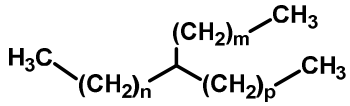
Embodiments

1. Compound of the formula I, wherein *n*, *m* and *p* are independently of each other an odd numbered integer value between 9 and 41, and where the total carbon number of formula I is between 31 and 65, with the proviso that when *n* and *m* are both 9, then *p* is not 9 or 11, and with the proviso that *n*, *m* and *p* are not all 11.



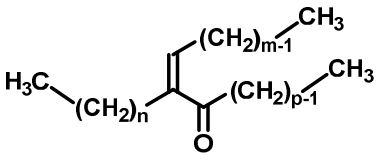
(I)

2. Compound according to embodiment 1, wherein *n* is 13 or 15; *m* and *p* are independently of each other either 15 or 17.

3. Compound according to embodiments 1 or 2, wherein *n* is 13; *m* and *p* are both 15.

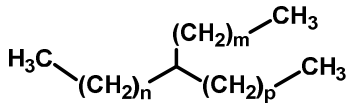
4. Process for obtaining isomerised star-shaped compounds comprising between 1 to 5 methyl branches, characterised in that one or more compounds of formula I wherein *n*, *m* and *p* are independently of each other an odd numbered integer value between 9 and 41, and where the total carbon number of formula I is between 31 and 65, with the proviso that when *n* and *m* are both 9, then *p* is not 9 or 11, and with the proviso that *n*, *m* and *p* are not all 11 is subjected to an isomerisation step, the isomerisation step being conducted in the presence of hydrogen and an isomerisation catalyst, such as a noble or non-noble isomerisation catalyst, at a temperature in the range of 250 to 400 °C, a pressure in the range from 10 to 60 barg, and a WHSV in the range of 0.1-5 h^{-1} and a H_2 flow of 100-800 nl H_2/l feed.

5. Compound of the formula II, wherein *n* is 13; *m* and *p* are both 15.



(II)

6. Base oil mixture comprising one or more compound(s) of formula I, wherein *n*, *m* and *p* are independently of each other an odd numbered integer value between 9 and 41, and where the total carbon number of formula I is between 31 and 65.



(I)

7. Base oil mixture according to embodiment 6 comprising one or more compound(s) of formula I, wherein *n* is 13 or 15; *m* and *p* are independently of each other either 15 or 17.

8. Base oil mixture according to embodiments 6 or 7 comprising a compound of formula I, wherein *n* is 13; *m* and *p* are both 15.

9. Base oil mixture according to any one of embodiments 6 – 8, wherein the base oil mixture has a boiling point of 380 °C or more, such as 450 °C or more, such as 460 °C or more, such as 470 °C or more.

10. Base oil mixture according to any one of embodiments 6 – 9, wherein the base oil mixture comprises at least 2 % or more, preferably 5 % or more of the one or more compound(s) of formula I.

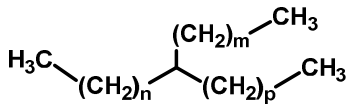
11. Process for base oil production, comprising:

a) trimerising a feed comprising at least one fatty acid to provide a trimerisation product where a mixture of fatty acid trimers is obtained; and

b) hydrotreating at least a portion of the trimerisation product to provide a base oil product having a pour point lower than 5 °C;

where the hydrotreated base oil product comprises one or more compound(s) of formula I, wherein *n*, *m* and *p* are independently of each other an integer

value between 9 and 41, and where the total carbon number of formula I is between 31 and 65;



(I)

- where carbon atoms of one or more compound(s) of formula I exclusively come from monocarboxylic fatty acids; and
- where the trimerisation is carried out at a conversion level of at least 99.5 % of the at least one fatty acid of the feed.

12. Process for base oil production according to embodiment 11, wherein step a) comprises contacting the at least one fatty acid with a trimerisation catalyst in a trimerisation zone under trimerisation conditions to provide the mixture of fatty acid trimers; and step b) comprises contacting the mixture of fatty acid trimers with a hydrotreating catalyst in the presence of hydrogen gas in a hydrotreating zone under hydrotreating conditions to provide the base oil product.

13. Process for base oil production according to embodiment 12, wherein the trimerisation conditions comprise a temperature in the range from 300 to 400 °C, a pressure in the range from 5 to 100 barg and a WHSV in the range from 0.1 – 5 h^{-1}, and the trimerisation catalyst comprises a metal oxide catalyst.

14. Process for base oil production according to any one of embodiments 11 – 13, wherein the trimerisation catalyst comprises a catalyst selected from one or more of the list consisting of: Ti, Mn, Mg, Ca containing metal oxide catalyst; preferably the trimerisation catalyst is a Ti containing metal oxide catalyst.

15. Process for base oil production according to any one of embodiments 11 – 14, wherein the trimerisation catalyst comprises TiO_2 and one or more alkali metal oxides, preferably where the one or more alkali metal oxides are selected from one or more of the list consisting of: Li, Na, K containing metal oxide(s).

16. Process for base oil production according to any one of embodiments 11 – 15, wherein trimerising comprises the formation of a ketone from a reaction between two fatty acids followed by a condensation reaction between the ketone and another fatty acid to produce an alpha-substituted and alpha-unsaturated ketone.

17. Process for base oil production according to any one of embodiments 11 – 16, wherein the at least one fatty acid is selected from a C_9 to C_{22} fatty acid.

18. Process for base oil production according to any one of embodiments 11 – 17, wherein the feed comprising at least one fatty acid is selected from one or more of the list consisting of: palm oil, canola oil, rapeseed oil, olive oil, sunflower oil, beef fat, lard, coconut oil, corn oil, soybean oil, jatropha oil, tall oil, crude tall oil, tall oil pitch, tall oil heads or tall oil fatty acids.

19. Process for base oil production according to any one of embodiments 11 – 18, wherein the feed comprising at least one fatty acid is diluted with a stream of hydrocarbons, or where the trimerisation product is diluted with a stream of hydrocarbons.

20. Process for base oil production according to any one of embodiments 12 – 19, wherein the feed comprising at least one fatty acid is diluted with a stream of product withdrawn from the process, for example withdrawn from the trimerisation zone or from the hydrotreatment zone.

21. Process for base oil production according to any one of embodiments 11 – 20, wherein in the trimerisation zone a gas feed is present, where the gas is selected from the list consisting of: nitrogen, carbon dioxide, water vapour, methane and/or hydrogen, preferably hydrogen.

22. Process for base oil production according to any one of embodiments 11 – 21, wherein the trimerisation product is isolated in a fraction having a boiling point of more than 450 °C.

23. Process for base oil production according to any one of embodiments 11 – 22, further comprising a step:
c) isomerising the hydrotreated base oil product.

24. Base oil composition obtainable according to any one of embodiments 11 – 23.

25. Use of a base oil composition according to embodiment 24 for improving the lubricating properties of base oil.

26. Process for obtaining isomerised star-shaped compounds comprising between 1 to 5 methyl branches, characterised in that a feed comprising at least 80 wt% hydrocarbons and comprising at least 2 wt%, preferably at least 5 wt% of one or more compounds of formula I wherein *n*, *m* and *p* are independently of each other an odd numbered integer value between 9 and 41, and where the total carbon number of formula I is between 31 and 65, with the proviso that when *n* and *m* are both 9, then *p* is not 9 or 11, and with the proviso that *n*, *m* and *p* are not all 11 is subjected to an isomerisation step, the isomerisation step being conducted in the presence of hydrogen and an isomerisation catalyst, such as a noble or non-noble isomerisation catalyst, at a temperature in the range of 250 to 400 °C, a pressure in the range from 10 to 60 barg, and a WHSV in the range of 0.1-5 h^{-1} and a H_2 flow of 100-800 nl H_2/l feed.

27. Process according to embodiment 26, characterised in that the feed comprising at least 15 wt%, at least 20 wt%, at least 32 wt%, such as at least 50 wt% or at least 80 wt% of one or more compounds of formula I.

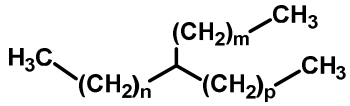
28. Process according to any one of embodiments 26 – 27, characterised in that the feed consists essentially of hydrocarbons.

29. Process according to any one of embodiments 26 – 28, characterised in that the feed comprises at least 15 wt% of one or more compounds of formula I.

30. Process according to embodiment 29, characterised in that the feed consists essentially of hydrocarbons and comprises at least 15 wt% of one or more compounds of formula I.

Claims

1. Compound of the formula I, wherein *n*, *m* and *p* are independently of each other an odd numbered integer value between 9 and 41, and where the total carbon number of formula I is between 31 and 65, with the proviso that when *n* and *m* are both 9, then *p* is not 9 or 11, and with the proviso that *n*, *m* and *p* are not all 11.



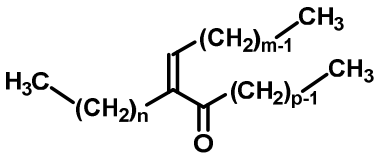
(I)

2. Compound according to claim 1, wherein *n* is 13 or 15; *m* and *p* are independently of each other either 15 or 17; preferably

   wherein *n* is 13; *m* and *p* are both 15.

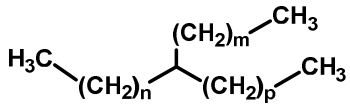
3. Process for obtaining isomerised star-shaped compounds comprising between 1 to 5 methyl branches, characterised in that a feed comprising at least 80 wt% hydrocarbons and comprising at least 2 wt%, preferably at least 5 wt%, of one or more compounds of formula I wherein *n*, *m* and *p* are independently of each other an odd numbered integer value between 9 and 41, and where the total carbon number of formula I is between 31 and 65, with the proviso that when *n* and *m* are both 9, then *p* is not 9 or 11, and with the proviso that *n*, *m* and *p* are not all 11, is subjected to an isomerisation step, the isomerisation step being conducted in the presence of hydrogen and an isomerisation catalyst, such as a noble or non-noble isomerisation catalyst, at a temperature in the range of 250 to 400 °C, a pressure in the range from 10 to 60 barg, and a WHSV in the range of 0.1-5 h^{-1} and a H_2 flow of 100-800 nl H_2/l feed.

4. Compound of the formula II, wherein *n* is 13; *m* and *p* are both 15.



(II)

5. Base oil mixture comprising one or more compound(s) of formula I, wherein *n*, *m* and *p* are independently of each other an odd numbered integer value between 9 and 41, and where the total carbon number of formula I is between 31 and 65, and wherein the base oil mixture comprises at least 2 wt%, preferably at least 5 wt%, of the one or more compound(s) of formula I.



(I)

6. Base oil mixture according to claim 6 comprising one or more compound(s) of formula I, wherein *n* is 13 or 15; *m* and *p* are independently of each other either 15 or 17, preferably

comprising a compound of formula I, wherein *n* is 13; *m* and *p* are both 15.

7. Process for production of a base oil mixture of claims 5 or 6, comprising:

a) trimerising a feed comprising at least one fatty acid by contacting the at least one fatty acid with a trimerisation catalyst in a trimerisation zone to provide a trimerisation product where a mixture of fatty acid trimers is obtained; and

b) hydrotreating at least a portion of the trimerisation product by contacting the mixture of fatty acid trimers with a hydrotreating catalyst in the presence of hydrogen gas in a hydrotreating zone under hydrotreating conditions to provide a base oil product having a pour point lower than 5 °C;

- where carbon atoms of one or more compound(s) of formula I exclusively come from monocarboxylic fatty acids; and
- where the trimerisation is carried out at a conversion level of at least 99.5 % of the at least one fatty acid of the feed.

8. Process for base oil production according to claim 7, wherein the trimerisation conditions comprise a temperature in the range from 300 to 400 °C, a pressure in the range from 5 to 100 barg and a WHSV in the range from 0.1 – 5 h^{-1}, and the trimerisation catalyst comprises a metal oxide catalyst.

9. Process according to claim 7- 8, wherein the trimerisation catalyst comprises a catalyst selected from one or more of the list consisting of: Ti, Mn, Mg, Ca containing metal oxide catalyst; preferably the trimerisation catalyst is a Ti containing metal oxide catalyst.

10. Process for base oil production according to any one of claims 7 – 9, wherein the trimerisation catalyst comprises TiO_2 and one or more alkali metal oxides, preferably where the one or more alkali metal oxides are selected from one or more of the list consisting of: Li, Na, K containing metal oxide(s).

11. Process according to any one of claims 7 – 10, wherein trimerising comprises the formation of a ketone from a reaction between two fatty acids followed by a condensation reaction between the ketone and another fatty acid to produce an alpha-substituted and alpha-unsaturated ketone.

12. Process for base oil production according to any one of claims 7 – 11, wherein the at least one fatty acid is selected from a C_9 to C_{22} fatty acid.

13. Process according to any one of claims 7 – 12, wherein the feed comprising at least one fatty acid is selected from one or more of the list consisting of: palm oil, canola oil, rapeseed oil, olive oil, sunflower oil, beef fat, lard, coconut oil, corn oil, soybean oil, jatropha oil, tall oil, crude tall oil, tall oil pitch, tall oil heads or tall oil fatty acids.

14. Process according to any one of claims 7 – 13, wherein the feed comprising at least one fatty acid is diluted with a stream of hydrocarbons, or where the trimerisation product is diluted with a stream of hydrocarbons.

15. Process for base oil production according to any one of claims 7 – 14, wherein the feed comprising at least one fatty acid is diluted with a stream of product withdrawn from the process, preferably withdrawn from the trimerisation zone or from the hydrotreatment zone.

16. Process according to any one of claims 7 – 15, wherein in the trimerisation zone a gas feed is present, where the gas is selected from the list consisting of: nitrogen, carbon dioxide, water vapour, methane and/or hydrogen, preferably hydrogen.

17. Process according to any one of claims 7 – 16, wherein the trimerisation product is isolated in a fraction having a boiling point of more than 450 °C.

18. Process according to any one of claims 7 – 18, further comprising a step:
c) isomerising the hydrotreated base oil product.

19. Base oil mixture of claim 5 obtainable according to any one of claims 7 – 18.

20. Use of a base oil mixture according to claim 19 for improving the lubricating properties of base oil.