Though such compatibility is desirable, it is typically not obtained for oils comprising a renewable component without generating significant amounts residues, significant amounts of other additives being added, and particularly not for the higher boiling fractions.

Objective of the invention

The object of the present invention is therefore to provide a low sulphur fuel blend comprising a renewable component for use in e.g. marine, stationary engines and/or heating oil applications not suffering from the compatibility issues describes above.

Description of the invention

According to one aspect of the present invention the objective of the invention is achieved through a low sulphur fuel blend of a first fuel blend component containing renewable hydrocarbon component(-s) and a second fuel blend component containing hydrocarbon to form at least part of a final low sulphur fuel blend having a sulphur content of less than 0,5 wt.%, where the first fuel blend component is characterised by having the characteristics (δ_{d1}, δ_{p1}, δ_{h1}) = (17-20, 6-10, 6-10); where the first fuel blend component comprises a fuel substance comprising 70 % by weight of compounds having a boiling point above 220 °C and is further characterized by having the characteristics (δ_d , δ_p , δ_h) = (17-20, 6-15, 6-12) and a linker substance comprising one or more sulphur containing solvents characterised by having the characteristics (δ_{d3}, δ_{p3}, δ_{h3})= (17-20, 3-6, 4-6); where the fuel substance is present in the first fuel blend component in a relative amount of 90-99,5 wt.%, and the linker substance is present in the first fuel blend component in a relative amount of 0.5 to 10 wt.%; where the second fuel blend component is characterised by having the characteristics (δ_{d2}, δ_{p2}, δ_{h2}) = (17-20, 3-5, 4-7) and selected from the group of ultra low sulphur fuel oils (ULSFO) such as RMG 180, low sulphur fuel oil ,marine gas oil, marine diesel oil, vacuum gas oil, and combinations

According to the present invention the linker substance may be present in the first in the first fuel component in a concentration from 0,5 to 10 % by weight such as in the range from 1.0 % by weight to 5.0 % by weight.

The concentration of the linker substance in the final low sulphur fuel blend may in many aspects of the present invention be in the range 0,5 % by weight to 5.0 % by weight such as in the range 1.0 to 4.0 % by weight.

Preferred sulphur containing linker substances according to the present invention includes fuel oils with a sulphur content of at least 1% by weight such as a sulphur content of at least 1.5% by weight, preferably a fuel oil having a sulphur content of at least 2.0% by weight. Nonlimiting examples of preferred linker substances according to the invention are high sulphur fuel oil such as RMG 380, vacuum gas oil, heavy vacuum gas oil or a combination thereof. The use of such common higher sulphur containing fuel oils as linker substances further have the advantage of being available at relatively low cost. Other sulphur containing solvents that may be used as linker substances according to the present invention include dimethyl di sulphide and butane thiol.

Generally the first fuel blend component may be present in the final low sulphur fuel blend in a relative amount of up to 80 %. In many embodiments of the present invention the first fuel blend component is present in the final low sulphur fuel blend in a relative amount of up between 10-75 wt.%, where the second fuel blend component is present in the final low sulphur fuel blend in a relative amount of between 25-90 wt.%.

In other advantageous embodiments of the present invention the first fuel blend component is present in the final low sulphur fuel blend in a relative amount of between 50-75 wt.%, where the second fuel blend component is present in the final low sulphur fuel blend in a relative amount of between 25-

50 wt.%, and where further the linker substance is present in the final low sulphur fuel blend in a relative amount of between 0.5 to 5 wt.%.

The low sulphur fuel blend according to the present invention generally comprises higher amounts of higher boiling compounds than the prior art. In a preferred embodiment the fuel substance comprised by the fuel first fuel blend component containing renewable hydrocarbon component(-s) comprises at least 70 % by weight having a boiling point of above 220 °C. Preferably the fuel substance comprised by the first fuel component comprises at least 70 % by weight having a boiling point above 300°C such as at least 70 % by weight having a boiling point above 350°C; Often the fuel substance comprised by the first fuel blend component comprises at least 70 % by weight having a boiling point above 370°C such as at least 70 % by weight of the fuel substance comprised by the first fuel component having a boiling point above 400°C.

In many embodiments according to the present invention the fuel substance comprised by the first fuel blend component containing renewable hydrocarbon component(-s) comprises at least 50 % having a boiling point above 300 °C such as at least 50 % by weight of the fuel substance comprised by first fuel component having a boiling point above 350 °C; preferably the fuel substance comprised by the first fuel blend component comprises at least 50 % by weight having a boiling point above 370 °C such as a fuel substance comprised by the first fuel blend component having at least 50 % by weight having a boiling point above 400 °C.

In a further preferred embodiment, the fuel substance comprised by the first fuel blend component containing renewable hydrocarbon component(-s) comprises at least 10 % by weight having a boiling point above 400 °C such as at least 10 % by weight of the fuel substance comprised by the first fuel component having a boiling point above 450 °C; preferably the fuel

substance of the first fuel blend component comprises at least 10 % by weight having a boiling point above 475 °C such as a fuel substance of the first fuel blend component comprising at least 10 % by weight of having a boiling point above 500 °C.

The water content of the fuel substance comprised by the first fuel blend component containing renewable hydrocarbon component(-s) may according to a preferred embodiment of the present invention have a water content of less than 1 % by weight such as a water content of less than 0,5 % by weight; preferably the fuel substance comprised by the first fuel blend component containing renewable hydrocarbon component(-s) have a water content of less than 0,25 % by weight such as a water content of less than 0,1 wt %.

The oxygen content of the fuel substance comprised by the first fuel blend component is in preferred embodiments according to the present invention below 15 % by weight such as an oxygen content of the fuel substance less than 12 % by weight; preferably the fuel substance of the first fuel blend component have an oxygen content of less than 10 % by weight such as an oxygen content of less than 8 % by weight.

In a preferred embodiment of the present invention, the second fuel blend component according to the present invention have a sulphur content of up to 1 % by weight, such as up to 0.5% by weight.

Hansen solubility parameters as will be explained and illustrated further in the detailed description of the a preferred embodiment of invention and examples, are used in the present invention to precisely characterize the different blend components of the low sulphur fuel blend to ensure full compatibility and miscibility of components the blend in the full concentration ranges according to the present invention e.g. the final low sulphur fuel blend may e.g. be diluted

with more secondary fuel component as long as the resulting blend is maintained within the specified characteristics and concentration ranges without that the resulting mixture loses its compatibility/miscibility whereby e.g. separation such as sedimentation in fuel tanks may be avoided in case that the tank should be filled and diluted with another fuel having the properties specified for the second fuel blend component e.g. if the low sulphur fuel blend according to the present invention should not be available.

According to the invention the first fuel blend component containing a renewable fuel component comprises a fuel substance and a linker substance. The first fuel blend component according to the present invention is generally specified by having characteristic Hansen Solubility parameters in the ranges (δ_{d1}, δ_{p1}, δ_{h1}) = (17-20, 6-10, 6-10). A preferred embodiment is where the first fuel blend component is characterised by having the characteristic Hansen Solubility Parameters (δ_{d1}, δ_{p1}, δ_{h1}) = (17-20, 7-9, 8.5-10);

The fuel substance comprised by the first fuel blend component may according to the present invention be characterized by the characteristic Hansen solubility parameters (δ_d , δ_p , δ_h) = (18.0-19,5, 6-12, 7-10) and the linker substance according to the invention may be characterized by having Hansen solubility parameters in ranges (δ_{d3}, δ_{p3}, δ_{h3}) = (17-20, 3-4.5, 4-6.5). Thereby the criteria of the Hansen solubility criteria for the first fuel blend component above is fullfilled.

The second fuel blend according to the present invention is generally characterised by having the characteristic Hansen solubility parameters (δ_{d2}, δ_{p2}, δ_{h2}) = (17-20, 3-5, 4-7) and selected from the group of ultra low sulphur fuel oils (ULSFO) such as RMG 180, low sulphur fuel oil ,marine gas oil, marine diesel oil, vacuum gas oil, and combinations thereof.

In some embodiments of the present invention, the linker substance further comprises components from the group of ketones, alcohols, toluene, xylene and/or creosol or combination thereof.

In a preferred embodiment of the present invention the linker substance comprises a further mixture of components comprised by 25-90 % by weight of ketones, 0.1-40 % by weight of alkanes, 1-40 % by weight alcohols and 0.1-20 % by weight of toluene and/or xylene and/or creosol.

A preferred embodiment of the present invention is where the low sulphur fuel blend have a viscosity at 50°C in the range 160-180 cSt, a flash point above 60°C, a pour point of less than 30°C, and a total acid number of less than 2,5 mg KOH/g.

Advantageously the first fuel component containing a renewable component is further characterized by having:

- a flash point in the range 60 to 150°C;
- a pour point below 30°C;
- an ash content of less than 0.1% by weight;
- a Conradson Carbon Residue number of less than 18; and
- an acid number of less than 2.5 mg KOH/g.

In a preferred embodiment the first fuel component containing renewable hydrocarbon have an oxygen content of less than 5% by weight,

The first fuel component containing renewable hydrocarbon may further be characterized by having a viscosity at 50°C in the range of 1000-10000 cSt such as a viscosity at 50°C in the range 100-1000 cSt.

The fuel substance comprised by first fuel component containing renewable hydrocarbon is according to a preferred embodiment of the present invention produced from biomass and/or waste.

In a particularly preferred embodiment the production of the fuel substance comprised by the first fuel blending component is produced by a hydrothermal liquefaction process.

In an advantageous embodiment of the fuel substance of the first fuel component containing renewable sources is produced by a hydrothermal liquefaction process by

a. Providing one or more biomass and/or waste materials contained in one or more feedstock;

b. Providing a feed mixture by slurring the biomass and/or waste material(-s) in one or more fluids at least one of which comprises water;

c. Pressurizing the feed mixture to a pressure in the range 100 to 400 bar;

d. Heating the pressurized feed to a temperature in the range 300°C to 450°C;

e. Maintaining the pressurized and heated feed mixture in a reaction zone in a reaction zone for a conversion time of 3 to 30 minutes.

f. cooling the converted feed mixture to a temperature in the range 25°C to 200°C

g. Expanding the converted feed mixture to a pressure of 1 to 120 bar;

h. Separating the converted feed mixture in to a crude oil, a gas phase and a water phase comprising water soluble organics and dissolved salts; and eventually a solid product phase;

i. Optionally further upgrading the crude oil by reacting it with hydrogen in the presence of one or more heterogeneous catalysts in one or more steps at a pressure in the range 60 to 200 bar and a temperature of 260 to 400°C; and separating the upgraded crude oil into a fraction comprising low boiling compounds and a first fuel component comprising high boiling compounds.

Through the testing of a number of solvents and mixtures; it was confirmed that 1) the addition of 2 wt.% of Toluene or the blend MEK/m-cresol (70:30) increase the solubility of biocrude and Bitumen. Although the mixture were not fully compatible at room temperature, it becomes compatible by spot test analysis when the blend is heated to 150ºC. 2) Biocrude and Vacum Gas Oil (VGO) blend become compatible by the addition 2 wt.% of solvent mixtures with HSP of about δ_D: 15.6, δ_P: 8.3, δ_H: 9.4. e.g Acetone (60 wt.%)+ Propanol (30 wt.%)+ pentane (10 wt.%). 3) Partially upgraded oil and VGO blends are compatible in a proportion up to 25% of Partially upgraded oil without the use of linkers.

Example 12: Linker substances for blending of renewable oil with marine fuels to produce low sulphur marine blends

Blending tests were performed in order to test the solubility of low sulphur marine fuel blendstocks with renewable liquids (crude oil, partially upgraded renewable oils and the 350+°C boiling fractions from the same oils) using concentrations in the range of 2 to 50 wt.% of renewable liquids. The tests showed only partial solubility of the renewable liquids with low sulphur marine fuel blendstock (RMG 180 Ultra Low sulphur fuel oil according to the ISO8217 (2012) standard), at any of the blending ratios tested. Obviously, such blend stock has compatibility issues that lead to precipitation, separation, and/or sedimentation of the insoluble components, etc. if used directly in blends with other marine fuels. Hence, a renewable blendstock not suffering from such compatibility issues are highly desirable.

A Hansen Solubility profile analysis was performed in order to identify a linker substance that will enable the blending of liquids in marine fuels. As visualized in Fig. 14a and 14b, there is overlapping of the sphere of solubility for each oil, which means that although their Hansen Solubility Parameters are different and the RED distance between their centre of solubility is greater than 1, they are partially soluble.

The identified potential mixtures of solvents that may acts as linker substances are mainly composed of sulphur-containing solvents, ketones, alkanes, and alcohols as well as aromatic compounds like toluene, xylene, and creosol.

Example 13: Low sulphur fuel blend comprising a first fuel blend component containing a renewable component

Based on the solubility profiles described in example 12 first fuel blend components containing a renewable component were produced from the heavy fraction of upgraded renewable crude oil having a boiling point of 350+°C and the Hansen Solubility Parameters (δ_D: 17-18.5, δ_P: 7-9.5, δ_H: 7-10.5; R_0: 4-8), and a linker substance comprising RMG380 high sulphur fuel oil (HSFO) with the Hansen Solubility Parameters (δ_D: 18-19.7, δ_P: 3-6, δ_H: 3-6; R_0: 4-6) and a sulphur content of 2.49% by weight in concentrations from 0 to 10 wt.%.

The first fuel blend components with the different linker substance concentrations up to 10% by weight were mixed with a second fuel component comprising ultra low sulphur fuel oil (ULSFO) according to the ISO 8217 RMG 180 ultra low sulphur specification having Hansen Solubility Parameters (δ_D: 18-19.7, δ_P: 3-6, δ_H: 3-4.5; R_0: 4-6.5).

As expected, the first fuel blend component without the linker substance was found to be incompatible when mixed the upgraded heavy fraction with two marine fuels (i.e.ultra low sulphur and high sulphur marine fuels) in proportions of 5 to 50 wt.% of upgraded renewable fraction. However, for first fuel blend components comprising 2% by weight or higher of the high sulphur linker substance the blends were found to be compatible. It was further found that the low sulphur fuel blend remained compatible at all ratios by dilution with the ultra low sulphur fuel oil (ULSFO) e.g. ultra low sulphur fuel oil can be added

CLAIMS

1. A low sulphur fuel blend of a first fuel blend component containing renewable hydrocarbon component(-s) and a second fuel blend component containing hydrocarbon to form at least part of a final low sulphur fuel blend having a sulphur content of less than 0.5 wt.%, where the first fuel blend component is characterised by having the characteristics (δ_{d1}, δ_{p1}, δ_{h1}) = (17-20, 6-10, 6-10); where the first fuel blend component comprises a fuel substance comprising 70 % by weight of compounds having a boiling point above 220 °C and is further characterized by having the characteristics (δ_d , δ_p , δ_h) = (17-20, 6-15, 6-12) and a linker substance comprising one or more sulphur containing solvents characterised by having the characteristics (δ_{d3}, δ_{p3}, δ_{h3})= (17-20, 3-6, 4-6); where the fuel substance is present in the first fuel blend component in a relative amount of 90-99.5 wt.%, and the linker substance is present in the first fuel blend component in a relative amount of 0.5 to 10 wt.%; where the second fuel blend component is characterised by having the characteristics (δ_{d2}, δ_{p2}, δ_{h2}) = (17-20, 3-5, 4-7) and selected from the group of ultra low sulphur fuel oils (ULSFO) such as RMG 180, low sulphur fuel oil, marine gas oil, marine diesel oil, vacuum gas oil, and combinations thereof, where the first fuel blend component is present in the final low sulphur fuel blend in a relative amount of up to 80 wt.%,

wherein δ_d is the Hansen Solubility parameter associated with dispersion, δ_p is the Hansen Solubility parameter associated with polarity and, δ_h is the Hansen Solubility parameter associated with hydrogen bonding,

wherein the linker substance is a fuel oil with a sulphur content of at least 1% by weight,

wherein the fuel substance of the first fuel blend component is further characterized by having an oxygen content of less than 15% by weight, and

wherein the fuel substance of the first fuel blend component is produced from biomass and/or waste.

2. A low sulphur fuel blend according to claims 2, where the linker substance is a fuel oil with a sulphur content of at least 1.5% by weight, preferably a fuel oil having a sulphur content of at least 2.0% by weight.

3. A low sulphur fuel blend according to claim 1 or 2, where the linker substance comprises a high sulphur fuel oil selected from RMG 380, vacuum gas oil, heavy vacuum gas oil or a combination thereof.

4. A low sulphur fuel blend according to any of the preceeding claims, where the first fuel blend component is present in the final low sulphur fuel blend in a relative amount of between 10-75 wt.%, where the second fuel blend component is present in the final low sulphur fuel blend in a relative amount of between 25-90 wt.%.

5. A low sulphur fuel blend according to any of claims 1 to 4, where the fuel substance comprised by the first fuel blend component containing renewable hydrocarbon component(-s) comprises at least 70 % by weight having a boiling point above 300°C such as at least 70 % by weight having a boiling point above 350°C; preferably the fuel substance of the first fuel blend component comprises at least 70 % by weight having a boiling point above 370°C such as at least 70 % by weight having a boiling point above 400°C.

6. A low sulphur fuel blend according to any of claims 1 to 4, where the fuel substance of the first fuel blend component containing renewable hydrocarbon component(-s) comprises at least 50 % by weight having a boiling point above 300 °C such as at least 50 % by weight having a boiling point above 350 °C; preferably the fuel substance of the first fuel

blend component comprises at least 50 % by weight having a boiling point above 370 °C such as at least 50 % by weight having a boiling point above 400 °C.

7. A low sulphur fuel blend according to any of claims 1 to 4, where the fuel substance of the first fuel blend component containing renewable hydrocarbon component(-s) comprises at least 10 % by weight having a boiling point above 400 °C such as at least 10 % by weight having a boiling point above 450 °C; preferably the the fuel substance of the first fuel blend component comprises at least 10 % by weight having a boiling point above 475 °C such as at least 10 % having a boiling point above 500 °C.

8. A low sulphur fuel blend according to any of the preceeding claims, where the final low sulphur fuel blend has a sulphur content of less than 0.1 wt.%.

9. A low sulphur fuel blend according to any of the preceding claims, where the sulphur content of the second fuel blend component is up to 1 % by weight, such as up to 0.5% by weight.

10. A low sulphur fuel blend according to any of the preceeding claims, where the first fuel blend component is present in the final low sulphur fuel blend in a relative amount of between 50-75 wt.%, and where the second fuel blend component is present in the final low sulphur fuel blend in a relative amount of between 25-50 wt.%.

11. A low sulphur fuel blend according to any of the preceeding claims, where the first fuel blend component is characterised by having the characteristics (δ_{d1}, δ_{p1}, δ_{h1}) = (17-20, 7-9, 8.5-10);

12. A low sulphur fuel blend according to any of the preceeding claims, where the fuel substance of first fuel blend component containing renewable hydrocarbon component(-s) have a water content of less than 1 % by weight such as a water content of less than 0.5 % by weight; preferably the first fuel blend component containing renewable hydrocarbon component(-s) have a water content of less than 0.25 % by weight such as a water content of less than 0.1 wt %.

13. A low sulphur fuel blend according to any of the claims 2-12, where the fuel substance is characterised by having the characteristics (δ_d , δ_p , δ_h) = (18.0-19,5, 6-12, 7-10) and where the linker substance is characterised by having the characteristics ranges (δ_{d3}, δ_{p3}, δ_{h3}) = (17-20, 3-4.5, 4-6.5).

14. A low sulphur fuel blend according to any of the claims 2-13, where the linker substance further comprises components from the group of ketones, alcohols, toluene, xylene and/or creosol or combination thereof.

15. A low sulphur fuel blend according to claim 14, where the linker substance further comprises a mixture of components comprised by 25-90 % by weight of ketones, 0.1-40 % by weight of alkanes, 1-40 % by weight alcohols and 0.1-20 % by weight of toluene and/or xylene and/or creosol.

16. A low sulphur fuel blend according to any of the preceding claims, where the viscosity of the low sulphur fuel blend at 50°C is in the range 160-180 cSt, the flash point of the low sulphur fuel blend above 60°C, the pour point of the low sulphur fuel blend is less than 30°C, and the total acid number is less than 2.5 mg KOH/g.

17. A low sulphur fuel blend according to any of the preceding claims, where the first fuel blend component and/or the fuel substance is further characterized by:

- a flash point in the range 60 to150°C,
- a pour point below 30°C,
- an ash content of less than 0.1% by weight,
- a Conradson Carbon Residue number of less than 18, and
- an acid number of less than 2.5 mg KOH/g

18. A low sulphur fuel blend according to any of the preceeding claims, where the fuel substance of the first fuel blend component is further characterized by having an oxygen content of less than 12 % by weight; preferably the first fuel blend component is further characterized by having an oxygen content of less than 10 % by weight such as an oxygen content of less than 8 % by weight.

19. A low sulphur fuel blend according to claim 18, where the fuel substance of first fuel blend component is further characterized by having a viscosity at 50 °C in the range of 1000-10000 cSt such as a viscosity at 50°C in the range 100-1000 cSt.

20. A low sulphur fuel blend according to claim 19, where the production of the fuel substance of first fuel blend component is performed by a hydrothermal liquefaction process.

21. A low sulphur fuel blend according to claim 20, where the fuel substance of the first fuel blend component is produced by:
a. Providing one or more biomass and/or waste materials contained in one or more feedstock;
b. Providing a feed mixture by slurrying the biomass and/or waste material(-s) in one or more fluids at least one of which comprises water;
c. Pressurizing the feed mixture to a pressure in the range 100 to 400 bar;
d. Heating the pressurized feed to a temperature in the range 300°C to

450°C;

e. Maintaining the pressurized and heated feed mixture in a reaction zone in a reaction zone for a conversion time of 3 to 30 minutes.

f. cooling the converted feed mixture to a temperature in the range 25°C to 200°C

g. Expanding the converted feed mixture to a pressure of 1 to 120 bar;

h. Separating the converted feed mixture in to a crude oil, a gas phase and a water phase comprising water soluble organics and dissolved salts

i.. Optionally further upgrading the crude oil by reacting it with hydrogen in the presence of one or more heterogeneous catalysts in one or more steps at a pressure in the range 60 to 200 bar and a temperature of 260 to 400°C; and separating the upgraded crude oil into a fraction comprising low boiling compounds and a first fuel component comprising high boiling compounds.

22. A low sulphur blend according to any of the preceeding claims for use as a marine fuel.

23. An intermediate blend component for forming a low sulphur fuel blend according to any of the preceding claims, the intermediate blend component comprising a fuel substance containing hydrocarbon and a linker substance to form at least part of the intermediate blend component, where the fuel substance is characterised by having the characteristics $(\delta_d\ ,\ \delta_p\ ,\ \delta_h\ )$ = (17-20, 6-12, 7-10) and where the linker substance is characterised by having the characteristics $(\delta_{d3},\ \delta_{p3},\ \delta_{h3}\ )$ = (17-20, 3-6, 3-6); where the fuel substance is present in the intermediate blend component in a relative amount of between 90-99.5 wt.% and where further the linker substance is present in the intermediate blend component in a relative amount of between 0.5 to 10 wt.%,

wherein δ_d is the Hansen Solubility parameter associated with dispersion, δ_p is the Hansen Solubility parameter associated with polarity and, δ_h is the Hansen Solubility parameter associated with hydrogen bonding,

wherein the linker substance is a fuel oil with a sulphur content of at least 1% by weight,

wherein the fuel substance is further characterized by having an oxygen content of less than 15% by weight, and

wherein the fuel substance is produced from biomass and/or waste.

24. An intermediate blend component according to claim 23, where the fuel substance is present in the intermediate blend component in a relative amount of up between 95-99.5 wt.% and where further the linker substance is present in the intermediate blend component in a relative amount of up between 0.5 to 5 wt.%.

25. A method of producing a low sulphur fuel blend containing a renewable hydrocarbon component having a sulphur content of less than 0.5% by weight according to any of claims 1 to 22, where the method comprises the steps of:

- Providing a first fuel blend component comprising a renewable component characterized by having the characteristics (δ_{d1}, δ_{p1}, δ_{h1}) = (17-20, 6-10, 6-10) in an amount of up to 80 % by weight of the final low sulphur fuel blend;
- Providing a second fuel blend component characterised by having the characteristics (δ_{d2}, δ_{p2}, δ_{h2}) = (17-20, 3-5, 4-7); and
- Providing a linker substance having the characteristics (δ_{d3}, δ_{p3}, δ_{h3}) = (17-20, 3-6, 4-6) in a relative amount of between 0.5 to 10 wt.% of the final low sulphur fuel blend;

- Adding the linker substance to the first or to the second fuel component to form an intermediate blend component; and
- Adding the second or the first fuel blend component to the intermediate blend component to form the low sulphur fuel blend,

wherein δ_d is the Hansen Solubility parameter associated with dispersion, δ_p is the Hansen Solubility parameter associated with polarity and, δ_h is the Hansen Solubility parameter associated with hydrogen bonding;
wherein the linker substance is a fuel oil with a sulphur content of at least 1% by weight.

26. A method according to claim 25, where the first fuel blend component and/or the second fuel blend component and/or the intermediate blend component is heated to a temperature in the range 70-150°C prior to forming the low sulphur fuel blend.

27. A method according to claim 26 or 27, where the intermediate blend component comprising the first or the second fuel blend component and the linker substance is manipulated to form a homogenous mixture prior to adding the second or the first fuel blend component to form the low sulphur fuel blend.

28. A method according to claim 27, where the manipulation to form a homogenous mixture is carried by stirring the mixture or by pumping the mixture.

29. A method for preparing the production of a low sulphur fuel blend according to any of claims 1 to 22, the method comprising measuring the characteristics (δ_{d1}, δ_{p1}, δ_{h1}) of a first fuel blend component containing a renewable hydrocarbon component, measuring the characteristics (δ_{d2},

δ_{p2}, δ_{h2}) of a second fuel blend component, determining the compatibility of the first and the second fuel component based on the measurement of the characteristics; and

when the first and the second fuel component are determined to be incompatible based on the measured characteristics, adding a linker substance to the first or the second fuel blend component to achieve compatibility, the linker substance comprising one or more sulphur containing solvents characterised by having the characteristics (δ_{d3}, δ_{p3}, δ_{h3}) = (17-20, 3-6, 4-6), the linker substance being a fuel oil with a sulphur content of at least 1% by weight, wherein δ_d is the Hansen Solubility parameter associated with dispersion, δ_p is the Hansen Solubility parameter associated with polarity and δ_h is the Hansen Solubility parameter associated with hydrogen bonding.