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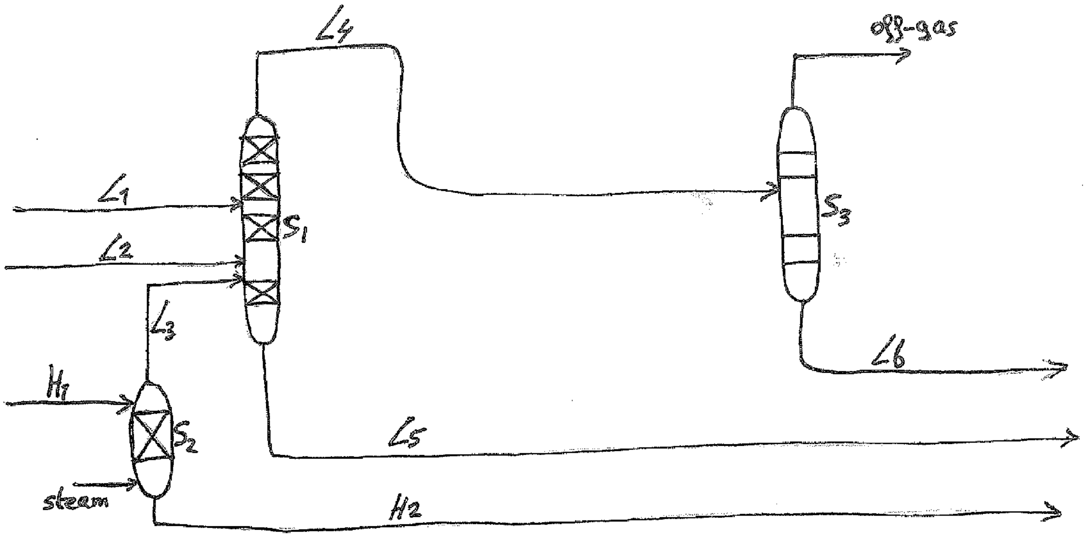
(54) Process to distill Fischer-Tropsch product

(57) A process a process for processing a Fischer-Tropsch product comprising the following steps by separating three hydrocarbon product streams, a light stream (L1), a less light stream (L2) and a heavy stream (H1); feeding (L1) and (L2) to a first separator (S1), and feeding (H1) to a second separator (S2); separating in (S2) a light stream (L3) and a heavy stream (H2); feeding at least a part of the light stream (L3) to the first separator (S1); separating in (S1) a light stream (L4) and a less light stream (L5); feeding (L4) to a third separator (S3); separating in (S3) an off-gas and a light stream (L6). The recovery of C3+ hydrocarbons is maximized. Streams (L5), (L6) and (H2), which are almost free of CO, CO2 and H2O, may be subjected to hydrogenation and/or hydrocracking/hydroisomersation.



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Description

[0001] The invention is directed to a process to distill Fischer-Tropsch product.

[0002] The Fischer-Tropsch process can be used for the conversion of synthesis gas (from hydrocarbonaceous feed stocks) into liquid and/or solid hydrocarbons. Generally, the feed stock (e.g. natural gas, associated gas and/or coal-bed methane, heavy and/or residual oil fractions, coal, biomass) is converted in a first step into a mixture of hydrogen and carbon monoxide; this mixture is often referred to as synthesis gas or syngas. The synthesis gas is then fed into a reactor where it is converted in one or more steps over a suitable catalyst at elevated temperature and pressure into paraffinic compounds and water. The obtained paraffinic compounds range from methane to high molecular weight hydrocarbons. The obtained high molecular weight hydrocarbons can comprise up to 200 carbon atoms, or, under particular circumstances, even more carbon atoms.

[0003] Numerous types of reactor systems have been developed for carrying out the Fischer-Tropsch reaction. For example, Fischer-Tropsch reactor systems include fixed bed reactors, especially multi-tubular fixed bed reactors, fluidized bed reactors, such as entrained fluidized bed reactors and fixed fluidized bed reactors, and slurry bed reactors such as three-phase slurry bubble columns and ebulated bed reactors.

[0004] During a Fischer-Tropsch process paraffinic compounds of different weights are formed. Additionally water is formed. When an effluent is withdrawn from a Fischer-Tropsch system in most processes some unconverted syngas leaves the system as well. Further, gaseous components such as carbon dioxide, nitrogen and argon may leave the system when an effluent is withdrawn from a Fischer-Tropsch system. Gaseous components such as carbon dioxide, nitrogen and argon may, for example, be present in the syngas used for the Fischer-Tropsch reaction. Effluent may be withdrawn through a single outlet or through several outlets in a Fischer-Tropsch reactor. Effluent may be withdrawn at different heights of a Fischer-Tropsch reactor. Effluent may be separated and/or fractionated after withdrawal from a Fischer-Tropsch reactor.

[0005] An example of a product stream that may be obtained is a stream comprising waxy hydrocarbons and possibly heavy oxygenates. Such streams may be subjected to an upgrading step. The upgrading step may result in a decrease in viscosity, a decrease in pour point or cloud point, and/or a decrease in (end) boiling point. A stream comprising waxy hydrocarbons may be subjected to a hydrogenation step, a hydrocracking step, or a hydrocracking/hydroisomerisation step, or a combination thereof.

[0006] Another example of a product stream that may be obtained is a stream comprising light hydrocarbons and possibly light oxygenates. A stream comprising light hydrocarbons may be used as such, or may be subjected to a treatment with hydrogen.

[0007] Before upgrading, a stream comprising heavy hydrocarbons may be subjected to a separation step. In the separation step carbon monoxide, carbon dioxide and water may be removed. Suitable separators are for example strippers, e.g. a light end stripper, a flasher, and a distillation unit.

[0008] An object of the present invention is an optimized separation process for a Fischer-Tropsch product comprising heavy hydrocarbons.

[0009] The present invention provides a process for processing a Fischer-Tropsch product comprising the following steps:

a) catalytic conversion of synthesis gas using a Fischer-Tropsch catalyst into a Fischer-Tropsch product;

b) separating the Fischer-Tropsch product of step a) into an off-gas and at least three hydrocarbon product streams:

- a light hydrocarbon product stream (L1) comprising at least 50 weight% of hydrocarbons comprising 6 to 19 carbon atoms, calculated on the total weight of hydrocarbons in the light hydrocarbon product stream (L1),
- a less light hydrocarbon product stream (L2) comprising at least 50 weight% of hydrocarbons comprising 12 to 30 carbon atoms, calculated on the total weight of the hydrocarbons in the less light hydrocarbon product stream (L2), and
- a heavy hydrocarbon product stream (H1) comprising at least 50 weight% of hydrocarbons comprising 25 or more carbon atoms, calculated on the total weight of the hydrocarbons in the heavy hydrocarbon product stream (H1);

c) feeding at least a part of the light hydrocarbon product stream (L1) and at least a part of the less light hydrocarbon product stream (L2) to a first separator (S1), and

d) feeding at least a part of the heavy hydrocarbon stream (H1) to a second separator (S2) ;

e) separating in the second separator (S2)

- -a light stream (L3) comprising carbon monoxide, carbon dioxide, water, and hydrocarbons comprising 10 or less carbon atoms, and
- a heavy stream (H2) comprising at least 50 weight% of hydrocarbons comprising 25 or more carbon atoms, calculated on the total weight of the hydrocarbons in the heavy hydrocarbon product stream (H2);

f) feeding at least a part of the light stream (L3) to the first separator (S1);

g) separating in the first separator (S1)

- a light stream (L4) comprising carbon monoxide, carbon dioxide, water, and hydrocarbons comprising 10 or less carbon atoms, and
- -a less light stream (L5) comprising at least 50 weight% of hydrocarbons comprising 10 to 30 carbon atoms, calculated on the total weight of the hydrocarbons in the less light stream (L5);

h) feeding at least a part of the light stream (L4) to a third separator (S3);
i) separating in the third separator (S3)

- an off-gas comprising carbon monoxide, carbon dioxide, water, methane and hydrocarbons comprising 2 carbon atoms, and
- a light stream (L6) comprising at least 50 weight% of hydrocarbons comprising 3 to 10 carbon atoms, calculated on the total weight of the hydrocarbons in the light stream (L6).

[0010] Applicants found that the process of the present invention is an optimized separation process for a Fischer-Tropsch product comprising heavy hydrocarbons.

[0011] One advantage of the process is that carbon monoxide and carbon dioxide and water can be removed very efficiently from the Fischer-Tropsch product. This is advantageous as the Fischer-Tropsch product comprising heavy hydrocarbons may now be subjected to an upgrading step with less or almost no negative effects of CO, CO2 and/or H2O on a catalyst that may be used for the upgrading.

[0012] Another advantage is that the recovery of hydrocarbons comprising 3 or more carbon atoms in the product streams is maximized.

[0013] A further advantage is that three streams, namely light streams (L5) and (L6) and heavy stream (H2) are obtained which can each be further used and/or processed as desired. Further processing may be performed on these streams separately, on combined streams, or on combined fractions of these streams, and may involve a treatment with hydrogen such as hydrogenation and/or hydrocracking/hydroisomersation.

Step a)

[0014] In step a) synthesis gas is subjected to catalytic conversion using a Fischer-Tropsch catalyst. The syngas is converted into a Fischer-Tropsch product. Catalytic conversion is preferably performed by providing syngas to a Fischer-Tropsch reactor and providing the following process conditions in the reactor: a temperature in the range from 125 to 350 °C, a pressure in the range from 5 to 150 bar absolute, and a gaseous hourly space velocity in the range from 500 to 10000 Nl/l/h.

[0015] Preferably the Fischer-Tropsch catalyst comprises a Group VIII metal component, more preferably cobalt, iron and/or ruthenium, most preferably cobalt. References to the Periodic Table and groups thereof used herein refer to the previous IUPAC version of the Periodic Table of Elements such as that described in the 68th Edition of the Handbook of Chemistry and Physics (CPC Press). Typically, the catalysts comprise a catalyst carrier. The catalyst carrier is preferably porous, such as a porous inorganic refractory oxide, more preferably alumina, silica, titania, zirconia or combinations thereof, most preferably titania.

[0016] The optimum amount of catalytically active metal present on the carrier depends inter alia on the specific catalytically active metal. Typically, the amount of cobalt present in the Fischer-Tropsch catalyst may range from 1 to 100 parts by weight per 100 parts by weight of carrier material, preferably from 10 to 50 parts by weight per 100 parts by weight of carrier material. In case the catalyst comprises cobalt and titania, the amount of cobalt preferably is in the range of between 10 weight percent (wt%) and 35 wt% cobalt, more preferably between 15 wt% and 30 wt% cobalt, calculated on the total weight of titania and cobalt.

Step b)

[0017] In step b) the Fischer-Tropsch product of step a) is separated into an off-gas and at least three hydrocarbon product streams. This may be performed by withdrawing effluent through a single outlet in a Fischer-Tropsch reactor, followed by separation in one or more separation units. Alternatively, this may be performed by withdrawing effluent through several outlets in a Fischer-Tropsch reactor, optionally followed by separation in one or more separation units. Effluent may be withdrawn at different heights of a Fischer-Tropsch reactor. In case effluent is withdrawn through several outlets, one stream may be considered Fischer-Tropsch off-gas. Alternatively, in case effluent is withdrawn through several outlets the stream(s) coming from one or more outlets may be separated and/or fractionated after withdrawal from the Fischer-Tropsch reactor into an off-gas and one or more hydrocarbon product streams.

[0018] In step b) at least three hydrocarbon product streams are separated from the Fischer-Tropsch product of step a) :

- a light hydrocarbon product stream (L1) comprising at least 50 weight% of hydrocarbons comprising 6 to 19 carbon atoms, calculated on the total weight of hydrocarbons in the light hydrocarbon product stream (L1),
- a less light hydrocarbon product stream (L2) comprising at least 50 weight% of hydrocarbons comprising 12 to 30 carbon atoms, calculated on the total weight of the hydrocarbons in the less light hydrocarbon product stream (L2), and
- a heavy hydrocarbon product stream (H1) comprising at least 50 weight% of hydrocarbons comprising 25 or more carbon atoms, calculated on the total

weight of the hydrocarbons in the heavy hydrocarbon product stream (H1).

[0019] The Fischer-Tropsch product of step a) from which an off-gas and at least three hydrocarbon product streams are separated in step b) may be Fischer-Tropsch product from one Fischer-Tropsch reactor, but it may also be combined product from several Fischer-Tropsch reactors.

[0020] The off-gas separated in step b) preferably comprises carbon monoxide, carbon dioxide, water, and hydrocarbons comprising 4 or less carbon atoms.

Step c)

[0021] In step c) at least a part of the light hydrocarbon product stream (L1) and at least a part of the less light hydrocarbon product stream (L2) are fed to a first separator (S1).

[0022] Separator (S1) may be a splitter, stripper, a flasher, and/or a distillation unit, or any other suitable separation unit. Preferably separator (S1) is a splitter. The splitter may be a column comprising trays or a packed beds, preferably packed beds, more preferably four packed beds.

[0023] In case the separator (S1) is a column comprising packed beds, stream (L1) preferably is fed to the column one packed bed above the other feed streams.

[0024] In case the separator (S1) is a column comprising packed beds, at least a part of the less light hydrocarbon product stream (L2) and at least a part of the light stream (L3) from step e) preferably are fed to the column above the bottom bed.

[0025] Preferably the light hydrocarbon product stream (L1) is heated before it is fed to the separator (S1).

[0026] In case the separator (S1) is a column comprising four packed beds, at least a part of the light hydrocarbon product stream (L1) preferably is fed to the column below the first two beds and at or above the third bed. At least a part of the less light hydrocarbon product stream (L2) and at least a part of the light stream (L3) from step e) are preferably fed to the column above the fourth bed and below the third bed.

[0027] The top temperature of the separator (S1) preferably is in the range of between 100 and 150 °C, more preferably between 110 and 135 °C. The bottom temperature of the separator (S1) preferably is in the range of between 250 and 300 °C, more preferably between 270 and 290 °C.

[0028] The separation in separator (S1) preferably takes place at a pressure in the range of from 1 to 10 bar a, more preferably 1 to 5 bar a.

[0029] Separator (S1) preferably has a reboiler. The reboiler is preferably present at the bottom of the separator.

[0030] In case the separator (S1) is a column comprising packed beds, preferably a reboiler is present below the bottom bed.

[0031] In case the separator (S1) is a column comprising packed beds and a reboiler, preferably a liquid draw-off tray is in installed below the bottom packed bed, and an effluent from the reboiler is returned to the column just below the liquid draw-off tray.

[0032] Separator (S1) preferably has a liquid draw-off tray at the top of the column.

[0033] In case the separator (S1) is a column comprising packed beds and a liquid draw-off tray at the top of the column, preferably a part of the liquid drawn off at the top of the column may be cooled and returned the column above the top packed bed, and another part of the liquid drawn off at the top of the column may be redistributed over the packed bed below the top bed.

Step d)

[0034] In step d) at least a part of the heavy hydrocarbon stream (H1) is fed to a second separator (S2).

[0035] Separator (S2) may be a splitter, stripper, a flasher, and/or a distillation unit, or any other suitable separation unit. Preferably separator (S2) is a stripper.

[0036] Separator (S2) preferably has packed beds, more preferably a single packed bed. Preferably the heavy hydrocarbon stream (H1) is fed to the separator (S2) above this/these bed(s).

[0037] The separation in separator (S2) preferably takes place at a temperature in the range of between 250 and 300 °C, more preferably between 270 and 290 °C.

[0038] The pressure at the top of the separator (S2) preferably is in the range of between 1 to 10 bar a, more preferably 1 to 5 bar a. The pressure at the bottom of the separator (S2) preferably is 0.1 to 3 bar higher, more preferably 0.5 to 1 bar higher, than the pressure at the top of the separator (S2).

[0039] Preferably the heavy hydrocarbon stream (H1) is heated before it is fed to the separator (S2).

[0040] Preferably steam is introduced below the single packed bed, or below the bottom packed bed in case of more than one packed bed, in separator (S2).

Step e)

[0041] In step e) are separated in separator (S2):

- -a light stream (L3) comprising carbon monoxide, carbon dioxide, water, and hydrocarbons comprising 10 or less carbon atoms, and
- a heavy stream (H2) comprising at least 50 weight% of hydrocarbons comprising 25 or more carbon atoms, calculated on the total weight of the hydrocarbons in the heavy hydrocarbon product stream (H2).

Step f)

[0042] In step f) at least a part of the light stream (L3) is fed to the first separator (S1).

Step g)

[0043] In step g) are separated in separator (S1):

- a light stream (L4) comprising carbon monoxide, carbon dioxide, water, and hydrocarbons comprising 10 or less carbon atoms, and
- -a less light stream (L5) comprising at least 50 weight% of hydrocarbons comprising 10 to 30 carbon atoms, calculated on the total weight of the hydrocarbons in the less light stream (L5).

[0044] Water may be removed from the light stream (L4) before it is fed to separator (S3) in step h). Water may, for example, be removed by condensing in one or more air coolers.

Step h)

[0045] In step h) at least a part of the light stream (L4) is fed to a third separator (S3). Even if water is removed from (L4) before it is fed to (S3) it may still comprise some water.

[0046] Separator (S3) may be a splitter, stripper, a flasher, and/or a distillation unit, or any other suitable separation unit. Preferably separator (S3) is a stripper. In separator (S3), CO, CO2, water, C1 and C2 are removed from the C10- fraction (L4).

[0047] Preferably separator (S3) comprises trays, more preferably more than 10 trays, even more preferably more than 15 trays. The trays preferably are Shell HiFi trays.

[0048] The top temperature of the separator (S3) preferably is in the range of between 80 and 120 °C, more preferably between 85 and 105 °C. The bottom temperature of the separator (S3) preferably is in the range of between 170 and 230 °C, more preferably between 180 and 220 °C.

[0049] The separation in separator (S1) preferably takes place at a pressure in the range of from 1 to 10 bar a, more preferably 5 to 10 bar a.

Step i)

[0050] In step i) are separated in separator (S3):

- an off-gas comprising carbon monoxide, carbon dioxide, water, methane and hydrocarbons comprising 2 carbon atoms, and
- a light stream (L6) comprising at least 50 weight% of hydrocarbons comprising 3 to 10 carbon atoms, calculated on the total weight of the hydrocarbons in the light stream (L6).

Fischer-Tropsch product upgrading

[0051] The three streams, namely light streams (L5) and (L6) and heavy stream (H2) which are obtained from the Fischer-Tropsch product are substantially free from carbon monoxide, carbon dioxide and water. This is advantageous as these streams may now be subjected to an upgrading step with less or almost no negative effects of CO, CO2 and/or H2O on a catalyst that may be used for the upgrading.

[0052] The three streams, namely light streams (L5) and (L6) and heavy stream (H2) may be further processed separately, combined, or as combined fractions of these streams.

[0053] Preferably the light stream (L5) is hydrogenated.

[0054] Preferably the less light stream (L6) is subjected to hydrocracking/hydroisomersation, or to hydrogenation and hydrocracking/hydroisomersation.

[0055] Preferably the heavy stream (H2) is subjected to hydrocracking/hydroisomersation, or to hydrogenation and hydrocracking/hydroisomersation.

[0056] At least a part of the less light stream (L6) and at least a part of the heavy stream (H2) may be combined and subjected to hydrocracking/hydroisomersation, or to hydrogenation and hydrocracking/hydroisomersation.

[0057] Hydrocracking/hydroisomersation may be performed in a reaction zone where a stream comprising hydrocarbons is contacted with hydrogen at a temperature in the range of 175 to 400 °C and a pressure in the range of 20 to 250 bar. Preferably a catalyst is present in the reaction zone. More preferably a catalyst comprising platinum and/or palladium, an amorphous silica/alumina, and optionally zeolite beta, is present in the reaction zone.

[0058] Preferably the hydrocracking/hydroisomerisation is a hydrocracking process in which hydrocarbons boiling above 315 °C are converted into hydrocarbons boiling below 315 °C. More preferably hydrocarbons boiling above 305 °C are converted into hydrocarbons boiling below 305 °C. Even more preferably hydrocarbons boiling above 250 °C are converted into hydrocarbons boiling below 250 °C. Still more preferably hydrocarbons boiling above 240 °C are converted into hydrocarbons boiling below 240 °C.

[0059] The catalyst preferably comprises as catalytically active component one or more metals selected from Groups VIB and VIII of the Periodic Table of Elements, in particular one or more metals selected from molybdenum, tungsten, cobalt, nickel, ruthenium, iridium, osmium, platinum and palladium. More preferably, the catalyst comprises one or more metals selected from nickel, platinum and palladium as the catalytically active component. Catalysts comprising platinum as the catalytically active component have been found to be particularly suitable.

[0060] Catalysts for the hydrocracking/hydroisomerisation process typically comprise a refractory metal oxide as a carrier. The carrier material may be amorphous or crystalline. Suitable carrier materials include silica, alumina, silica-alumina, zirconia, titania and mixtures thereof. The carrier may comprise one or more zeolites, either alone or in combination with one or more of the aforementioned carrier materials. Preferred carrier materials for inclusion in the catalyst are silica, alumina and silica-alumina. A particularly preferred catalyst comprises platinum supported on an amorphous silica-alumina carrier.

[0061] As catalyst for the hydrocracking/hydroisomerisation process a catalyst comprising zeolite beta may be used. In that case the catalyst preferably comprises 0.1-15 wt% of a zeolite beta, calculated on the weight of the catalyst. More preferably the zeolite beta in the catalyst is present in an amount of at least 0.5 wt%, more in particular in an amount of at least 1 wt%, and/or in an amount of at most 10 wt%, more in particular in an amount of at most 8 wt%, even more particular in an amount of at most 4 wt %, calculated on the weight of the catalyst.

[0062] The catalyst for the hydrocracking/hydroisomerisation process may comprise 0.005 to 5.0 wt% of a Group VIII noble metal on a carrier, the carrier comprising 0.1-15 wt% of a zeolite beta and at least 40 wt% of an amorphous silica-alumina, calculated on the weight of the catalyst. Preferably such a catalyst comprises 0.005 to 5.0 wt% platinum and/or palladium. Preferably the zeolite beta in such a catalyst is present in an amount of at least 0.5 wt%, more in particular in an amount of at least 1 wt%, and/or in an amount of at most 10 wt%, more in particular in an amount of at most 8 wt%, even more particular in an amount of at most 4 wt %. The zeolite beta in the catalyst preferably has a silica:alumina molar ratio of at least 50, more preferably at least 75 and at most 500, calculated as Si02 and A1203. The amorphous silica-alumina preferably has an alumina content, calculated as A1203, of 5-70 wt%.

[0063] In the hydrocracking/hydroisomerisation process, the hydrocarbons are contacted with hydrogen in the presence of the catalyst at elevated temperature and pressure. The temperature will preferably be in the range of from 175 to 400 °C, more preferably 200 to 400 °C, even more preferably from 275 to 375 °C. The pressure will preferably be in the range of from 20 to 250 bars, more preferably from 40 to 200 bars, even more preferably from 40 to 100 bars. Hydrogen preferably is supplied at a gas hourly space velocity of from 100 to 10000 Nl/l/hr, more preferably from 500 to 5000 Nl/l/hr. The hydrocarbon feed preferably is provided at a weight hourly space velocity of from 0.1 to 5 kg/l/hr, more preferably from 0.25 to 2 kg/l/hr. The ratio of hydrogen to hydrocarbon feed preferably is from 100 to 5000 Nl/kg, more preferably from 250 to 2500 Nl/kg.

[0064] The degree of hydrocracking occurring in the hydrocracking/hydroisomerisation step may be measured by determining the degree of conversion of the fraction boiling above 370 °C. Typically, the hydrocracking/hydroisomerisation stage is operated at a conversion of at least 40%.

Claims

1. A process for processing a Fischer-Tropsch product comprising the following steps:

a) catalytic conversion of synthesis gas using a Fischer-Tropsch catalyst into a Fischer-Tropsch product;
b) separating the Fischer-Tropsch product of step a) into an off-gas and at least three hydrocarbon product streams:

- a light hydrocarbon product stream (L1) comprising at least 50 weight% of hydrocarbons comprising 6 to 19 carbon atoms, calculated on the total weight of hydrocarbons in the light hydrocarbon product stream (L1),
- a less light hydrocarbon product stream (L2) comprising at least 50 weight% of hydrocarbons comprising 12 to 30 carbon atoms, calculated on the total weight of the hydrocarbons in the less light hydrocarbon product stream (L2), and
- a heavy hydrocarbon product stream (H1) comprising at least 50 weight% of hydrocarbons comprising 25 or more carbon atoms, calculated on the total weight of the hydrocarbons in the heavy hydrocarbon product stream (H1);

c) feeding at least a part of the light hydrocarbon product stream (L1) and at least a part of the less light hydrocarbon product stream (L2) to a first separator (S1), and
d) feeding at least a part of the heavy hydrocarbon stream (H1) to a second separator (S2) ;
e) separating in the second separator (S2)

- -a light stream (L3) comprising carbon monoxide, carbon dioxide, water, and hydrocarbons comprising 10 or less carbon atoms, and
- a heavy stream (H2) comprising at least 50 weight% of hydrocarbons comprising 25 or more carbon atoms, calculated on the total weight of the hydrocarbons in the heavy hydrocarbon product stream (H2);

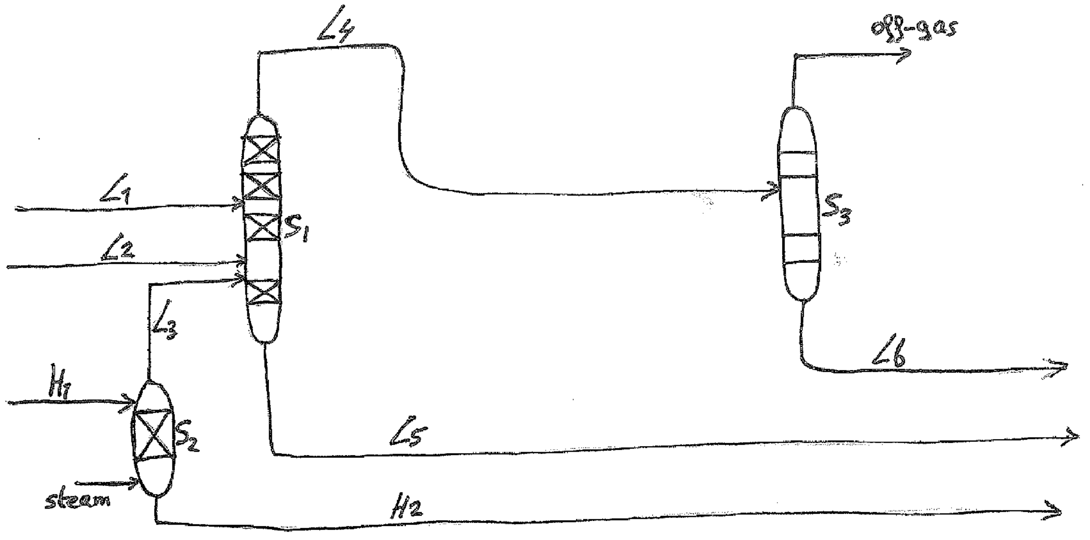
f) feeding at least a part of the light stream (L3) to the first separator (S1);
g) separating in the first separator (S1)

- a light stream (L4) comprising carbon monoxide, carbon dioxide, water, and hydrocarbons comprising 10 or less carbon atoms, and
- -a less light stream (L5) comprising at least

50 weight% of hydrocarbons comprising 10 to 30 carbon atoms, calculated on the total weight of the hydrocarbons in the less light stream (L5);

h) feeding at least a part of the light stream (L4) to a third separator (S3);
i) separating in the third separator (S3)

- an off-gas comprising carbon monoxide, carbon dioxide, water, methane and hydrocarbons comprising 2 carbon atoms, and
- a light stream (L6) comprising at least 50 weight% of hydrocarbons comprising 3 to 10 carbon atoms, calculated on the total weight of the hydrocarbons in the light stream (L6).



TS 2864

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EUROPEAN SEARCH REPORT

Application Number
EP 13 15 0791

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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			TECHNICAL FIELDS SEARCHED (IPC)
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The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
The Hague	29 May 2013	Pardo Torre, J

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 13 15 0791

29-05-2013

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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