CLAIMS

WHAT IS CLAIMED IS:

1. A method for processing a glyceride-containing feedstock, comprising:

exposing a feedstock containing glycerides (*e.g.*, at least 10 wt% glycerides, at least 25 wt% glycerides, or at least 50 wt% glycerides) to a catalyst comprising at least about 5 wt% of a rare earth metal salt, an alkali metal salt, an alkaline earth metal salt, or a combination thereof in the presence of hydrogen under effective deoxygenation conditions to form an effluent containing ketones, the weight percentage of ketones in the effluent being at least about 50% of the weight percentage (*e.g.*, about 75% of the weight percentage or about 90% of the weight percentage) of the glycerides in the feedstock; and

exposing, without intermediate separation, at least a portion of the effluent containing ketones to a dewaxing catalyst bound with a hydrothermally stable binder under effective dewaxing conditions to form a deoxygenated effluent,

wherein the glycerides in the feedstock have an average carbon number for side chains in the glycerides, and wherein an average carbon number of the ketones in the effluent is greater than 1.5 times (*e.g.*, greater than 1.75 times or greater than 1.9 times) the average carbon number for the side chains.

2. 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.

3. The method of any of the above claims, wherein the feedstock further comprises at least one of free fatty acids and fatty acid derivatives, the fatty acid derivatives being fatty acid esters, fatty acid amides, or a combination thereof.

4. The method of claim 3, wherein the weight percentage of ketones in the effluent containing ketones is at least about 50% of the combined weight percentage (*e.g.*, about 75% of the weight percentage or about 90% of the weight percentage) of the glycerides, free fatty acids, and fatty acid derivatives in the feedstock, the free fatty acids and fatty

acid derivatives in the feedstock having an average carbon number for the fatty acid chains, and wherein the average carbon number of the ketones in the effluent is greater than 1.5 times (*e.g.*, greater than 1.75 times or greater than 1.9 times) the weighted average carbon number for the side chains of the glycerides and the fatty acid chains of the free fatty acids and fatty acid derivatives.

5. A method for processing a glyceride-containing feedstock, comprising:

exposing a feedstock containing at least 10 wt% glycerides (*e.g.*, at least 25 wt% glycerides or at least 50 wt% glycerides) to a catalyst mixture comprising a dewaxing catalyst bound with a hydrothermally stable binder and a catalyst comprising at least about 5 wt% of a rare earth metal salt, alkali metal salt, alkaline earth metal salt, or a combination thereof in the presence of hydrogen under effective deoxygenation conditions, the effective deoxygenation conditions including a temperature of at least about 300°C, to form a deoxygenated effluent,

wherein the glycerides in the feedstock have an average carbon number for side chains in the glycerides, and at least 1 wt% (*e.g.*, at least 5 wt% or at least 25 wt%) of the deoxygenated effluent comprises lubricant boiling range molecules derived from the glycerides in the feedstock, the lubricant boiling range molecules having a number of carbon atoms greater than 1.5 times (*e.g.*, greater than 1.75 times or greater than 1.9 times) the average carbon number for the glyceride side chains.

6. The method of claim 5, wherein exposing the feedstock to a catalyst mixture comprises exposing the feedstock to a plurality of mixed catalyst beds, wherein a catalyst mixture in a first mixed catalyst bed has a lower volume percentage of dewaxing catalyst than a second mixed catalyst bed that is downstream relative to the flow of feedstock from the first mixed catalyst bed.

7. The method of claim 5 or claim 6, wherein the feedstock further comprises at least one of free fatty acids or fatty acid derivatives, the fatty acid derivatives being fatty acid esters, fatty acid amides, or a combination thereof.

8. The method of any of claims 3, 4, or 7, wherein the combined weight of glycerides, free fatty acids, and fatty acid derivatives is at least about 10 wt% of the feedstock (*e.g.*, at least about 25 wt% of the feedstock or at least 50 wt% of the feedstock), and at least 1 wt% (*e.g.*, at least 5 wt% or at least 25 wt%) of the deoxygenated effluent comprises lubricant boiling range molecules derived from the glycerides, free fatty acids, and fatty acid derivatives in the feedstock, the lubricant boiling range molecules having a number of carbon atoms greater than 1.8 times (*e.g.*, greater than 1.75 times or greater than 1.9 times) the weighted average carbon number for the side chains of the glycerides and the fatty acid chains of the free fatty acids and fatty acid derivatives.

9. The method of any of the previous claims, wherein the dewaxing catalyst comprises ZSM-48, ZSM-23, or a combination thereof, and wherein the hydrothermally stable binder comprises titanium oxide, zirconium oxide, cerium oxide, or a combination thereof.

10. A method for processing a glyceride-containing feedstock, comprising:

exposing a glyceride-containing feedstock containing at least 25 wt% (*e.g.*, at least 50 wt%) of a combined weight of glycerides, free fatty acids, and fatty acid derivatives to a catalyst mixture in the presence of hydrogen under effective deoxygenation conditions to form a deoxygenated effluent, the effective deoxygenation conditions including a temperature of at least about 300°C, the fatty acid derivatives being fatty acid esters and/or fatty acid amides,

the catalyst mixture comprising

(a) a dewaxing catalyst comprising ZSM-48, ZSM-23, or a combination thereof, the dewaxing catalyst being bound with a hydrothermally stable binder comprising zirconium oxide, titanium oxide, cerium oxide, or a combination thereof, and

(b) a catalyst comprising at least about 5 wt% of a rare earth metal salt, alkali metal salt, alkaline earth metal salt, or a combination thereof on a support comprising zirconium oxide, titanium oxide, cerium oxide, or a combination thereof,

wherein the glycerides, free fatty acids, and fatty acid derivatives in the feedstock have a weighted average carbon number for the fatty acid chains and the side chains in the glycerides, and at least 1 wt% (*e.g.*, at least 5 wt% or at least 25 wt%) of the deoxygenated effluent comprises lubricant boiling range molecules derived from the free fatty acids, fatty acid derivatives, and side chains of glycerides in the feedstock, the lubricant boiling range molecules having an average number of carbon atoms greater than 1.5 times (*e.g.*, greater than 1.75 times or greater than 1.9 times) the weighted average carbon number for the side chains of the glycerides and the fatty acid chains of the free fatty acids and fatty acid derivatives.

11. The method of claim 9, wherein the feedstock contains at least 10 wt% of glycerides.

12. The method of any of the previous claims, wherein the catalyst comprising a rare earth metal salt, an alkali metal salt, an alkaline earth metal salt, or a combination thereof comprises a clay containing at least one of a rare earth metal salt, an alkali metal salt, and an alkaline earth metal salt.

13. The method of any of the previous claims, wherein one or more of the following are satisfied:

the rare earth metal salt, alkali metal salt, and/or alkaline earth metal salt is Na, K, Rb, Cs, Mg, Ca, Sr, Ba, La, Ce, Y, or a combination thereof, *e.g.*, is Na, K, Cs, Mg, Ca, La, or a combination thereof;

the catalyst further comprises a hydrothermally stable support comprising titanium oxide, zirconium oxide, cerium oxide, or a combination thereof; *e.g.*, comprising titanium oxide and/or zirconium oxide; and

the hydrothermally stable binder comprises titanium oxide.

14. The method of any of the previous claims, wherein the glycerides in the feedstock comprise triglycerides.

WHAT IS CLAIMED IS:

1. A method for processing a glyceride-containing feedstock, comprising:

exposing a feedstock containing at least 10 wt % glycerides to a catalyst mixture comprising a dewaxing catalyst bound with a hydrothermally stable binder and a catalyst comprising at least about 5 wt % of a rare earth metal salt, alkali metal salt, alkaline earth metal salt, or a combination thereof in the presence of hydrogen under effective deoxygenation conditions, the effective deoxygenation conditions including a temperature of at least about 300°C, to form a deoxygenated effluent,

wherein the glycerides in the feedstock have an average carbon number for side chains in the glycerides, and at least 1 wt % of the deoxygenated effluent comprises lubricant boiling range molecules derived from the glycerides in the feedstock, the lubricant boiling range molecules having a number of carbon atoms greater than 1.5 times the average carbon number for the glyceride side chains, wherein exposing the feedstock to a catalyst mixture comprises exposing the feedstock to a plurality of mixed catalyst beds, and wherein a catalyst mixture in a first mixed catalyst bed has a lower volume percentage of dewaxing catalyst than a second mixed catalyst bed that is downstream relative to the flow of feedstock from the first mixed catalyst bed.

2. The method of claim 1, wherein the feedstock comprises at least 25 wt % of glycerides and at least 5 wt % of the deoxygenated effluent comprises lubricant boiling range molecules derived from the glycerides in the feedstock, the lubricant boiling range molecules having a number of carbon atoms greater than 1.5 times the average carbon number for the side chains.

3. The method of claim 1, wherein the feedstock comprises at least 50 wt % of glycerides and at least 25 wt % of the deoxygenated effluent comprises lubricant boiling range molecules derived from the glycerides in the feedstock, the lubricant boiling range molecules having a number of carbon atoms greater than 1.5 times the average carbon number for the side chains.

4. The method of claim 1, wherein the catalyst mixture comprises a) a dewaxing catalyst comprising ZSM-48, ZSM-23, or a combination thereof, the dewaxing catalyst being bound with a hydrothermally stable binder comprising zirconium oxide, titanium oxide, cerium oxide, or a combination thereof, and b) a catalyst comprising at least about 5 wt % of a rare earth metal salt, alkali metal salt, alkaline earth metal salt, or a combination thereof on a hydrothermally stable support comprising zirconium oxide, titanium oxide, cerium oxide, or a combination thereof.

5. The method of claim 4, wherein the rare earth metal salt, alkali metal salt, and/or alkaline earth metal salt is Na, K, Cs, Mg, Ca, La, or a combination thereof, the hydrothermally stable support comprises titanium oxide, zirconium oxide, cerium oxide, or a combination thereof, and the hydrothermally stable binder comprises titanium oxide.

6. The method of claim 1, wherein the glycerides in the feedstock comprise triglycerides.

7. The method of claim 1, wherein the feedstock further comprises at least one of free fatty acids and fatty acid derivatives, the fatty acid derivatives being fatty acid esters, fatty acid amides, or a combination thereof.

8. The method of claim 7, wherein the combined weight of glycerides, free fatty acids, and fatty acid derivatives is at least about 25 wt % of the feedstock, and at least 5 wt % of the deoxygenated effluent comprises lubricant boiling range molecules derived from the glycerides, free fatty acids, and fatty acid derivatives in the feedstock, the lubricant boiling range molecules having a number of carbon atoms greater than 1.5 times the weighted average carbon number for the side chains of the glycerides and the fatty acid chains of the free fatty acids and fatty acid derivatives.

9. A method for processing a glyceride-containing feedstock, comprising:

exposing a glyceride-containing feedstock containing at least 25 wt % of a combined weight of glycerides, free fatty acids, and fatty acid derivatives to a catalyst mixture in the presence of hydrogen under effective deoxygenation conditions to form

a deoxygenated effluent, the effective deoxygenation conditions including a temperature of at least about 300°C, the fatty acid derivatives being fatty acid esters and/or fatty acid amides, the catalyst mixture comprising

a) a dewaxing catalyst comprising ZSM-48, ZSM-23, or a combination thereof, the dewaxing catalyst being bound with a hydrothermally stable binder comprising zirconium oxide, titanium oxide, cerium oxide, or a combination thereof, and

b) a catalyst comprising at least about 5 wt % of a rare earth metal salt, alkali metal salt, alkaline earth metal salt, or a combination thereof on a support comprising zirconium oxide, titanium oxide, cerium oxide, or a combination thereof,

wherein the glycerides, free fatty acids, and fatty acid derivatives in the feedstock have a weighted average carbon number for the fatty acid chains and the side chains in the glycerides, and at least 1 wt % of the deoxygenated effluent comprises lubricant boiling range molecules derived from the free fatty acids, fatty acid derivatives, and side chains of glycerides in the feedstock, the lubricant boiling range molecules having an average number of carbon atoms greater than 1.5 times the weighted average carbon number for the side chains of the glycerides and the fatty acid chains of the free fatty acids and fatty acid derivatives, wherein exposing the glyceride-containing feedstock to a catalyst mixture comprises exposing the feedstock to a plurality of mixed catalyst beds, and wherein a catalyst mixture in a first mixed catalyst bed has a lower volume percentage of dewaxing catalyst than a second mixed catalyst bed that is downstream relative to the flow of feedstock from the first mixed catalyst bed.

10. The method of claim 9, wherein the feedstock contains at least 10 wt % of glycerides.