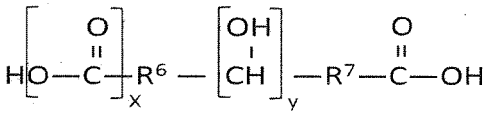
a supported catalyst to form an effluent containing a fatty alcohol, wherein the fatty alcohol is recovered and subsequently dehydrated in a dehydration zone under dehydration conditions to forming an alpha-olefin product.

[010] In one embodiment, the alpha-olefin product formed is oligmerized in an oligomerization zone under oligomerization conditions to form an oligomer. In yet another embodiment, the oligomer formed is hydrogenated forming a base oil, under hydroprocessing conditions including a temperature from 302°F to 752°F (150°C to 400°C) and a total reaction pressure of from 50 to 3000 psig (0.35 to 20.7 MPa gauge).

[011] In the ~~invention~~disclosure, the promoted self-supported catalyst or the promoted supported catalyst comprises at least a Group VIB metal selected from molybdenum and tungsten, at least a Group VIII metal selected from cobalt and nickel, the promoter being selected from the group of hydroxy-(di)-carboxylic acids with steric configurations and having the structure of:

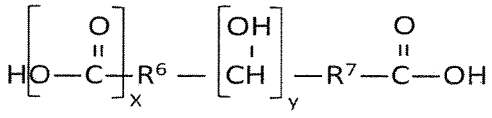


[012]

[013] where x is 1 or 0, y is 1 or 0, and R^6 or R^7 are a saturated, unsaturated, cyclic, acyclic, aromatic, alcoholic, branched or unbranched hydrocarbon group, with R^6 or R^7 being $(CH)_{2m}(CH_2)_n$ with m and n as ≥0 integers.

[013a] In one embodiment, there is provided a process for the catalytic upgrade of a feedstock comprising renewable materials consisting essentially of triglycerides, the process comprising:

contacting the feedstock under hydroprocessing conditions with at least a promoted catalyst to form a liquid effluent and a gaseous product, the catalyst is selected from a self-supported catalyst, a supported catalyst and combinations thereof, the catalyst comprising at least a Group VIB metal selected from molybdenum and tungsten, at least a Group VIII metal selected from cobalt and nickel, the promoter being selected from the group of hydroxy-(di)-carboxylic acids with steric configurations and having the structure of:



where x is 1 or 0, y is 1 or 0, and R^6 or R^7 are a saturated, unsaturated, cyclic, acyclic, aromatic, alcoholic, branched or unbranched hydrocarbon group, with R^6 or R^7 being $(CH)_{2m}(CH_2)_n$ with m and n as ≥0 integers; and

recovering the liquid effluent comprising at least one of normal paraffins, fatty alcohols, aliphatic monoesters and combinations thereof,

wherein the hydroprocessing conditions are selected substantially according to any of:

a reaction temperature of at least 446°F (230°C) for a triglycerides conversion rate of at least 50 %;

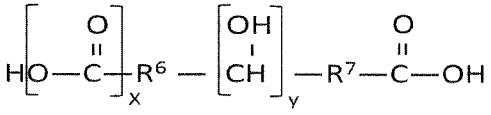
a reaction temperature of at least 446°F (230°C) and a total reaction pressure from 50 to 3000 psig (0.35 to 20.7 MPa gauge) for the liquid effluent to have a normal paraffins concentration of at least 30 wt. %;

a reaction temperature of 302°F to 554°F (150°C to 290°C) and a total reaction pressure from 50 to 3000 psig (0.35 to 20.7 MPa gauge) for the liquid effluent to have a fatty alcohols concentration of at least 5 wt. %;

a reaction temperature of 302°F to 554°F (150°C to 290°C) and a total reaction pressure from 50 to 3000 psig (0.35 to 20.7 MPa gauge) for the liquid effluent to have an aliphatic monoesters concentration of at least 5 wt. %.

[013b] In one embodiment, there is provided a process for the catalytic upgrade of a feedstock comprising renewable materials consisting essentially of triglycerides, the process comprising:

contacting the feedstock under hydroprocessing conditions with at least a promoted catalyst to form a liquid effluent and a gaseous product, the promoted catalyst is selected from a self-supported catalyst, a supported catalyst and combinations thereof, the catalyst comprising at least a Group VIB metal selected from molybdenum and tungsten, a Group VIII metal selected from cobalt and nickel, the promoter being selected from the group of hydroxy-(di)-carboxylic acids with steric configurations and having the structure of:



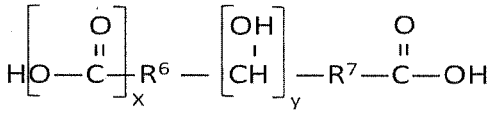
where x is 1 or 0, y is 1 or 0, and R^6 or R^7 are a saturated, unsaturated, cyclic, acyclic, aromatic, alcoholic, branched or unbranched hydrocarbon group, with R^6 or R^7 being $(CH)_{2m}(CH_2)_n$ with m and n as ≥0 integers; and

recovering the liquid effluent having a normal paraffins concentration of at least 30 wt. %,

wherein the hydroprocessing conditions include a temperature of from 446°F to 752°F (230°C to 400°C) and a total reaction pressure from 50 to 3000 psig (0.35 to 20.7 MPa gauge).

[013c] In one embodiment, there is provided a process for the catalytic upgrade of a feedstock comprising renewable materials consisting essentially of triglycerides, the process comprising:

contacting the feedstock under hydroprocessing conditions with at least a promoted catalyst to form a liquid effluent and a gaseous product, the promoted catalyst is selected from a self-supported catalyst, a supported catalyst and combinations thereof, the catalyst comprising at least a Group VIB metal selected from molybdenum and tungsten, a Group VIII metal selected from cobalt and nickel, the promoter being selected from the group of hydroxy-(di)-carboxylic acids with steric configurations and having the structure of:



where x is 1 or 0, y is 1 or 0, and R^6 or R^7 are a saturated, unsaturated, cyclic, acyclic, aromatic, alcoholic, branched or unbranched hydrocarbon group, with R^6 or R^7 being $(CH)_{2m}(CH_2)_n$ with m and n as ≥0 integers; and

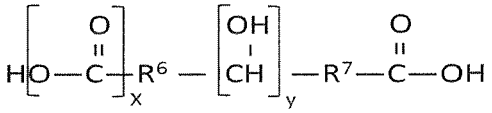
recovering the liquid effluent having a fatty alcohols concentration of at least 5 wt. %,

wherein the hydroprocessing conditions include a temperature of from 302°F to 554°F (150°C to 290°C) and a total reaction pressure from 50 to 3000 psig (0.35 to 20.7 MPa gauge).

[013d] In one embodiment, there is provided a process for the catalytic upgrade of a feedstock comprising renewable materials consisting essentially of triglycerides, the process comprising:

contacting the feedstock under hydroprocessing conditions with at least a promoted catalyst to form a liquid effluent and a gaseous product, the promoted catalyst is selected from a

self-supported catalyst, a supported catalyst and combinations thereof, the catalyst comprising at least a Group VIB metal selected from molybdenum and tungsten, a Group VIII metal selected from cobalt and nickel, the catalyst is promoted with a promoter selected from the group of hydroxy-(di)-carboxylic acids with steric configurations and having the structure of:



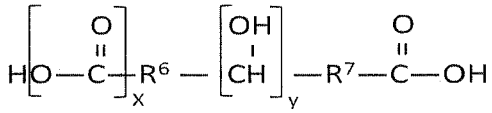
where x is 1 or 0, y is 1 or 0, and R^6 or R^7 are a saturated, unsaturated, cyclic, acyclic, aromatic, alcoholic, branched or unbranched hydrocarbon group, with R^6 or R^7 being $(CH)_{2m}(CH_2)_n$ with m and n as ≥0 integers; and

recovering the liquid effluent having an aliphatic monoesters concentration of at least 5 wt. %,

wherein the hydroprocessing conditions include a temperature of from 302°F to 554°F (150°C to 290°C) and a total reaction pressure from 50 to 3000 psig (0.35 to 20.7 MPa gauge).

[013e] In one embodiment, there is provided a process for the catalytic upgrade of a feedstock comprising renewable materials consisting essentially of triglycerides, the process comprising:

contacting the feedstock under hydroprocessing conditions with at least a promoted catalyst to form a liquid effluent and a gaseous product, the promoted catalyst is selected from a self-supported catalyst, a supported catalyst and combinations thereof, the catalyst comprising at least a Group VIB metal selected from molybdenum and tungsten, a Group VIII metal selected from cobalt and nickel, the promoter being selected from the group of hydroxy-(di)-carboxylic acids with steric configurations, having the structure:



where x is 1 or 0, y is 1 or 0, and R^6 or R^7 are a saturated, unsaturated, cyclic, acyclic, aromatic, alcoholic, branched or unbranched hydrocarbon group, with R^6 or R^7 being $(CH)_{2m}(CH_2)_n$ with m and n as ≥0 integers; the hydroprocessing conditions including a temperature of from 446°F to

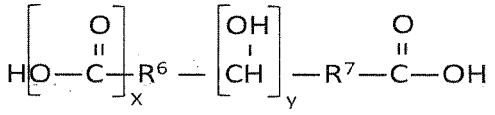
752°F (230°C to 400°C) and a total reaction pressure of from 50 to 3000 psig (0.35 to 20.7 MPa gauge) for a triglycerides conversion rate of at least 50 wt.%;

recovering the liquid effluent having a normal paraffins concentration of at least 30 wt. %, and

catalytically-isomerizing at least a portion of the normal paraffins to form an isomerized product comprising isoparaffins.

[013f] In one embodiment, there is provided a process for the catalytic upgrade of a feedstock comprising renewable materials consisting essentially of triglycerides, the process comprising:

contacting the feedstock under hydroprocessing conditions with at least a promoted catalyst to form a liquid effluent and a gaseous product, the promoted catalyst is selected from a self-supported catalyst, a supported catalyst and combinations thereof, the catalyst comprising at least a Group VIB metal selected from molybdenum and tungsten, a Group VIII metal selected from cobalt and nickel, the promoter being selected from the group of hydroxy-(di)-carboxylic acids with steric configurations, having the structure:



where x is 1 or 0, y is 1 or 0, and R^6 or R^7 are a saturated, unsaturated, cyclic, acyclic, aromatic, alcoholic, branched or unbranched hydrocarbon group, with R^6 or R^7 being $(CH)_{2m}(CH_2)_n$ with m and n as ≥0 integers; the hydroprocessing conditions including a temperature of from 302°F to 554°F (150°C to 290°C) and a total reaction pressure of from 50 to 3000 psig (0.35 to 20.7 MPa gauge) for a triglycerides conversion rate of at least 10 wt.%;

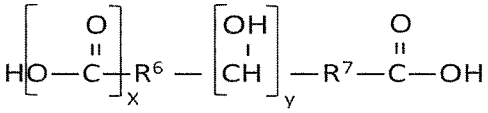
recovering the liquid effluent having a fatty alcohols concentration of at least 5 wt. %;

recovering a fatty alcohols product from the liquid effluent; and

dehydrating the fatty alcohols product under dehydrating conditions in the presence of at least a catalyst for a sufficient amount of time and at a sufficient temperature forming α-olefin products.

[013g] In one embodiment, there is provided a process for the catalytic upgrade of a feedstock comprising renewable materials consisting essentially of triglycerides, the process comprising:

contacting the feedstock under hydroprocessing conditions with at least a promoted catalyst to form a liquid effluent and a gaseous product, the promoted catalyst is selected from a self-supported catalyst, a supported catalyst and combinations thereof, the catalyst comprising at least a Group VIB metal selected from molybdenum and tungsten, a Group VIII metal selected from cobalt and nickel, the promoter being selected from the group of hydroxy-(di)-carboxylic acids with steric configurations, having the structure:



where x is 1 or 0, y is 1 or 0, and R^6 or R^7 are a saturated, unsaturated, cyclic, acyclic, alcoholic, aromatic, branched or unbranched hydrocarbon group, with R^6 or R^7 being $(CH)_{2m}(CH_2)_n$ with m and n as ≥0 integers; the hydroprocessing conditions including a temperature of from 302°F to 554°F (150°C to 290°C) and a total reaction pressure of from 50 to 3000 psig (0.35 to 20.7 MPa gauge) for a triglycerides conversion rate of at least 10 wt. %;

recovering the liquid effluent having a fatty alcohols concentration of at least 5 wt. %;

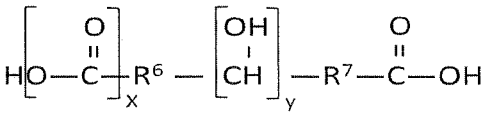
recovering a fatty alcohols product from the liquid effluent;

dehydrating the fatty alcohols product under dehydrating conditions in the presence of at least a catalyst for a sufficient amount of time and at a sufficient temperature forming α-olefin products; and

reacting the α-olefin products over a heterogeneous acidic catalyst at a temperature of 100-300° C and under pressure of 0-1000 psig to form a blend of oligomers.

[013g] In one embodiment, there is provided a process to optimize hydrogen consumption in the catalytic upgrade of a feedstock comprising renewable materials consisting essentially of triglycerides, the process comprising:

contacting the feedstock under hydroprocessing conditions with at least a promoted catalyst to form a liquid effluent and a gaseous product, the promoted catalyst is selected from a self-supported catalyst, a supported catalyst and combinations thereof, the catalyst comprising at least a Group VIB metal selected from molybdenum and tungsten, a Group VIII metal selected from cobalt and nickel, the promoter being selected from the group of hydroxy-(di)-carboxylic acids with steric configurations, having the structure:



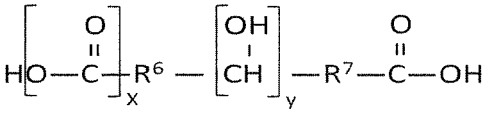
where x is 1 or 0, y is 1 or 0, and R^6 or R^7 are a saturated, unsaturated, cyclic, acyclic, aromatic, alcoholic, branched or unbranched hydrocarbon group, with R^6 or R^7 being $(CH)_{2m}(CH_2)_n$ with m and n as ≥0 integers; the hydroprocessing conditions including a reactor temperature of from 446°F to 752°F (230°C to 400°C) and a total reaction pressure from 50 to 3000 psig (0.35 to 20.7 MPa gauge); and

recovering the liquid effluent having a normal paraffins concentration of at least 30 wt. %,

wherein the hydroprocessing conditions are adjusted by any of: increasing the reactor temperature of at least 50°F, decreasing the total reaction pressure of at least 100 psi, and combinations thereof for a reduction in hydrogen consumption in the process of at least 10 SCF/barrel of feedstock.

[013h] In one embodiment, there is provided a process for the catalytic upgrade of a feedstock comprising renewable materials consisting essentially of triglycerides, the process comprising:

contacting the feedstock under hydroprocessing conditions with at least a promoted catalyst to form a liquid effluent and a gaseous product, the promoted catalyst is selected from a self-supported catalyst, a supported catalyst and combinations thereof, the catalyst comprising at least a Group VIB metal selected from molybdenum and tungsten, a Group VIII metal selected from cobalt and nickel, the promoter being selected from the group of hydroxy-(di)-carboxylic acids with steric configurations, having the structure:



where x is 1 or 0, y is 1 or 0, and R^6 or R^7 are a saturated, unsaturated, cyclic, acyclic, aromatic, alcoholic, branched or unbranched hydrocarbon group, with R^6 or R^7 being $(CH)_{2m}(CH_2)_n$ with m and n as ≥0 integers; and

recovering the liquid effluent comprising at least one of normal paraffins, fatty alcohols, aliphatic monoesters and combinations thereof,

recovering a normal paraffins product from the liquid effluent;

catalytically-isomerizing at least a portion of the normal paraffins product to form an isomerized product comprising isoparaffins;

wherein the hydroprocessing conditions are selected substantially according to any of:

a reaction temperature of at least 446°F (230°C) for a triglycerides conversion rate of at least 50 wt. %;

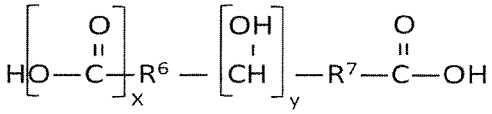
a reaction temperature of at least 446°F (230°C) and a total reaction pressure from 50 to 3000 psig (0.35 to 20.7 MPa gauge) for the liquid effluent to have a normal paraffins concentration of at least 30 wt. %;

a reaction temperature of 302°F to 554°F (150°C to 290°C) and a total reaction pressure from 50 to 3000 psig (0.35 to 20.7 MPa gauge) for the liquid effluent to have a fatty alcohols concentration of at least 5 wt. %;

a reaction temperature of 302°F to 554°F (150°C to 290°C) and a total reaction pressure from 50 to 3000 psig (0.35 to 20.7 MPa gauge) for the liquid effluent to have an aliphatic monoesters concentration of at least 5 wt. %.

[013i] In one embodiment, there is provided a process for the catalytic upgrade of a feedstock comprising renewable materials consisting essentially of triglycerides, the process comprising:

contacting the feedstock under hydroprocessing conditions with at least a promoted catalyst to form a liquid effluent and a gaseous product, the promoted catalyst is selected from a self-supported catalyst, a supported catalyst and combinations thereof, the catalyst comprising at least a Group VIB metal selected from molybdenum and tungsten, a Group VIII metal selected from cobalt and nickel, the promoter being selected from the group of hydroxy-(di)-carboxylic acids with steric configurations, having the structure:



where x is 1 or 0, y is 1 or 0, and R^6 or R^7 are a saturated, unsaturated, cyclic, acyclic, aromatic, alcoholic, branched or unbranched hydrocarbon group, with R^6 or R^7 being $(CH)_{2m}(CH_2)_n$ with m and n as ≥0 integers; and

recovering the liquid effluent comprising at least one of normal paraffins, fatty alcohols, aliphatic monoesters and combinations thereof,

recovering a fatty alcohols product from the liquid effluent;

dehydrating the fatty alcohols under dehydrating conditions in the presence of at least a catalyst for a sufficient amount of time and at a sufficient temperature forming α-olefin products;

wherein the hydroprocessing conditions are selected substantially according to any of:

a reaction temperature of at least 446°F (230°C) for a triglycerides conversion rate of at least 50 wt. %;

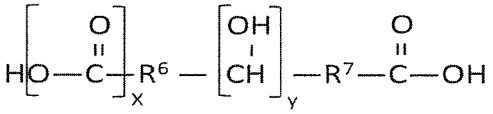
a reaction temperature of at least 446°F (230°C) and a total reaction pressure from 50 to 3000 psig (0.35 to 20.7 MPa gauge) for the liquid effluent to have a normal paraffins concentration of at least 30 wt. %;

a reaction temperature of 302°F to 554°F (150°C to 290°C) and a total reaction pressure from 50 to 3000 psig (0.35 to 20.7 MPa gauge) for the liquid effluent to have a fatty alcohols concentration of at least 5 wt. %;

a reaction temperature of 302°F to 554°F (150°C to 290°C) and a total reaction pressure from 50 to 3000 psig (0.35 to 20.7 MPa gauge) for the liquid effluent to have an aliphatic monoesters concentration of at least 5 wt. %.

[013j] In one embodiment, there is provided a process for the catalytic upgrade of a feedstock comprising renewable materials consisting essentially of triglycerides, the process comprising:

contacting the feedstock under hydroprocessing conditions with at least a promoted catalyst to form a liquid effluent and a gaseous product, the catalyst is selected from a promoted self-supported catalyst, a promoted supported catalyst and combinations thereof, the catalyst comprising at least a Group VIB metal selected from molybdenum and tungsten, a Group VIII metal selected from cobalt and nickel, the promoter being selected from the group of hydroxy-(di)-carboxylic acids with steric configurations, having the structure:



where x is 1 or 0, y is 1 or 0, and R^6 or R^7 are a saturated, unsaturated, cyclic, acyclic, aromatic, alcoholic, branched or unbranched hydrocarbon group, with R^6 or R^7 being $(CH)_{2m}(CH_2)_n$ with m and n as ≥0 integers; and

recovering the liquid effluent comprising at least one of normal paraffins, fatty alcohols, aliphatic monoesters and combinations thereof,

recovering a fatty alcohols product from the liquid effluent;

dehydrating the fatty alcohols product under dehydrating conditions in the presence of at least a catalyst for a sufficient amount of time and at a sufficient temperature forming α-olefin products;

reacting the α-olefin products over a heterogeneous acidic catalyst at a temperature of 100-300° C and under pressure of 0-1000 psig to form a blend of oligomers;

wherein the hydroprocessing conditions are selected substantially according to any of:

a reaction temperature of at least 446°F (230°C) for a triglycerides conversion rate of at least 50 wt. %;

a reaction temperature of at least 446°F (230°C) and a total reaction pressure from 50 to 3000 psig (0.35 to 20.7 MPa gauge) for the liquid effluent to have a normal paraffins concentration of at least 30 wt. %;

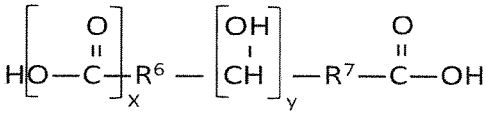
a reaction temperature of 302°F to 554°F (150°C to 290°C) and a total reaction pressure from 50 to 3000 psig (0.35 to 20.7 MPa gauge) for the liquid effluent to have a fatty alcohols concentration of at least 5 wt. %;

a reaction temperature of 302°F to 554°F (150°C to 290°C) and a total reaction pressure from 50 to 3000 psig (0.35 to 20.7 MPa gauge) for the liquid effluent to have an aliphatic monoesters concentration of at least 5 wt. %.

[013k] In one embodiment, there is provided a process for the catalytic upgrade of a feedstock comprising renewable materials consisting essentially of triglycerides, the process comprising:

contacting the feedstock under hydroprocessing conditions with at least a promoted catalyst to form a liquid effluent and a gaseous product, the catalyst is selected from a promoted self-supported catalyst, a promoted supported catalyst and combinations thereof, the catalyst comprising at least a Group VIB metal selected from molybdenum and tungsten, a Group VIII

metal selected from cobalt and nickel, the promoter being selected from the group of hydroxy-(di)-carboxylic acids with steric configurations, having the structure:



where x is 1 or 0, y is 1 or 0, and R^6 or R^7 are a saturated, unsaturated, cyclic, acyclic, aromatic, alcoholic, branched or unbranched hydrocarbon group, with R^6 or R^7 being $(CH)_{2m}(CH_2)_n$ with m and n as ≥0 integers; the hydroprocessing conditions include a temperature of from 302°F to 554°F (150°C to 290°C) and a total reaction pressure from 50 to 3000 psig (0.35 to 20.7 MPa gauge);

recovering the liquid effluent comprising at least one of normal paraffins, fatty alcohols, aliphatic monoesters and combinations thereof, the liquid effluent having a fatty alcohols concentration of at least 5 wt. %;

recovering a fatty alcohols product from the liquid effluent;

dehydrating the fatty alcohols product under dehydrating conditions in the presence of at least a catalyst for a sufficient amount of time and at a sufficient temperature forming α-olefin products; and

co-oligomerizing the α-olefin products with light olefins over a heterogeneous acidic catalyst at a temperature of 100-300° C and under pressure of 0-1000 psig to form Group 3 lubricant products.

BRIEF DESCRIPTION OF THE FIGURES

[014] Figure 1 is a schematic diagram showing the various reaction pathways in the hydroprocessing of a renewable feedstock, e.g., triglycerides, generating various desired products such as long chain normal paraffins, fatty alcohols, fatty acids and esters.

[015] Figure 2 is a schematic diagram showing formation of various desirable products, e.g., oligomers, esters, Guerbet alcohols and EOR (Enhanced Oil Recovery) surfactants, from the upgrading of a renewable feedstock, e.g., triglycerides.

DETAILED DESCRIPTION

[016] The following terms will be used throughout the specification and will have the following meanings unless otherwise indicated.