American petroleum pool, more extensive upgrading (such as aromatic hydrogenation) is required in order to meet fluid product specifications. Use of mineral oils in cosmetics and food preparation is banned in the European Union due to concerns about presence of trace amounts of carcinogenic polyaromatic hydrocarbons—thus providing the need for synthetic products that are inherently free of these aromatic components.

[0005] Synthetic hydrocarbon products have been used for some industrial fluid applications. For example C_{16}/C_{18} linear alpha olefins (LAOs) from oligomerization of ethylene, are used as drilling base fluids. However, this synthetic route is non-selective, producing a wide distribution of even carbon number LAOs, mostly in the C_4 to C_{10} range, such that further expensive processing and separation steps are required to achieve the desired LAO product. Moreover, these even carbon number LAOs in the C_4 to C_{10} range are chemical intermediates and not end-products suitable for use in industrial fluid applications.

[0006] Use of the Fischer-Tropsch process for producing synthetic hydrocarbons suitable for certain hydrocarbon fluid applications has also been reported. However, the FT process is very capital intensive and most of the FT manufacturing is dedicated to fuel production. Because the hydrocarbon range of interest for synthetic hydrocarbon fluids comprises a small percentage of the wide distribution of FT hydrocarbons (C1-C50+), it is more economical to hydrocrack and hydrotreat the FT wax and light oil fractions into complex compositions for fuel use.

[0007] There is thus a need for new processes for producing hydrocarbon fluids from alternative feeds. More specifically, there is a need for hydrocarbon fluid products that, based on their feedstocks and conversion processes, are substantially free of aromatics without further processing such as by aromatic hydrogenation conditions.

SUMMARY

[0008] In an ~~aspect~~embodiment, a method is provided involving altering the viscosity of bio-derived paraffins to produce a paraffinic fluid, where the altering step includes oligomerizing bio-derived paraffins, unsaturating bio-derived paraffins, chlorinating bio-derived paraffins, or a combination of any two or more thereof; the bio-derived paraffins are produced by

fluid includes a hydrodeoxygenated product and a hydroisomerized product; the hydrodeoxygenated product is produced by hydrodeoxygenating a bio-derived feed; the hydroisomerized product is produced by at least partially hydroisomerizing the hydrodeoxygenated product; the bio-derived feed includes bio-derived fatty acids, fatty acid esters, or a combination thereof; the hydrodeoxygenated product includes n-paraffins; the hydroisomerized product includes isoparaffins; the paraffinic fluid contains less than about 1 wt% aromatics; and the n-paraffins have a kinematic viscosity of less than about 10 cSt at 40 °C and have a biodegradability of at least about 40% after about 23 days of exposure to microorganisms; the isoparaffins are at least about 80 wt% mono-methyl branched paraffins where the mono-methyl branched paraffins comprise less than about 30 wt% terminal branched isoparaffins, have a kinematic viscosity of less than about 10 cSt at 40 °C, and have a biodegradability of at least about 40% after about 23 days of exposure to microorganisms. In some embodiments, the substrate includes a soil substrate, a topsoil substrate, a subsoil substrate, a clay substrate, a sand substrate, a rock substrate, or a stone substrate. In some embodiments, the step of producing an orifice includes hydraulic fracturing of the substrate with the paraffinic fluid.

[0015] In another ~~aspect~~embodiment, a method is provided involving protecting a substance by applying a paraffinic fluid. In the method, the paraffinic fluid includes a hydrodeoxygenated product; where the hydrodeoxygenated product is produced by hydrodeoxygenating a bio-derived feed; the bio-derived feed comprises bio-derived fatty acids, fatty acid esters, or a combination thereof; the hydrodeoxygenated product comprises n-paraffins; the paraffinic fluid contains less than 1 wt% aromatics; and the n-paraffins have a kinematic viscosity of less than about 10 cSt at 40 °C and have a biodegradability of at least 40% after about 23 days of exposure to microorganisms. In some embodiments, the hydrodeoxygenated product includes n-paraffins in the range of about 80 wt% to about 100 wt%; cycloparaffins in the range of about 1 wt% to about 10 wt%; less than about 1 wt% total aromatics. In some embodiments, the paraffinic fluid further comprises a hydroisomerized product produced by at least partially hydroisomerizing the hydrodeoxygenated product; where the hydroisomerized product comprises isoparaffins where at least about 80 wt% of the isoparaffins are mono-methyl branched paraffins; the mono-methyl branched paraffins comprise less than about 30 wt% terminal branched isoparaffins; and the isoparaffins have a

kinematic viscosity of less than about 10 cSt at 40 °C and have a biodegradability of at least about 40% after about 23 days of exposure to microorganisms.

[0016] In some embodiments, the substance is a food crop, a metal, or wood. In some embodiments, protecting involves solvating the substance. In such embodiments, the substance includes pesticides, herbicides, paints, inks, or coatings. In some embodiments, protecting involves cleaning the substance with the paraffinic fluid In such embodiments, the substance comprises fabric, metal, or plastic. In some embodiments, protecting involves lubricating the substance where the substance is metal.

[0017] In an ~~aspect~~embodiment, a method is provided which involves producing an orifice in a substrate by at least injecting a paraffinic fluid into the substrate, wherein the paraffinic fluid comprises a hydrodeoxygenated product; the hydrodeoxygenated product is produced by hydrodeoxygenating a bio-derived feed; the bio-derived feed comprising bio-derived fatty acids, fatty acid esters, or a combination thereof; the hydrodeoxygenated product comprises n-paraffins; the paraffinic fluid contains less than about 1 wt% aromatics; and the n-paraffins have a kinematic viscosity of less than about 10 cSt at 40 °C and have a biodegradability of at least about 40% after about 23 days of exposure to microorganisms. In some embodiments, the hydrodeoxygenated product includes n-paraffins in the range of about 80 wt% to about 100 wt%; cycloparaffins in the range of about 1 wt% to about 10 wt%; and less than about 1 wt% total aromatics. In some embodiments, the paraffinic fluid further includes a hydroisomerized product produced by at least partially hydroisomerizing the hydrodeoxygenated product; wherein the hydroisomerized product comprises isoparaffins where at least about 80 wt% of the isoparaffins are mono-methyl branched paraffins; the mono-methyl branched paraffins comprise less than about 30 wt% terminal branched isoparaffins; and the isoparaffins have a kinematic viscosity of less than about 10 cSt at 40 °C and have a biodegradability of at least about 40% after about 23 days of exposure to microorganisms.

[0018] In some embodiments, the substrate comprises a soil substrate, a topsoil substrate, a subsoil substrate, a clay substrate, a sand substrate, a rock substrate, or a stone substrate. In some embodiments, the bio-derived fatty acids, fatty acid esters, or a combination thereof comprises algae oils, beef tallow, camelina oil, canola oil, rapeseed oil, castor oil, choice

WHAT IS CLAIMED IS:

1. A method comprising altering the viscosity of a bio-derived paraffins to produce a paraffinic fluid, wherein

the altering step comprises oligomerizing the bio-derived paraffins, unsaturating the bio-derived paraffins, chlorinating the bio-derived paraffins, or a combination of any two or more thereof;

the bio-derived paraffins are produced by hydrodeoxygenating a bio-based feed;

the bio-based feed comprises bio-derived fatty acids, fatty acid esters, or a combination thereof;

the bio-derived paraffins comprise n-paraffins; and

the n-paraffins

have a kinematic viscosity of less than about 10 cSt at 40 °C; and

have a biodegradability of at least about 40% after about 23 days of exposure to microorganisms.

2. The method of claim 1, wherein oligomerizing bio-derived paraffins comprises contacting the bio-derived paraffins with an organic peroxide to produce an oligomerized product, wherein the oligomerized product has a kinematic viscosity of at least about 10 cSt at 40 °C.

3. The method of claim 2, wherein the oligomerized product has a biodegradability of at least about 40% after about 23 days of exposure to microorganisms.

4. The method of claim 2, wherein the oligomerized product is a dimer, trimer, tetramer, or a mixture of any two or more thereof.

5. The method of claim 2, wherein the organic peroxide is present in an amount between about 2 wt% and about 40 wt% based on the total weight of the bio-derived paraffins and the organic peroxide.

6. The method of claim 2, wherein the organic peroxide is of the formula

R-O-O-R'

where R and R' are each independently H, alkyl, or aryl.

7. The method of claim 2, wherein the organic peroxide comprises di-tert butyl peroxide, 2,5-dimethyl 2,5-di(t-butylperoxy)hexane, dicumyl peroxide, dibenzoyl peroxide, dipropyl peroxide, ethyl propyl peroxide, or tert-butyl tert-amyl peroxide.

8. The method of claim 2, wherein the contacting is performed at a temperature between about 50 °C and about 250 °C.

9. The method of claim 2, wherein the oligomerized product is used as a drilling fluid, a hydraulic fracturing fluid, a metal working fluid, a protecting agent, or a combination of any two or more thereof.

10. The method of claim 1, wherein chlorinating the bio-derived paraffins comprises contacting the bio-derived paraffins with chlorine gas at a temperature between about 60 °C and about 150 °C to produce a chlorinated product, wherein

the chlorinated product comprises haloalkanes; and

the chlorinated product has a kinematic viscosity of greater than about 10 cSt at 40 °C.

11. The method of claim 10, wherein the chlorinated product is used as a protecting agent, a cleaning agent, or a combination of both.

12. The method of claim 10, wherein the chlorinated product acts as a flame retardant.

13. The method of claim 10, wherein the chlorinated product is used to clean fabric, metal, or plastic.

14. The method of claim 1, wherein unsaturating the bio-derived paraffins comprises dehydrogenation of the bio-derived paraffins by contacting the bio-derived paraffins with a dehydrogenation catalyst at a temperature from about 360 °C to about 660 °C to produce an olefinic fluid, wherein

the olefinic fluid comprises at least about 10 wt% internal olefins in the C_{15} to C_{18} range; and

the olefinic fluids has a viscosity of less than about 10 cSt at 40 °C.

15. The method of claim 14, wherein the olefinic fluid comprises at least about 20 wt% internal olefins in the C_{15} to C_{18} range.

16. The method of claim 14, further comprising oligomerizing the olefinic fluid to produce dimers, trimers, tetramers, or a mixture of any two or more thereof.

17. The method of claim 14, wherein the olefinic fluid is used as a hydraulic fracturing fluid, as a drilling fluid, or a combination of the two.

18. The method of claim 1, wherein the bio-derived paraffins are produced by

hydrodeoxygenating the bio-based feed to produce a hydrodeoxygenated product; and

at least partially hydroisomerizing the hydrodeoxygenated product to produce a hydroisomerized product;

wherein

the bio-derived paraffins comprise the hydrodeoxygenated product and the hydroisomerized product;

the hydrodeoxygenated product comprises n-paraffins;

the hydroisomerized product comprises isoparaffins where at least about 80 wt% of the isoparaffins are mono-methyl branched paraffins;

the mono-methyl branched paraffins comprise less than about 30 wt% terminal branched isoparaffins; and

the isoparaffins

have a kinematic viscosity of less than about 10 cSt at 40 °C; and

have a biodegradability of at least about 40% after about 23 days of exposure to microorganisms.

19. The method of claim 18, wherein the hydrodeoxygenated product comprises

n-paraffins in the range of about 80 wt% to about 100 wt%;
cycloparaffins in the range of about 0 wt% to about 10 wt%; and
less than about 1 wt% total aromatics.

20. The method of claim 1, wherein the bio-derived fatty acids, fatty acid esters, or a combination thereof comprises algae oils, beef tallow, camelina oil, canola oil, rapeseed oil, castor oil, choice white grease, coconut oil, coffee bean oil, corn oil, cottonseed oil, fish oils, hemp oil, Jatropha oil, linseed oil, mustard oil, palm oil, palm kernel oil, poultry fat, soybean oil, sunflower oil, tall oil, tall oil fatty acid, Tung oil, used cooking oils, yellow grease, products of the food industry, or combinations of any two or more thereof.

21. The method of claim 1, wherein the bio-derived fatty acids, fatty acid esters, or a combination thereof comprise soybean oil, corn oil, cottonseed oil, canola oil, coconut oil, sunflower oil, palm oil, palm kernel oil, rapeseed oil, or a combination of any two or more thereof.

22. A method comprising producing an orifice in a substrate by at least injecting a viscosity-altered paraffinic fluid into the substrate, wherein
the paraffinic fluid comprises a hydrodeoxygenated product and a hydroisomerized product;
the hydrodeoxygenated product is produced by hydrodeoxygenating a bio-derived feed;
the hydroisomerized product is produced by at least partially hydroisomerizing the hydrodeoxygenated product;
the bio-derived feed comprises bio-derived fatty acids, fatty acid esters, or a combination thereof;
the hydrodeoxygenated product comprises n-paraffins;
the hydroisomerized product comprises isoparaffins;
the paraffinic fluid contains less than about 1 wt% aromatics; and
the n-paraffins
have a kinematic viscosity of less than about 10 cSt at 40 °C; and

have a biodegradability of at least about 40% after about 23 days of exposure to microorganisms;

the isoparaffins

are at least about 80 wt% mono-methyl branched paraffins where the mono-methyl branched paraffins comprise less than about 30 wt% terminal branched isoparaffins;

have a kinematic viscosity of less than about 10 cSt at 40 °C; and

have a biodegradability of at least about 40% after about 23 days of exposure to microorganisms.

23. The method of claim 22, wherein the substrate comprises a soil substrate, a topsoil substrate, a subsoil substrate, a clay substrate, a sand substrate, a rock substrate, or a stone substrate.

24. The method of claim 22, wherein the step of producing an orifice comprises hydraulic fracturing of the substrate with the paraffinic fluid.

Claims

1. A method comprising producing an orifice in a substrate by at least injecting a viscosity-altered paraffinic fluid into the substrate, wherein

the paraffinic fluid comprises a hydrodeoxygenated product and a hydroisomerized product;

the hydrodeoxygenated product is produced by hydrodeoxygenating a bio-derived feed;

the hydroisomerized product is produced by at least partially hydroisomerizing the hydrodeoxygenated product;

the bio-derived feed comprises bio-derived fatty acids, fatty acid esters, or a combination thereof;

the hydrodeoxygenated product comprises n-paraffins;

the hydroisomerized product comprises isoparaffins;

the paraffinic fluid contains less than about 1 wt% aromatics; and

the n-paraffins

have a kinematic viscosity of less than about 10 cSt at 40 °C; and

have a biodegradability of at least about 40% after about 23 days of exposure to microorganisms;

the isoparaffins

are at least about 80 wt% mono-methyl branched paraffins where the mono-methyl branched paraffins comprise less than about 30 wt% terminal branched isoparaffins;

have a kinematic viscosity of less than about 10 cSt at 40 °C; and

have a biodegradability of at least about 40% after about 23 days of exposure to microorganisms.

2. The method of claim 1, wherein the substrate comprises a soil substrate, a topsoil substrate, a subsoil substrate, a clay substrate, a sand substrate, a rock substrate, or a stone substrate.

3. The method of claim 1, wherein the step of producing an orifice comprises hydraulic fracturing of the substrate with the paraffinic fluid.

4. The method of claim 1, wherein the bio-derived fatty acids, fatty acid esters, or a combination thereof comprises algae oils, beef tallow, camelina oil, canola oil, rapeseed oil, castor oil, choice white grease, coconut oil, coffee bean oil, corn oil, cottonseed oil, fish oils, hemp oil, Jatropha oil, linseed oil, mustard oil, palm oil, palm kernel oil, poultry fat, soybean oil, sunflower oil, tall oil, tall oil fatty acid, Tung oil, used cooking oils, yellow grease, products of the food industry, or combinations of any two or more thereof.

5. The method of claim 1, wherein the bio-derived fatty acids, fatty acid esters, or a combination thereof comprise soybean oil, corn oil, cottonseed oil, canola oil, coconut oil, sunflower oil, palm oil, palm kernel oil, rapeseed oil, or a combination of any two or more thereof.

6. The method of claim 1, wherein the hydrodeoxygenated product comprises

n-paraffins in the range of about 80 wt% to about 100 wt%;

cycloparaffins in the range of about 0 wt% to about 10 wt%; and

less than about 1 wt% total aromatics.

7. The method of claim 1, wherein the hydrodeoxygenated product is free of benzene.

8. The method of claim 1, wherein the mono-methyl branched paraffins comprise less than about 5 wt% terminal branched isoparaffins.

9. The method of claim 1, wherein the hydroisomerized product has a ratio of isoparaffins to normal paraffins in the range of about 1:1 to about 30:1.

10. The method of claim 1, wherein the hydroisomerized product has a ratio of isoparaffins to normal paraffins in the range of about 1:1 and about 10:1.

11. The method of claim 1, wherein the hydroisomerized product is free of benzene.

12. The method of claim 1, wherein the paraffinic fluid further comprises an olefinic fluid, an oligomerized product, a chlorinated product, or mixtures of any two or more thereof.

13. The method of claim 1, wherein the paraffinic fluid further comprises an olefinic fluid, wherein the olefinic fluid comprises

at least about 10 wt% internal olefins in the C_{16} to C_{18} range;

a viscosity of less than about 10 cSt at 40 °C; and
is free of benzene.

14. The method of claim 13, wherein the olefinic fluid comprises
about 50-90 wt% n-paraffins in the C_{16}-C_{18} range;
about 10-40 wt% linear internal olefins in the C_{16}-C_{18} range; and
about 0-10 wt% linear alpha olefins in the C_{16}-C_{18} range.

15. The method of claim 1, wherein the paraffinic fluid further comprises an oligomerized product wherein the oligomerized product has a kinematic viscosity of at least about 10 cSt at 40 °C and is free of benzene.

16. The method of claim 15, wherein the oligomerized product has a biodegradability of at least about 40% after about 23 days of exposure to microorganisms.

17. The method of claim 15, wherein the oligomerized product is a dimer, trimer, tetramer, or a mixture of any two or more thereof.

18. The method of claim 1, wherein the paraffinic fluid is free of benzene.

19. The method of claim 1, wherein the paraffinic fluid has a kinematic viscosity of less than about 10 cSt at 40 °C.

20. The method of claim 1, wherein the paraffinic fluid comprises less than 0.1 wt% total aromatics.

21. The method of claim 1, wherein the hydroisomerized product comprises a pour point of at most about -10 °C.

22. The method of claim 1, wherein the paraffinic fluid comprises a kinematic viscosity of less than about 5 cSt at 40 °C.

23. The method of claim 1, wherein the paraffinic fluid is free of benzene and comprises
less than about 0.5 wt% aromatics;
a kinematic viscosity of less than about 5 cSt at 40 °C; and

an olefinic fluid, wherein the olefinic fluid comprises

about 50-90 wt% n-paraffins in the C_{16}-C_{18} range;

about 10-40 wt% linear internal olefins in the C_{16}-C_{18} range; and

about 0-10 wt% linear alpha olefins in the C_{16}-C_{18} range.

24. The method of claim 23, wherein the step of producing an orifice comprises hydraulic fracturing of the substrate with the paraffinic fluid.