CLAIMS

1. A method for the production of hydrocarbon composition, comprising

i) providing carbonaceous feedstock (a);

ii) subjecting the carbonaceous feedstock (a) to catalytic hydroliquefaction in the presence of hydrogen to obtain a product mixture comprising liquid hydrocarbons and off-gas comprising carbon monoxide (CO), carbon dioxide, (CO_2), hydrogen (H_2), water vapor (H_2O), light (C_1-C_3) hydrocarbons, and light oxygenates;

iii) separating the liquid hydrocarbons and the off-gas to obtain a first liquid fraction (b-1) comprising liquid hydrocarbons and a first gaseous fraction (c-1) comprising carbon monoxide (CO), carbon dioxide (CO_2), hydrogen (H_2), water vapor (H_2O), light (C_1-C_3) hydrocarbons, and light oxygenates;

iv) recovering at least part of H_2 from the first gaseous fraction (c-1) to obtain a H_2 depleted second gaseous fraction (c-2), and recirculating at least part, preferably all, of the recovered H_2 to step ii);

v) subjecting at least part, preferably all, of the H_2 depleted second gaseous fraction (c-2) to partial oxygenation (POx) to convert at least part of the light hydrocarbons comprised in the H_2 depleted first gaseous fraction to syngas to obtain a third gaseous fraction (c-3) comprising syngas;

vi) converting in the presence of water steam at least part of the carbon monoxide (CO) comprised in the third gaseous fraction (c-3) to carbon dioxide (CO_2) and hydrogen (H_2) to obtain a CO_2 and H_2 enriched third gaseous fraction (c-3e);

vii) recovering at least part of H_2 from the CO_2 and H_2 enriched third gaseous fraction (c-3e) and recirculating at least part, preferably all, of the recovered H_2 to step ii); and

viii) recovering the first liquid fraction (b-1) to provide a liquid hydrocarbon composition;

wherein the carbonaceous feedstock comprises lignocellulosic biomass feedstock.

2. The method as claimed in claim 1, wherein step ii) is accomplished by

ii-1) subjecting the carbonaceous feedstock (a) to catalytic hydroliquefaction in the presence of hydrogen to obtain an intermediate product mixture comprising partially treated carbonaceous material, deoxygenated liquid hydrocarbons, and off-gas comprising carbon monoxide (CO), carbon dioxide (CO_2), hydrogen (H_2), water vapor (H_2O), light (C_1-C_3) hydrocarbons, and light oxygenates;

ii-3) subjecting the intermediate product mixture to catalytic hydroliquefaction in the presence of hydrogen to obtain a product mixture comprising liquid hydrocarbons and off-gas comprising carbon monoxide (CO), carbon dioxide (CO_2), hydrogen (H_2), water vapor (H_2O), light (C_1-C_3) hydrocarbons, and light oxygenates.

3. The method as claimed in claim 2, wherein step ii) further comprises the following;

ii-2) separating and removing at least part of the non-hydrogen gases comprised in the off-gas formed in step ii-1 from the intermediate product mixture to obtain a hydrogen enriched off-gas fraction (c-h) and a second off-gas fraction (c-o) comprising carbon monoxide (CO), carbon dioxide (CO_2), light (C_1-C_3) hydrocarbons, and light oxygenates; and

subjecting the hydrogen enriched off-gas fraction (c-h) resulting from step ii-2) to catalytic hydroliquefaction in the presence of hydrogen in step ii-3).

4. The method as claimed in any one of claims 1 - 3, wherein recovering in step viii) comprises upgrading and distillation.

5. The method as claimed in any one of claims 1 to 4,wherein the catalytic hydroliquefaction in step ii) is carried out at a temperature from 250 to 450 °C.

6. The method as claimed in any one of claims 1 to 5, wherein the catalytic hydroliquefaction in step ii) is carried out at a temperature from 300 to 400 °C.

7. The method as claimed in any one of claims 1 to 6, wherein the catalytic hydroliquefaction in step ii) is carried out at a temperature from 320 to 390 °C.

8. The method as claimed in any one of claims 1 to 7, wherein the catalyst in the catalytic hydroliquefaction step is selected from sulfided heterogeneous metal catalysts.

9. The method as claimed in claim any one of claims 1 to 8, wherein the catalyst in the hydroliquefaction step is selected from sulfided NiMo, sulfided CoMo, and sulfided Mo based catalysts.

10. The method as claimed in any one of claims 1 to 9, wherein the carbonaceous feedstock consists of lignocellulosic biomass feedstock.

11. The method as claimed in any one of claims 1 to 10, wherein essentially all, such as 95 to 100 %, typically 95 to 98 %, of the hydrocarbons present in the treated second gaseous fraction is converted to CO and H_2 by the end of the partial oxidation step.

12. The method as claimed in any one
of claims 1 to 11, wherein partial oxidation step v) is accomplished at a temperature from 800 to 1600 °C and at a pressure from 0.5 to 30 MPa, given as gauge pressure.

13. The method as claimed in any one of claims 1 to 12, wherein partial oxidation step v) is accomplished at a temperature from 1100 to 1500 °C and at a pressure from 2 to 8 MPa, given as gauge pressure.

14. The method as claimed in any one of claims 1 to 13, wherein partial oxidation step v) is accomplished at a temperature from 1200 to 1400 °C and at a pressure from 4 to 8 MPa, given as gauge pressure.

15. The method as claimed in any one of claims 1 to 14, wherein the gas hourly space velocity (GHSV) in conversion step v) is typically from 1500 to 15000 h^{-1},

16. The method as claimed in any one of claims 1 to 15, wherein the gas hourly velocity (GHSV) in conversion step v) is from 2000 to 10000 h^{-1}.

17. The method as claimed in any one of claims 1 to 16, wherein the gas hourly velocity (GHSV) in conversion step v) is from 3000 to 5000 h^{-1}.

18. The method as claimed in any one of claims 1 to 17, wherein the carbonaceous feedstock comprises at least 10 wt%, oxygen on a dry basis, measured as elemental oxygen.

19. The method as claimed in any one of claims 1 to 18, wherein the carbonaceous feedstock comprises at least 20 wt% oxygen on a dry basis, measured as elemental oxygen.

20. The method as claimed in any one of claims 1 to 19, wherein the carbonaceous feedstock comprises from 45 to 55 wt%, carbon, and less than 10 wt%, hydrogen on a dry basis, measured as elemental carbon and hydrogen, respectively.