

Claims

1. A hydrotreatment unit (10) for an oxygenate feedstock (11), said unit (10) comprising:
 - 5 - a hydrotreatment reactor (20); said hydrotreatment reactor (20) being arranged to receive said oxygenate feedstock (11) and convert it to a hydrotreated first hydrocarbon stream (21);
 - a first cooling unit (30) arranged to receive said hydrotreated first hydrocarbon stream (21) from said hydrotreatment reactor (20) and cool it to a cooled second hydrocarbon stream (31);
 - 10 - a high-pressure separator (40) arranged to receive the cooled second hydrocarbon stream (31) from said first cooling unit (30) and separate it into at least a hydrocarbon-rich stream (41), and a H₂-rich stream (42);
 - a low pressure flash unit (50), said low pressure flash unit (50) arranged to receive the hydrocarbon-rich stream (41) from said high-pressure separator unit (40) and de-
15 gas it; thereby providing an off-gas (56) and a degassed hydrocarbon-rich stream (52),
 - wherein said hydrotreatment unit (10) is arranged to feed at least a part of the hydrogen-rich stream (42) from the high-pressure separator (40) to the hydrotreatment reactor (20); and
 - 20 - wherein said hydrotreatment unit (10) is arranged to feed a part of the degassed hydrocarbon-rich stream (52) from said low pressure flash unit (50) as a hydrocarbon recycle stream (54) to the hydrotreatment reactor (20).
2. The hydrotreatment unit (10) according to claim 1, further comprising a
25 hydroisomerization section (70) located between said hydrotreatment reactor (20) and said first cooling unit (30); and being arranged to receive said hydrotreated first hydrocarbon stream (21) from said hydrotreatment reactor (20), perform catalytic hydroisomerization of said hydrotreated first hydrocarbon stream (21) and provide a dewaxed first hydrocarbon stream (23) to said first cooling unit (30).
3. The hydrotreatment unit (10) according to claim 2, further comprising a second
30 heating or cooling unit (39) located in said hydrotreated first hydrocarbon stream (21) between said hydrotreatment reactor (20) and said hydroisomerization section (70).
4. The hydrotreatment unit (10) according to any one of the preceding claims, wherein said hydrotreatment unit (10) is arranged to provide a part of the degassed hydrocarbon-rich stream (52) from said low pressure flash unit (50) as a hydrocarbon product stream (53).

5. The hydrotreatment unit (10) according to any one of the preceding claims wherein said off-gas (56) comprises H_2 , CO_2 , C1 and C3 gaseous components.
6. The hydrotreatment unit (10) according to any one of the preceding claims, further comprising an H_2 make-up feed (12), arranged to be combined with said H_2 -rich stream (42) so as to provide treat gas (43).
7. The hydrotreatment unit (10) according to any one of the preceding claims, further comprising a first compressor (60) arranged to compress the H_2 -rich stream (42).
8. The hydrotreatment unit (10) according to any one of the preceding claims, wherein said hydrotreatment unit (10) is arranged to combine said H_2 -rich stream (42) or said treat gas (43) with said hydrocarbon recycle stream (54) to provide a combined stream (55) which is fed to the hydrotreatment reactor (20).
9. The hydrotreatment unit (10) according to any one of the preceding claims, wherein said hydrotreatment unit (10) is arranged to combine said at least an amount of combined stream (55) with at least a portion of the oxygenate feedstock (11) prior to being fed to the hydrotreatment reactor (20).
10. A diesel plant comprising the hydrotreatment unit (10) according to any one of the preceding claims, and a separation unit, said diesel plant arranged such that at least a part of said degassed hydrocarbon-rich stream (52), is fed from said hydrotreatment unit (10) to said separation unit and purified to provide at least a diesel and/or a jet product.
11. A method for hydrotreating an oxygenate feedstock (11) using the hydrotreatment unit (10) according to any one of claims 1-9, said method comprising the steps of:
- feeding said oxygenate feedstock (11) to the hydrotreatment reactor (20); and converting it to a hydrotreated first hydrocarbon stream (21);
 - feeding said hydrotreated first hydrocarbon stream (21) from said hydrotreatment reactor (20) to said first cooling unit (30) and cooling it to a cooled second hydrocarbon stream (31);
 - feeding the cooled second hydrocarbon stream (31) from said first cooling unit (30) to said high-pressure separator (40), and separating it into at least a hydrocarbon-rich stream (41), and a hydrogen-rich stream (42);
 - feeding the hydrocarbon-rich stream (41) from said high-pressure separator (40) to said low pressure flash unit (50), and de-gassing it; thereby providing an off-gas (56) and a degassed hydrocarbon-rich stream (52),

- v. feeding at least a part of the hydrogen-rich stream (42) from the high-pressure separator (40) to the hydrotreatment reactor (20);
- vi. separating the degassed hydrocarbon-rich stream (52) from the low pressure flash unit (40) into a hydrocarbon product stream (53) and a hydrocarbon recycle stream (54); and
- 5 vii. feeding said hydrocarbon recycle stream (54) to the hydrotreatment reactor (20).

12. The method according to claim 11, wherein the low pressure flash unit (40) operates at a pressure of between ambient pressure and 30 barg, preferably between ambient pressure and 15 barg.

- 10 13. The method according to any one of claims 11-12, wherein the high pressure separator (40) operates at a pressure of between 20-100 barg, preferably between 30-80 barg.

14. The method according to any one of claims 11-13, further comprising a step of performing catalytic hydroisomerization on the hydrotreated first hydrocarbon stream (21)
- 15 from said hydrotreatment reactor (20), and providing a dewaxed first hydrocarbon stream (23) to said first cooling unit (30).