciyl esters of fatty acids, sulfolipids, proteins, hydroxycinnamic acids, waxes, flavonoids, carotenoids.
3. The process of claim 2 further comprising the step of removing at least one of the valuable chemicals from the unsaponifiable material using at least one of saponification, transesterification, esterification, hydrolysis, and solvent separation.
4. The process of claim 1 wherein the separating step includes using at least one of cold filtration, distillation, membrane separation, adsorption, and resin filtration.
5. The process of claim 1 wherein the unsaponifiable materials are recovered by solvent extraction.
6. The process of claim 1 further comprising introducing the feedstock to a pre-treatment process before transesterification.
7. A process for producing a purified biodiesel from a feedstock containing unsaponifiable material, said method comprising:
   a. introducing the feedstock to a pre-treatment process to produce a pretreated feedstock;
   b. introducing the pretreated feedstock to an FFA refining process to produce a refined feedstock;

c. reacting the refined feedstock in a transesterification reactor with an alcohol to produce a crude biodiesel;

d. purifying the crude biodiesel to produce a purified biodiesel and a biodiesel residue;

e. recovering unsaponifiable material from the biodiesel residue.

8. The process of claim 7 wherein the unsaponifiable material includes at least one of the following valuable chemicals: sterols, steryl esters, steryl glucosides, terpenes, tocopherols, vitamins, sulfolipids, proteins, hydroxycinnamic acids, fatty acid myricyl esters, waxes, flavonoids, carotenoids.

9. The process of claim 8 further comprising the step of removing at least one of the valuable chemicals from the unsaponifiable material using at least one of saponification, transesterification, esterification, hydrolysis, and solvent separation.

10. The process of claim 7 wherein the purification step includes using at least one of cold filtration, distillation, membrane filtration, and resin filtration.

11. The process of claim 7 wherein the purification is by distillation.

12. The process of claim 11 wherein the biodiesel distillation occurs between 170 - 300°C and 800 – 0 Torr.

13. The process of claim 7 further comprising drying the crude biodiesel using an alcohol stripper to remove the water and alcohol before separating the unsaponifiable material therefrom.

14. The process of claim 7 wherein the unsaponifiable materials are recovered by solvent extraction.

15. A process for recovering a valuable chemical while producing purified biodiesel from a feedstock, said process comprising:

a. reacting the feedstock in a transesterification reactor with an alcohol to produce a crude biodiesel stream;

b. purifying the crude biodiesel stream by distillation to produce a purified biodiesel stream and a distillation bottoms;

c. recovering the valuable chemical from the distillation bottoms.

16. The process of claim 15 wherein the valuable chemical includes at least one of the following: sterols, steryl esters, steryl glucosides, terpenes, tocopherols, vitamins,

sulfolipids, proteins, hydroxycinnamic acids, fatty acid myricyl esters, waxes, flavonoids, carotenoids.

17. The process of claim 16 further comprising the step of removing the valuable chemical from the unsaponifiable material using at least one of saponification, transesterification, esterification, hydrolysis, precipitation, sedimentation, crystallization, distillation, and solvent separation.

18. The process of claim 15 wherein the biodiesel distillation occurs between 170 - 300°C and 800 – 0 Torr.

19. The process of claim 15 further comprising drying the crude biodiesel using an alcohol stripper to remove the water and alcohol before separating the unsaponifiable material therefrom.

20. The process of claim 15 wherein the unsaponifiable materials are recovered by solvent extraction.

~~21. A process for producing hydrocarbons from a biological feedstock, said process comprising:~~

~~a. diluting the biological feedstock with a hydrocarbon oil to produce a diluted biological feedstock, wherein the biological feedstock includes unsaponifiable material at concentrations greater than 2 wt%;~~

~~b. subjecting the diluted biological feedstock to a hydrodeoxygenation process by contacting the diluted biological feedstock with a hydrogen-rich gas and a catalyst at an elevated temperature and pressure to produce a reactor effluent; and~~

~~c. recovering a hydrocarbons fraction from the reactor effluent.~~

~~22. The process of Claim 21 wherein the biological feedstock comprises free fatty acids and fatty acid glyceride esters.~~

~~23. The process of claim 21 wherein the elevated temperature is between about 260 C and 371 C and the elevated pressure is between about 500 and 2,500 psig.~~

~~24. The process of claim 21 wherein the biological feedstock comprises distillation bottoms recovered from a biodiesel distillation process.~~

~~25. The process of claim 21 wherein the biological feedstock comprises at least 20 wt% high molecular weight components.~~

26. The process of claim 25 wherein the high molecular weight components are indicated by 20 wt% boiling above about 400 °C according to at least one of ASTM D2887-18 or ASTM D7169-11 measured on the diluted biological feedstock.

27. The process of claim 21 wherein the hydrocarbon oil comprises C15, C16, C17, and C18 n-paraffins.

28. The process of claim 21 wherein the hydrocarbon oil is a petroleum fraction.

29. The process of claim 21 wherein the reactor effluent is a hydrocarbon with less than 5 wt% boiling above 380 °C according to ASTM D2887-18.

30. The process of claim 16 wherein the reactor effluent is a hydrocarbon with acid number below 0.05 mg KOH/g.

31. The process of claim 24 wherein the biodiesel distillation process purifies biodiesel made by at least one of transesterification and esterification of a lipid feedstock comprised of greater than 10 wt% an unconventional lipid wherein the unconventional lipid has a fatty acid profile with at least 20 wt% C20+ fatty acids.

32. The process of claim 24 wherein the distillation bottoms comprises at least 15 wt% of a fatty acid chain length having C20+ fatty acid alkyl esters.

33. A process for producing hydrocarbons from a biological feedstock, said process comprising:

a. diluting the biological feedstock with a hydrocarbon oil to produce a diluted biological feedstock, wherein the biological feedstock includes a fatty acid alkyl ester fraction consisting of greater than 40 wt% of a fatty acid chain length having C16 and shorter carbon fatty acid chains;

b. subjecting the diluted biological feedstock to a hydrodeoxygenation process by contacting the diluted biological feedstock with a hydrogen-rich gas and a catalyst at an elevated temperature and pressure to produce a reactor effluent; and

c. recovering a hydrocarbons fraction from the reactor effluent.

34. The process of claim 33 wherein the elevated temperature is between about 260 C and 371 C and the elevated pressure is between about 500 and 2,500 psig

35. The process of claim 33 further comprising separating the reactor effluent into a hydrocarbon phase, a gas phase, and an aqueous phase and using a hydrocarbon stripper

~~to separate the hydrocarbon phase into an overheads fraction and the hydrocarbons fraction.~~

~~36. The process of claim 33 further comprising adding the hydrocarbons fraction to a diesel fuel.~~

~~37. The process of claim 33 further comprising introducing the hydrocarbons fraction to at least one of a hydrocracking and hydroisomerization process to produce a renewable diesel fuel.~~

~~38. A process for producing a purified biodiesel from a feedstock containing unsaponifiable material, said method comprising:~~

~~a. introducing the feedstock to a pre-treatment process to produce a pretreated feedstock;~~

~~b. introducing the pretreated feedstock to a FFA refining process to produce a refined feedstock;~~

~~c. reacting the refined feedstock in a transesterification reactor with an alcohol to produce a crude biodiesel;~~

~~d. purifying the crude biodiesel by distillation to produce a purified biodiesel and a distillation bottoms;~~

~~e. diluting the distillation bottoms with a hydrocarbon oil to produce a diluted biological feedstock;~~

~~f. subjecting the diluted biological feedstock to a hydrodeoxygenation process by contacting the diluted biological feedstock with a hydrogen-rich gas and a catalyst at an elevated temperature and pressure to produce a reactor effluent;~~

~~g. recovering a hydrocarbons fraction from the reactor effluent.~~

~~39. The process of claim 38 further comprising separating the reactor effluent into a hydrocarbon phase, a gas phase, and an aqueous phase and using a hydrocarbon stripper to separate the hydrocarbon phase into an overheads fraction and the hydrocarbons fraction.~~

~~40. The process of claim 38 further comprising adding the hydrocarbons fraction to a diesel fuel.~~

41. The process of claim 38 further comprising introducing the hydrocarbons fraction to at least one of a hydrocracking and hydroisomerization process to produce a renewable diesel fuel.

42. A process for producing stripped hydrocarbons from a biological feedstock, said process comprising:

a. diluting the biological feedstock with a hydrocarbon oil to provide a diluted biological feedstock;

b. subjecting the diluted biological feedstock to a hydrodeoxygenation process by contacting the diluted biological feedstock with a hydrogen-rich gas and a catalyst at an elevated temperature and pressure to produce a reactor effluent;

c. separating the reactor effluent into a hydrocarbon phase, a gas phase, and an aqueous phase;

d. using a hydrocarbon stripper to separate the hydrocarbon phase into a stripper overheads fraction and a stripped hydrocarbons fraction.

43. The process of claim 42 wherein the biological feedstock comprises free fatty acids, fatty acid glyceride esters, and unsaponifiable material at concentrations greater than 2 wt%.

44. The process of claim 42 wherein the elevated temperature is between about 260 C and 371 C and the elevated pressure is between about 500 and 2,500 psig.

45. The process of claim 42 further comprising adding the stripped hydrocarbons fraction to a diesel fuel.

46. The process of claim 42 further comprising introducing the stripped hydrocarbons fraction to at least one of a hydrocracking and hydroisomerization process to produce a renewable diesel fuel.