

HYDROTREATED HYDROCARBON TAR, FUEL OIL COMPOSITION, AND PROCESS FOR MAKING IT

FIELD

[0001] The present disclosure relates to a hydrotreated hydrocarbon tar. The present disclosure further relates to a fuel oil composition containing the hydrotreated tar. The present disclosure further relates to a process for making the fuel oil composition.

BACKGROUND

[0002] Conventionally, high-sulfur fuel oils, i.e., those having 1 wt% or more sulfur, have been employed in marine and shipping applications due to their relative availability and low cost. However, impending international regulatory changes mandate the use of fuel oils having lower sulfur content. Thus, there is a need for low-cost, low-sulfur fuel oils for marine and shipping applications.

[0003] Low-sulfur fuel oils, i.e., fuel oils having less than 1.0 wt% sulfur, are currently produced from a wide variety of streams produced from processing crude oil. Most low-sulfur fuel oils contain high-viscosity residuals, e.g., C₅₀+ hydrocarbons (50+ carbons), from vacuum distillation towers from the processing of low-sulfur crude oils. The high-viscosity residuals are typically fluxed with aromatics-rich distillates, such as those distillates produced from the C₁₀+ hydrocarbons of fluid catalytic cracking units, to form low-sulfur fuel oils.

[0004] Steam cracker tars, the residuals from steam crackers, typically contain C₁₀ to C₇₅ aromatics and typically cannot be blended into low-sulfur fuel oils because the resulting fuel oils would not meet many of required product specifications. One specification steam cracker tars typically do not meet is

compatibility. Asphaltenes in steam cracker tars are not soluble in many low-sulfur fuel oil formulations. Another specification not typically met is sulfur content, which often exceeds 0.5 wt% in steam cracker tars. Another specification not typically met is density, which is typically high at 1.1 g/cc. Another specification not typically met is combustion quality, which is poor due to high aromaticity.

[0005] It would be desirable to have fuel oils that can be partially formulated with steam cracker tar streams. It would further be desirable to have such fuel oils that meet conventional physical property and performance specifications for fuel oils.

SUMMARY OF THE DISCLOSURE

[0006] According to the present disclosure, there is provided a hydrocarbon tar. The tar has 75 wt% or more of aromatics of 10 carbons to 75 carbons based on the total weight of the tar. The hydrocarbon tar exhibits 40% to 80% aromaticity, which refers to the percent of total carbon atoms in aromatic rings as measured by carbon NMR. The tar has a boiling point of from 300°F to 1350°F.

[0007] According to the present disclosure, there is further provided a fuel oil composition. The composition is a blend of 10 wt% to 100 wt% of aromatics of 10 carbons to 75 carbons and 90 wt% to 0 wt% of non-aromatic hydrocarbons of 10 or more carbons based on the total weight of the composition. The aromatics exhibit an aromaticity of 40% to 80%. The aromatics and the non-aromatic hydrocarbons are 95 wt% or more of the total weight of the composition.

[0008] According to the present disclosure, there is further provided a process for making a hydrogenated tar. The process has the steps of (a) refining a first stream of hydrocarbons in a vacuum or atmospheric distillation tower to produce a

tower stream; (b) cracking the tower stream in a steam cracker to produce a cracker stream of 75 wt% or more of aromatics of 10 carbons to 75 carbons and 60% to 80% aromaticity based on the total weight of the tower stream; and (c) partially hydrogenating the cracker stream to form a hydrocarbon tar of an aromaticity of 40% to 80% and a boiling point of from 300°F to 1350°F.

[0009] According to the present disclosure, there is further provided a process for making a hydrocarbon tar. The process has the steps of (a) refining a crude oil or a natural gas liquid stream to produce an aromatic stream of 75 wt% or more of aromatics of 10 carbons to 75 carbons and 60% to 80% aromaticity based on the total weight of the composition and (b) partially hydrogenating the aromatic stream to form a hydrocarbon tar of an aromaticity of 40% to 80% and a boiling point of from 300°F to 1350°F.

[0010] According to the present disclosure, there is further provided a process for making a hydrocarbon tar. The process has the steps of (a) refining a crude oil or a natural gas liquid stream to produce an aromatic stream including at 75 wt% or more of aromatics of 10 carbons to 75 carbons and 60% to 80% aromaticity based on the total weight of the composition and (b) partially hydrogenating the aromatic stream to form a hydrocarbon tar of an aromaticity of 40% to 80% and a boiling point of from 300°F to 1350°F.

BRIEF DESCRIPTION OF THE FIGURES

[0011] Fig. 1 is a 2D GC image of a hydrotreated tar according to the present disclosure.

[0012] Fig. 2 is a 2D GC image of a C25-C29 fraction of a hydrotreated tar according to the present disclosure.

[0013] Fig. 3 is a 2D GC image of the crystals of Fig. 4 dissolved in the pentane is shown in Fig. 3.

[0014] Fig. 4 is a 2D GC image of isolated crystals of the C₂₅-C₂₉ aromatic fraction.

[0015] Fig. 5 is a 2D GC image of a C₁₈-C₄₅ aromatic fraction of a virgin vacuum gas oil.

[0016] Fig. 6 is a 2D GC image of a C₁₈-C₄₅ aromatic fraction of a virgin vacuum gas oil.

[0017] Fig. 7 is a 2D GC image of a C₂₁-C₄₀ aromatic fraction of a hydrovisbroken vacuum gas oil.

[0018] Fig. 8 is a 2D GC image of a C₂₁-C₄₀ aromatic fraction of a hydrovisbroken vacuum gas oil.

[0019] Fig. 9 is a schematic diagram of an embodiment of a process of the present disclosure.

[0020] Fig. 10 are 2D GC plots of silica gel fractions of a C₂₀-C₂₃ distillation fraction of a C₁₀+ hydrotreated tar.

[0021] Fig. 11 is a 2D GC plot of a Virgin Kearn vacuum gas oil.

[0022] Fig. 12 is a 2D GC plot of the gas oil of Fig. 11 with tar saturates superimposed.

[0023] Fig. 13 is a 2D GC plot of 650°F-922°F hydrovisbroken Basrah residual.

[0024] Fig. 14 is a 2D GC plot of the hydrovisbroken Basrah residual of Fig. 13 with tar saturates superimposed.

DETAILED DESCRIPTION

[0025] All numerical values within the detailed description and the claims herein are modified by “about” or “approximately” the indicated value, and take into account experimental error and variations that would be expected by a person having ordinary skill in the art.

[0026] The hydrotreated hydrocarbon tars of the disclosure have aromatic compounds range from 10 carbons to 75 carbons. Other embodiments of hydrotreated tars have aromatic compounds ranging from 18 carbons to 23 carbons and 25 carbons to 29 carbons. The hydrotreated tars further exhibit an aromaticity of 40% to 80% and preferably 50% to 70%. In other embodiments, the hydrotreated tars may also further exhibit an aromaticity of 40% to 68% or 50% to 65%. Aromaticity is measured according to ¹³C NMR. The hydrotreated tar preferably has a density of 0.90 to 1.06 grams/cubic centimeter (gm/cc) and more preferably 0.94 to 1.04 gm/cc. The composition can have a boiling point of from 300°F to 1380°F, a boiling point of from 400°F to 1350°F, or a boiling point of 650°F to 1350°F. The tar preferably has a viscosity of 40 centistokes to and 400 centistokes at 40°C and more preferably 50 centistokes to 300 centistokes according to ASTM Test D445-3. The hydrotreated tar preferably is 100% soluble in 75 wt% toluene/25 wt% heptane at 100°C and more preferably 100% soluble in 50 wt% toluene/50 wt% heptane at 100°C. The C₂₀+ fraction of the hydrotreated tar preferably between 0 and 15 wt% sats, more preferably between 1 and 10 wt% sats, and most preferably between 2 and 8 wt% sats. Aromatics are preferably 60 wt% or more preferably 75 wt% or more of the total weight of the hydrotreated tar. The hydrotreated tar may also be referred to herein as steam cracker tar or hydrocarbon tar.

[0027] Regular and low-sulfur fuel oil compositions can be produced by blending the hydrocarbon tar with fuel oil hydrocarbon base stocks in any amount or proportion. The hydrocarbon tar may be used by itself as a fuel oil composition, but blending with less expensive fuel oil base stocks is preferred. While the hydrocarbon tar can be used in fuel oil applications, the tar may also be used in specialty chemical applications as a feedstock for manufacture of petroleum-based compounds and substances.

[0028] The fuel oil compositions of the present disclosure include 10 wt% to 100 wt% of the aromatics. In some embodiments, the remainder of the fuel oil compositions includes 90 wt% to 0 wt% of non-aromatic hydrocarbons of 10 or more carbons and preferably 90 wt% to 50 wt% of non-aromatic hydrocarbons of 50 or more carbons. In other embodiments, the remainder of the fuel oil compositions include 90 wt% to 0 wt% of non-aromatic hydrocarbons of 10 or more carbons and preferably 90 wt% to 50 wt% of non-aromatic hydrocarbons of 50 or more carbons derived from vacuum residual. In still other embodiments, the remainder of the fuel oil compositions includes 90 wt% to 70 wt% of non-aromatic hydrocarbons of 10 or more carbons and preferably 70 wt% to 40 wt% of non-aromatic hydrocarbons of 50 or more carbons derived from vacuum residual. In yet another embodiment, the fuel oil composition has 10 wt% to 95 wt% of a hydrocarbon tar of 75 wt% or more aromatics and 90 wt% to 5 wt% of non-aromatic hydrocarbons of 10 or more carbons. When low-sulfur compositions are desired, the fuel oil composition can have a sulfur concentration of 1.0 wt% or less. Fuel oil compositions of higher sulfur content are also within the scope of the present disclosure, including those of a sulfur concentration of 3.5 wt% or less. Sulfur concentration is typically measured according to D2622. The aromatic stream and the hydrocarbon stream together are 95 wt% or more and preferably 99 wt% or more of the total weight of the fuel oil composition. The partially hydrogenated aromatic stream corresponds to the hydrocarbon tar disclosed herein.

[0029] Typical fuel oil compositions will contain highly viscous vacuum residual as a fuel oil base stock. The hydrocarbon tar of the disclosure, when blended with the fuel oil base stock, reduces the viscosity of the fuel oil base stock.

[0030] Useful species of aromatics commonly found in steam cracker tar include monoaromatics such as indanes and tetralins, and polyaromatics, such as 1-phenylnaphthalene, 1-benzyl-naphthalene, and 1-phenylethyl-naphthalene.

[0031] Refining is carried out according to the disclosure herein with regard to vacuum and/or atmospheric distillation and steam cracking. Hydrogenation is carried out according to the disclosure herein with regard to hydrogenation apparatuses and operating conditions.

[0032] Hydrogenation or hydrotreating can be carried out by processes known in the art. Disclosure of such processes is described, for example, in U.S. Patent Publication Nos. 20070090020 and 20100025291 and U.S. Patent Nos. 2,859,169 and 4,548,709, all of which are incorporated herein by reference.

[0033] Hydrotreating may be performed at a temperature of from 500°F (260°C) to 900°F (482°C), preferably from 650°F (343°C) to 900°F (482°C), more preferably from 700°F (371°C) to 900°F (482°C), more preferably from 750°F (399°C) to 900°F (482°C), and still more preferably from 750°F (399°C) to 800°F (427°C). In some embodiments, the preferred pressure is from 500 to 10,000 psig, preferably 1000 to 4000 psig may be used, and more preferably from 1500 to 3000 psig. The selected temperature may vary according to the composition and conditions of the hydrocarbon feed. Preferred liquid hourly space velocity may be from 0.1 to 5, preferably 0.25 to 1. The hydrogen supply rate (makeup and recycle hydrogen) to the hydrotreating zone may be in the range of from 500 to 20,000 standard cubic feet per barrel of hydrocarbon feed, preferably 2,000 to 5,000 standard cubic feet per barrel. Hydrotreating may be

carried out utilizing a single zone or a plurality of hydrotreating zones, e.g., two or more hydrotreating zones in parallel or in series. For example, in one embodiment a first zone may comprise a first catalyst that may be designed to accumulate most of the metals removed from the feedstock, and in series a second zone may comprise a second catalyst that can be designed for maximum heteroatom removal and aromatics hydrogenation. In another embodiment, a first catalyst can be designed to accumulate most of the metals removed from the feedstock, and a second zone with a second catalyst can be designed for maximum heteroatom removal and a third zone with a third catalyst can be designed to increase aromatics hydrogenation. The first and second catalysts may be piped in series reactors or loaded in series in the same zone. The design of hydrotreating zones or units is not critical to the present disclosure.

[0034] The catalyst employed in the typical commercial hydrotreating zone(s) is comprised of material having hydrogenation-dehydrogenation activity together with an amorphous carrier. Exemplary amorphous carriers include alumina, silica-alumina, silica, zirconia, or titania. Hydrogenation-dehydrogenation components of the catalyst preferably comprise at least one hydrogenation component selected from Group VI metals and compounds of Group VI metals and at least one hydrogenation component selected from Group VIII metals and compounds of Group VIII metals. Preferred combinations of hydrogenation components include nickel sulfide with molybdenum sulfide, cobalt sulfide with molybdenum sulfide, cobalt with molybdenum, and nickel with tungsten. The catalyst employed in the invention may also be comprised of a material having hydrogenation-dehydrogenation activity formulated without an amorphous carrier. Exemplary catalysts include Nebula.

[0035] Resid hydroprocessing includes substantially any process resulting in the hydrogenation of resid and/or resid-containing fractions, and encompasses (but is not limited to) commercially available resid hydroprocessing technologies.

Examples of these commercially available processes are the H-Oil process, the Chevron RDS, VRDS, OCR, and LC-Fining processes, the HYVAHL process, and the ENI-Snamprogetti EST process. Suitable hydroprocessing processes may include, for example, fixed bed catalyst systems, ebullating bed systems, fluidized bed systems, and/or combinations thereof.

[0036] The partial hydrogenation of steam cracker tar affords the following advantages: (1) reduction in aromaticity, (2) substantial reduction in the viscosity of the tar, (3) substantially improvement of compatibility of the tar in fuel oil formulations, (4) reduction in sulfur content of the tar, (5) improvement in dissolution of asphaltenes in fuel oil formulations containing the partially hydrogenated tar, and (6) improved combustion quality (higher volatility and cetane number).

[0037] Steam cracking can be carried out by processes known in the art. Disclosure of such processes is described, for example, in U.S. Patent Publication No. 20070066860; U.S. Patent Nos. 8,201,619 and 8,286,695; and PCT Publication Nos. WO2004005431 and WO 2005113713, all of which are incorporated herein by reference.

[0038] Steam cracking can be carried out in a steam cracker, which refers generally to a thermal pyrolysis unit or furnace and pyrolysis units. The use of steam is optional but is typically added for one or more reasons, such as to reduce hydrocarbon partial pressure, to control residence time, and/or to minimize coke formation. In preferred embodiments, the steam may be superheated, such as in the convection section of the pyrolysis unit, and/or the steam may be sour or treated process steam.

[0039] Steam cracking may be carried out at a temperature of at least 600°F (315°C.), preferably at least 650°F (343°C), more preferably at least 750°F

(399°C). Preferably the pressure is at least 1800 psig. A preferred steam cracking temperature range may be from 650°F (343°C) to 900°F (482°C).

[0040] Vacuum distillation and atmospheric distillation can be carried out by processes known in the art. Disclosure of such processes is described, for example, in U.S. Patent Nos. 6,105,941; 6,287,367; and 7,137,622, all of which are incorporated herein by reference. Vacuum distillation is separation of a multi-component hydrocarbon stream into its components at elevated temperatures and reduced pressures. Reduced pressures enable components to be distilled at lower temperatures than would be possible at atmospheric or elevated pressures. If desired, distillation can be carried out at atmospheric pressure at elevated temperatures. Distillation typically takes place in a tower or series of towers. The tower may have trays or random packing material and demister pads therein. Vacuum may be induced in the tower by any means known in the art, such as with steam ejectors. Components distill out of the tower based on vapor pressure. Lighter components with higher vapor pressures distill out toward the top of the tower and heavier components with lower vapor pressures distill out toward the bottom of the tower. Components exiting the tower may be gas or inerts, vacuum gas oils (light, medium, or heavy), and residuum or bottoms.

[0041] Feedstocks useful in producing the hydrocarbon tars of the disclosure include crude oil and natural gas derived liquids. The natural gas derived liquids are obtained by compression and/or refrigeration of gases obtained from oil wells and natural gas wells. The natural gas derived liquids are 10+ carbon hydrocarbon liquids typically formed as competing polymerization byproducts from gas and naphtha crackers.

[0042] The following is an example of the present disclosure and is not to be construed as limiting.

EXAMPLES

Example 1

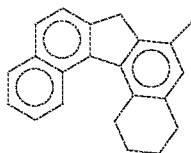
[0043] Steam cracker tar at 1.1 g/cc and 2.2 wt% sulfur (S) was hydrotreated at 1000 psig (pounds per square inch gauge), 400°C, and 0.4 LHSV (liquid hourly headspace velocity) with 1400 SCFB (standard cubic feet per barrel) hydrogen cofeed. Hydrogen consumption was 1200 SCFB of feed, resulting in a composition with a density of 1.02 g/cc and 0.4 wt% S.

[0044] The resulting hydrotreated composition is a suitable as a fuel oil blending component. A 2D GC image of the composition is set forth in Fig. 1. In Fig. 1, the peaks for the aromatics increase in carbon number along the slope, with the peak for C₂₀ situated generally in the middle along the slope. The generally linear line of peaks along the bottom of the image represent paraffin waxes, which make up <1 wt% of the composition. Fig. 2 is a 2D GC image of a C₂₅₋₂₉ fraction of the hydrotreated composition. The C₂₅₋₂₉ fraction was obtained via distillation in a spinning band distillation column.

[0045] The 500+ component hydroprocessed steam cracker tar of the present example is useful as a fuel oil blending component. The density, viscosity, sulfur content, solubility, solvency, and combustion quality all make the 500°F-1050°F composition a premium quality fuel oil blending component. The process for making disclosed herein provides a composition having aromatics of a relatively narrow range of number of carbons. The unique GC fingerprint of the composition makes it possible to identify the presence of the composition in fuel oil blends.

[0046] The composition contains polynuclear aromatic hydrocarbons that readily crystallize. The C₂₅₋₂₉ fraction of the composition was isolated and characterized by 2D GC. 20 grams of the C₂₅₋₂₉ fraction were dissolved in 100 cc

of pentane and placed in the freezer at -20°F. 0.3 g of crystals was isolated. A 2D GC image of the isolated crystals is shown in Fig. 4 and the 2D GC image of the crystals dissolved in the pentane is shown in Fig. 3. The NMR of the isolated crystals is consistent with the following molecular structure:



[0047] The composition of the disclosure can be detected in fuel oil blends by distilling the fuel oil and separating out C₂₀₋₂₃ and C₂₅₋₂₉ heart cuts (fractions), separating these fractions using preparative chromatography, and using NMR, 2D GC, and mass spectroscopy to characterize the fractions. The composition of the disclosure can be concentrated in the aromatic fractions isolated from the preparative chromatography.

[0048] Distillation was used to separate a C₂₀₋₂₃ fraction from the C₁₀–C₆₀ fraction of the hydrotreated steam cracker tar liquid product. The C₂₀₋₂₃ fraction was separated into 6 parts using silica gel chromatography. The 6 parts are saturates, aromatic ring class 1 (ARC-1), aromatic ring class 2 (ARC-2), aromatic ring class 3 (ARC-3), aromatic ring class 4+ (ARC-4+), sulfides, and polars. Each fraction was analyzed by 2D GC. The yields of the silica gel fractions and the 2D GC results for each fraction are shown in Figure 10.

[0049] The saturates fraction provides the easiest way to identify the presence of the product of the disclosure in a fuel oil mixture. C₁₉₋₂₂ polynuclear naphthenes with <4 carbons worth of sidechains (>15 carbons in naphthene rings) comprise the top “circle” of peaks in the saturates fraction. These molecules are extremely rare if not non-existent in the refinery streams used today to blend fuel oils. Figure 11 is a 2D GC image of Kearn vacuum gas oil. Figure 12 is a 2D GC image of the C₂₀₋₂₃ saturated fraction from the hydrotreated tar superimposed on the 2D GC

image of the Kearn vacuum gas oil. Figure 13 is a 2D GC image of hydroconverted Basrah atmospheric residual. Figure 14 is a 2D GC image of the C₂₀₋₂₃ saturated fraction from the hydrotreated tar superimposed on the 2D GC image of the hydroconverted Basrah atmospheric resid.

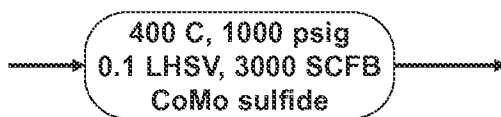
[0050] There may not be an economically viable means of producing the polynuclear naphthenes of the present disclosure except by hydrotreating steam cracker tars. The precursor polynuclear aromatics are not found in virgin crude oils. They can only be produced by thermal cracking of crude oil residuals and coals. Once produced, the tars of steam crackers, cokers, coke ovens, and other pyrolysis means have proven too difficult to hydrotreat on a large scale.

[0051] Basrah VGO (vacuum gas oil) contains molecules from C₁₈ to C₄₅. Virgin Basrah VGO and Basrah hydrovisbroken VGO were separated and compared. 2D GC images of the aromatic fractions 3 and 4 from the virgin VGO are shown in Figs. 5 and 6, respectively. 2D GC images of the aromatic fractions 3 and 4 from the hydrovisbroken VGO are shown in Figs. 7 and 8, respectively. Thus, these compositions are readily distinguishable from the composition of the disclosure.

[0052] The feedstock and product for Example 1 were analyzed by molecule type as a function of boiling point. The feedstock and product were analyzed for molecular type by distillation, deasphalting, and silica gel separation (SGS) and the results set forth in Table 1. The product was analyzed by refinery gas analysis, distillation, deasphalting, and SGS and the results set forth in Table 2. The feedstock and product were analyzed for SGS fractions vs. boiling point by refinery gas analysis, distillation, deasphalting, and silica gel separation and the results set forth in Table 3. The asphalt in Table 3 has a carbon aromaticity by NMR of 75%. The DAO in Table 3 has a carbon aromaticity by NMR of 60%.

Table 1

Baton Rouge Tar		Product Yields	
Sats	1.6	Sats	10.3
ARC-1	3.0	ARC-1	25.0
ARC-2	28.4	ARC-2	19.0
ARC-3	25.0	ARC-3	21.7
ARC-4	8.0	ARC-4	13.3
Sulfides	2.0	Sulfides	0.7
Polars	2.0	Polars	0.3
Asphalt	32.0	Asphalt	8.0
Wax	0.0	Wax	0.0



wherein:

Sats = saturated hydrocarbons = paraffins + isoparaffins + napthenes;

ARC-1 = aromatic ring class 1;

ARC-2 = aromatic ring class 2;

ARC-3 = aromatic ring class 3;

ARC-4 = aromatic ring class 4;

Sulfides = R-S-R;

Polars = a complex mixture of hydrocarbons that stick to the columns;

Asphalt = fraction of composition that is insoluble in cold pentane; and

Wax = n and mono-methyl paraffins.

Table 2

(Product Yields)

H ₂ S	1.8
C ₄ -	1.8
C ₅ -C ₉	3.4
C ₁₀ -C ₁₉	40.0
C ₂₀ + DAO	45.0
C ₂₀ + Solids	8.0

wherein DAO = deasphalted oil

Table 3
(SGS Fractions vs. Boiling Point)

	Sats	Arc-1	Arc-2	Arc-3	Arc 4	Sulfides	Polars	Asphalt
H2S								
C4-	100.0	0.0						
C5-C9	30.0	70.0						
C10-C19	13.0	49.9	23.1	14				
C20+ DAO	5.0	5.8	21.8	35.7	29.5	1.5	0.7	
C20+ Solids	0.0							100.0

[0053] All patents and patent applications, test procedures (such as ASTM methods, UL methods, and the like), and other documents cited herein are fully incorporated by reference to the extent such disclosure is not inconsistent with this disclosure and for all jurisdictions in which such incorporation is permitted.

[0054] When numerical lower limits and numerical upper limits are listed herein, ranges from any lower limit to any upper limit are contemplated. While the illustrative embodiments of the disclosure have been described with particularity, it will be understood that various other modifications will be apparent to and can be readily made by those skilled in the art without departing from the spirit and scope of the disclosure. Accordingly, it is not intended that the scope of the claims appended hereto be limited to the examples and descriptions set forth herein but rather that the claims be construed as encompassing all the features of patentable novelty which reside in the present disclosure, including all features which would be treated as equivalents thereof by those skilled in the art to which the disclosure pertains.

[0055] The present disclosure has been described above with reference to numerous embodiments and specific examples. Many variations will suggest themselves to those skilled in this art in light of the above detailed description. All such obvious variations are within the full intended scope of the appended claims.

WHAT IS CLAIMED IS:

1. A hydrocarbon tar, comprising: 75 wt% or more of aromatics of 10 carbons to 75 carbons based on the total weight of the tar, wherein the tar is of 40% to 80% aromaticity and a boiling point of from 300° to 1350°F.
2. The tar of claim 1, wherein the tar has a sulfur concentration of 0.5 wt% or less.
3. The tar of claim 1, wherein the hydrocarbon tar is of 50% to 65% aromaticity.
4. The tar of claim 1, wherein the hydrocarbon tar is of 40% to 68% aromaticity.
5. The tar of claim 1, wherein the hydrocarbon tar is of 50% to 70% aromaticity.
6. The tar of claim 1, wherein density of the tar is 0.90 to 1.06 grams/cubic centimeter.
7. The tar of claim 1, wherein viscosity of the tar is 40 centistokes to 400 centistokes at 40°C.
8. The tar of claim 1, wherein viscosity of the tar is 100 centistokes to 400 centistokes at 40°C.
9. The tar of claim 1, wherein the tar exhibits 100% solubility in 75 wt% toluene/25 wt% heptanes at 100°C.
10. The tar of claim 1, wherein the tar exhibits a carbon residue of 0.3 wt% or less.

11. The tar of claim 1, wherein the aromatics are of 25 carbons to 29 carbons.
12. The tar of claim 1, wherein the aromatics are of 18 carbons to 23 carbons.
13. A fuel oil composition, comprising: a blend of 10 wt% to 100 wt% of aromatics of 10 carbons to 75 carbons and 90 wt% to 0 wt% of non-aromatic hydrocarbons of 10 or more carbons, wherein the aromatics exhibit 40% to 80% aromaticity, wherein the aromatics and the non-aromatic hydrocarbons are 95 wt% or more of the total weight of the composition.
14. The composition of claim 13, wherein the aromatics are of 40% to 68% aromaticity.
15. The composition of claim 13, wherein the composition has a sulfur concentration of 1.0 wt% or less.
16. The composition of claim 13, wherein the aromatics are 10 wt% to 30 wt% and the hydrocarbons are 90 wt% to 70 wt% based on the total weight of the composition.
17. The composition of claim 13, wherein the aromatics are of 25 carbons to 29 carbons.
18. The composition of claim 13, wherein the aromatics and the hydrocarbons are 99 wt% or more of the total weight of the composition.
19. A process for making a hydrogenated tar, comprising:
 - a) refining a first stream of hydrocarbons in a vacuum or atmospheric distillation tower to produce a tower stream;

b) cracking the tower stream in a steam cracker to produce a cracker stream of 75 wt% or more of aromatics of 10 carbons to 75 carbons and 60% to 80% aromaticity based on the total weight of the tower stream; and

c) partially hydrogenating the cracker stream to form a hydrocarbon tar of an aromaticity of 40% to 80% and a boiling point of from 300°F to 1350°F.

20. The process of claim 19, further comprising blending into a second stream of non-aromatic hydrocarbons of 10 or more carbons the hydrocarbon tar to form a fuel oil composition.

21. The process of claim 19, wherein the cracker stream is partially hydrogenated to form a hydrocarbon tar of an aromaticity of 40% to 68%.

22. A process for making a hydrocarbon tar, comprising:

a) refining a crude oil or a natural gas liquid stream to produce an aromatic stream of at 75 wt% or more of aromatics of 10 carbons to 75 carbons and 60% to 80% aromaticity based on the total weight of the composition;

b) partially hydrogenating the aromatic stream to form a hydrocarbon tar of an aromaticity of 40% to 80% and a boiling point of from 300°F to 1350°F.

23. The process of claim 22, further comprising: blending 10 wt% to 95 wt% of the hydrocarbon tar into 90 wt% to 5 wt% of a stream of non-aromatic hydrocarbons of 10 or more carbons to form a fuel oil composition based on the total weight of the composition, wherein the aromatic stream and the hydrocarbon stream together are 95 wt% or more of the total weight of the fuel oil composition.

24. The process of claim 22, wherein the aromatic stream is partially hydrogenated to form a hydrocarbon tar of an aromaticity of 40% to 68%.