**Title: Method for co-production of aviation fuel and diesel**

Conversion of oxygenates such as renewables in hydroprocessing has so far been focused on making diesel, since the paraffins corresponding to the typical fatty acids of biological materials such as vegetable oils and animal fats (C14, C16 and C18) typical boil from 250°C to 320°C, corresponding well with typical diesel products boiling from 150°C to 380°C. Jet fuel products require a boiling range of 120ºC to 300ºC, which means that an amount of the heavy part of paraffins from renewable feedstocks needs to be converted into lighter materials to produce only jet fuel. The present disclosure relates to a process having a high yield of a mix of liquid transportation fuels, especially renewable diesel and renewable jet fuel meeting typical product requirements by selectively converting the heavy material to lighter material.

**Summary**

In an aspect of the present disclosure, there is provided a process for production of a hydrocarbon fraction suitable for use as jet fuel from an oxygenate feedstock, comprising the steps of

a. combining the feedstock with an amount of a hydrocracked intermediate product and optionally a liquid diluent to form a combined feedstock, directing said combined feedstock to contact a material catalytically active in hydrodeoxygenation (HDO) under hydrotreating conditions to provide a hydrodeoxygenated intermediate product,

b. separating said hydrodeoxygenated intermediate product in at least two fractions including a vapor fraction and a liquid fraction,

c. optionally providing an amount of said liquid fraction as said liquid dilu-ent, directing at least an amount of said liquid fraction to contact a material catalytically active in isomerization (ISOM) under isomerization conditions to provide an isomerized intermediate product,

d. fractionating said isomerized intermediate product to provide at least a hydrocarbon suitable for use as jet fuel and a bottom fraction,

e. directing at least an amount of said bottom fraction to contact a mate-rial catalytically active in hydrocracking (HDC) under hydrocracking conditions to provide the hydrocracked intermediate product.

In another aspect of the present disclosure, there is provided a process plant for production of a hydrocarbon fraction suitable for use as jet fuel from an oxygenate feedstock, said process plant comprising a hydrocracking section (HDC), a hydrodeoxygenation section (HDO), a separator section, an isomerization section (ISOM) and a fractionation section (FRAC), said process plant being configured for

a. directing a recycled product to a hydrocracking section (HDC) to provide a hydrocracked intermediate product,

b. directing the feedstock, said hydrocracked intermediate product, and optionally a further recycled liquid diluent to the hydrodeoxygenation section (HDO) to provide a hydrodeoxygenated intermediate product,

c. separating said hydrodeoxygenated intermediate product in a vapor fraction and a liquid fraction in said separator section (SEP),

d. directing at least an amount of said liquid hydrodeoxygenated intermediate product to contact a material catalytically active in isomerization (ISOM) under isomerization conditions to provide an intermediate isomerized product, and

e. fractionating said isomerized intermediate product in said fractionation section (FRAC) providing at least a hydrocarbon fraction suitable for use as jet fuel and said recycled product.

**Description**

During hydrotreatment of renewable feedstocks in a unit designed for making diesel, an amount of jet fuel is often also produced. However, there is an interest in making a flexible and well controlled conversion from the intermediate products of renewable feedstocks boiling mainly in the diesel range to jet fuel products, which requires significant conversion.

The standard controlling the quality of jet fuel originating from hydroprocessed esters and fatty acids is ASTM D7566, A2.1, which inter alia specifies the boiling point curve and composition. Most of these properties can be easily met by hydrotreating and fractionation. However, special care need to be taken to meet the freezing point (FP) requirement of max -40°C. and the total aromatics content of max 0.5 wt/wt%. In addition, the standard requires an amount of low boiling product by requiring $T_{10}$, i.e. the temper-

**Claims:**

1. A process for production of a hydrocarbon fraction suitable for use as jet fuel from an oxygenate feedstock, comprising the steps of
    a. combining the feedstock with an amount of a hydrocracked intermediate product and optionally a liquid diluent to form a combined feedstock, directing said combined feedstock to contact a material catalytically active in hydrodeoxygenation (HDO) under hydrotreating conditions to provide a hydrodeoxygenated intermediate product,
    b. separating said hydrodeoxygenated intermediate product in at least two fractions including a vapor fraction and a liquid fraction,
    c. optionally providing an amount of said liquid fraction as said liquid diluent, directing at least an amount of said liquid fraction to contact a material catalytically active in isomerization (ISOM) under isomerization conditions to provide an isomerized intermediate product,
    d. fractionating said isomerized intermediate product to provide at least a hydrocarbon suitable for use as jet fuel and a bottom fraction,
    e. directing at least an amount of said bottom fraction to contact a material catalytically active in hydrocracking (HDC) under hydrocracking conditions to provide the hydrocracked intermediate product.

2. The process according to claim 1, wherein said hydrocarbon fraction suitable for use as jet fuel has a final boiling point according to ASTM D86 being less than 300°C.

3. The process according to claim 1 or 2, wherein the volume of hydrogen sulfide relative to the volume of molecular hydrogen in the gas phase of the combined feedstock directed to contact the material catalytically active in hydrodeoxygenation is at least 50 $ppm_v$, 100 $ppm_v$ or 200 $ppm_v$, optionally by adding a stream comprising one or more sulfur compounds, such as dimethyl disulfide or fossil fuels.

4. The process according to claim 1, 2, or 3, wherein the volume of hydrogen sulfide relative to the volume of molecular hydrogen in the gas phase of the total stream directed to contact the material catalytically active in hydrocracking (HDC) is at

least 50 $ppm_v$, 100 $ppm_v$ or 200 $ppm_v$, optionally by adding a stream comprising one or more sulfur compounds, such as dimethyl disulfide or fossil fuels.

5. The process according to claim 1, 2, 3, or 4, wherein said feedstock comprises at least 50%wt triglycerides or fatty acids.

6. The process according to claim 1, 2, 3, or 4, wherein hydrodeoxygenation conditions involve a temperature in the interval 250-400°C, a pressure in the interval 30-150 Bar, and a liquid hourly space velocity (LHSV) in the interval 0.1-2 and wherein the material catalytically active in hydrodeoxygenation comprises one or more sulfided metals taken from the group of nickel, cobalt, molybdenum or tungsten, supported on a carrier comprising one or more refractory oxides, such as alumina, silica or titania.

7. The process according to claim 1, 2, 3, 4, 5, or 6, wherein hydrocracking conditions involve a temperature in the interval 250-425°C, a pressure in the interval 30-150 Bar, and a liquid hourly space velocity (LHSV) in the interval 0.5-4, optionally together with intermediate cooling by quenching with cold hydrogen, feed or product and wherein the material catalytically active in hydrocracking comprises (a) one or more active metals taken from the group platinum, palladium, nickel, cobalt, tungsten and molybdenum, (b) an acidic support taken from the group of a molecular sieve showing high cracking activity, and having a topology such as MFI, BEA and FAU and amorphous acidic oxides such as silica-alumina and (c) a refractory support such as alumina, silica or titania, or combinations thereof.

8. The process according to claim 1, 2, 3, 4, 5, 6, or 7, wherein the amount of material boiling above 300ºC in said hydrocracked intermediate product is reduced by at least 20%wt, 50%wt or 80%wt or more compared to said bottom fraction.

9. The process according to claim 1, 2, 3, 4, 5, 6, 7, or 8, wherein at least an amount of said isomerized intermediate product is directed to contact a material catalytically active in hydrodearomatization (HDA) under hydrodearomatization conditions to provide a hydrodearomatized product comprising less than 1 wt/wt%, 0.5 wt/wt% or

0.1 wt/wt%, calculated by total mass of the aromatic molecules relative to all hydrocarbons in the stream.

10. The process according to claim 9, wherein hydrodearomatization conditions involve a temperature in the interval 200-350°C, a pressure in the interval 30-150 Bar, and a liquid hourly space velocity (LHSV) in the interval 0.5-8 and wherein said material catalytically active in hydrodearomatization comprises an active metal taken from the group comprising platinum, palladium, nickel, cobalt, tungsten and molybdenum, preferably one or more elemental noble metals such as platinum or palladium and a refractory support, preferably amorphous silica-alumina, alumina, silica or titania, or combinations thereof.

11. The process according to claim 8, 9 or 10, wherein a hydrogen rich stream comprising at least 90%vol hydrogen is directed to contact the material catalytically active in hydrodearomatization (HDA).

12. The process according to claim 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, or 11, wherein isomerization conditions involves a temperature in the interval 250-350°C, a pressure in the interval 30-150 Bar, and a liquid hourly space velocity (LHSV) in the interval 0.5-8 and wherein the material catalytically active in isomerization comprises an active metal taken from the group comprising platinum, palladium, nickel, cobalt, tungsten and molybdenum, preferably one or more elemental noble metals such as platinum or palladium, an acidic support preferably a molecular sieve, more preferably having a topology taken from the group comprising MOR, FER, MRE, MWW, AEL, TON and MTT and an amorphous refractory support comprising one or more oxides taken from the group comprising alumina, silica and titania or combinations thereof.

13. A process plant for production of a hydrocarbon fraction suitable for use as jet fuel from an oxygenate feedstock, said process plant comprising a hydrocracking sec-

tion (HDC), a hydrodeoxygenation section (HDO), a separator section, an isomerization section (ISOM) and a fractionation section (FRAC), said process plant being configured for

a. directing a recycled product to a hydrocracking section (HDC) to provide a hydrocracked intermediate product,
b. directing the feedstock, said hydrocracked intermediate product, and optionally a further recycled liquid diluent to the hydrodeoxygenation section (HDO) to provide a hydrodeoxygenated intermediate product,
c. separating said hydrodeoxygenated intermediate product in a vapor fraction and a liquid fraction in said separator section (SEP),
d. directing at least an amount of said liquid hydrodeoxygenated intermediate product to contact a material catalytically active in isomerization (ISOM) under isomerization conditions to provide an intermediate isomerized product, and
e. fractionating said isomerized intermediate product in said fractionation section (FRAC) providing at least a hydrocarbon fraction suitable for use as jet fuel and said recycled product.