CLAIMS

WHAT IS CLAIMED IS:

1. A method for processing an amide-containing bio oil, comprising:

exposing a biomass feed comprising algae to water under hydrothermal processing conditions including a temperature of at least 250ºC to obtain an amide-containing bio oil containing fatty acids, fatty acid derivatives, at least about 1.5 wt % nitrogen, and at least about 10 wt % fatty amides;

exposing the amide-containing bio oil to a first catalyst in the presence of hydrogen, wherein the first catalyst comprises at least about 5 wt % of a metal salt component containing a rare earth metal salt, an alkali metal salt, an alkaline earth metal salt, or a combination thereof under effective coupling conditions including a temperature from about 300ºC to about 450ºC to form an effluent containing ketones;

separating the effluent containing ketones to form at least a gas phase effluent and a liquid effluent containing ketones; and

exposing at least a portion of the liquid effluent containing ketones to a hydroprocessing catalyst under effective hydroprocessing conditions including a temperature from about 200ºC to about 450ºC to form a deoxygenated effluent,

wherein an average carbon number of the ketones in the liquid effluent is greater than 1.5 times an average carbon number for the combined fatty amides, fatty acids, and fatty acid derivatives in the amide-containing bio oil.

2. The method of claim 1, wherein the weight percentage of ketones in the effluent containing ketones is at least 50% of the combined weight percentage of the fatty amides, the fatty acids, and the fatty acid derivatives in the amide-containing bio oil.

3. The method of claim 1, wherein the hydroprocessing catalyst comprises ZSM-48, ZSM-23, or a combination thereof, with a hydrothermally stable binder comprising titanium oxide, zirconium oxide, cerium oxide, or a combination thereof.

4. The method of claim 1, wherein the first catalyst comprises a clay containing the at least one of a rare earth metal salt, an alkali metal salt, and an alkaline earth metal salt.

5. The method of claim 1, wherein the metal salt component comprises a salt of Na, K, Rb, Cs, Mg, Ca, Sr, Ba, La, Ce, Y, or a combination thereof.

6. The method of claim 1, wherein the metal salt component comprises a salt of Mg, Ca, or a combination thereof.

7. The method of claim 1, wherein the metal salt component comprises a salt of Na, K, Cs, Mg, Ca, La, or a combination thereof, wherein the first catalyst further comprising a hydrothermally stable support comprising titanium oxide, zirconium oxide, cerium oxide, or a combination thereof.

8. The method of claim 7, wherein the hydrothermally stable support comprises titanium oxide or zirconium oxide, and wherein the hydroprocessing catalyst comprises a hydrothermally stable binder comprising titanium oxide.

9. The method of claim 1, further comprising fractionating the deoxygenated effluent to form at least a diesel boiling range fraction and a lubricant boiling range fraction.

10. The method of claim 1, wherein the fatty acid derivatives comprise glycerides.

11. The method of claim 1, wherein the fatty amides comprise substituted fatty amides.

12. The method of claim 1, wherein the amide-containing bio oil comprises at least 2 wt % nitrogen.

13. The method of claim 1, wherein the effluent containing ketones further comprises nitriles, and wherein the first catalyst further comprises a support material

selected from the group consisting of aluminum oxide, magnesium oxide, calcium oxide, and a combination thereof.

14. The method of claim 13, wherein the support material is selected from the group consisting of magnesium oxide, calcium oxide, and a combination thereof.

15. The method of claim 1, wherein the hydrothermal processing conditions include a temperature of at least 275ºC.