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3,661,780

**HYDROCARBON COMPOSITION CONTAINING
POLYALKYL-SUBSTITUTED TETRAHYDRO-
NAPHTHALENES AND DI-n-C₁₀-C₁₅-ALKARYL
HYDROCARBONS AND PROCESS FOR PRE-
PARING SAME**

George C. Feighner, Franklin Lakes, N.J., and Oliver C. Kerfoot, Delmar D. Krehbiel, and Gene E. Nicks, Ponca City, Okla., assignors to Continental Oil Company, Ponca City, Okla.

No Drawing. Continuation-in-part of application Ser. No. 716,351, Mar. 27, 1968, which is a continuation-in-part of application Ser. No. 643,370, June 5, 1967, both now abandoned. This application Oct. 26, 1970, Ser. No. 84,125

Int. Cl. C10m 1/16

U.S. Cl. 252—59

11 Claims

ABSTRACT OF THE DISCLOSURE

Hydrocarbon composition containing at least 20 volume percent polyalkyl-substituted tetrahydronaphthalenes and from 25 to 60 volume percent di-n-C₁₀-C₁₅-alkaryls, each of said tetrahydronaphthalenes and said di-n-C₁₀-C₁₅-alkaryls containing from 26 to 36 carbon atoms. Process for preparing said hydrocarbon composition, wherein the process comprises (1) contacting an admixture of mono-n-C₁₀-C₁₅-alkaryls and alkyl-substituted tetrahydronaphthalenes with a Friedel-Crafts catalyst, and (2) fractionally distilling the reaction mass to recover the desired hydrocarbon composition. The hydrocarbon composition is suitable for use both as a feedstock for preparing oil-soluble sulfonic acids and as a lubricant, particularly a lubricant for low-temperature ambient conditions.

**CROSS-REFERENCE TO RELATED
APPLICATIONS**

The present application is a continuation-in-part of application Ser. No. 716,351, filed Mar. 27, 1968, now abandoned which in turn was a continuation-in-part of application Ser. No. 643,370, filed June 5, 1967, and now abandoned.

BACKGROUND

The present invention relates, in one aspect, to hydrocarbon compositions which are especially suitable as feedstocks for preparing oil-soluble sulfonic acids and sulfonates and which comprises a mixture of di-n-C₁₀-C₁₅-alkaryls and polyalkyl-substituted tetrahydronaphthalenes. In a second and preferred aspect, the present invention relates to a process for preparing the hydrocarbon compositions of the aforementioned nature by the disproportionation of a mixture of alkyl-substituted tetrahydronaphthalenes and mono-n-C₁₀-C₁₅-alkaryls.

Oil-soluble sulfonic acids are particularly useful in modern technology. As the metal salts (particularly sodium, barium, calcium, and magnesium salts) they are used in lubricating oils, metal working oils, soluble oils, and rust inhibitors. Highly basic additive agents, derived from oil-soluble sulfonic acids and containing dispersed barium, calcium, or magnesium compounds, are particularly useful in lubricating oils and marine diesel lubricants.

One of the earliest methods of producing oil-soluble sulfonic acids was that of treating aromatic-containing petroleum fractions with sulfuric acid. The sulfonates so produced, upon conversion to sodium salts, were known to the trade as mahogany sulfonates. In general, these sulfonates were a by-product of the manufacture of lubricating oil base stocks or white oils. Inasmuch as they were a by-product, the supply of the materials was related to the amount of lubricating oil base stocks which

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were acid treated. The development of improved methods of preparing lubricating oil base stocks has substantially reduced the supply of mahogany sulfonates.

More recently, synthetic feedstocks have been used to prepare oil-soluble sulfonic acids. The synthetic feedstocks are hydrocarbon fractions containing substantial amounts of alkyl-aromatic compounds which sulfonate readily. An example of a particularly satisfactory synthetic hydrocarbon feedstock for preparing oil-soluble sulfonic acids is postdodecylbenzene, which is a by-product of the preparation of dodecylbenzene. While postdodecylbenzene is quite satisfactory as a feedstock for preparing oil-soluble sulfonic acids, it has the disadvantage that the availability thereof is tied directly to the production of dodecylbenzene.

In order for a hydrocarbon feedstock to be particularly useful commercially for the preparation of oil-soluble sulfonic acids, it must possess certain requisites. First, it must have a molecular weight of sufficient magnitude that the sulfonic acids thereof are readily oil-soluble. Usually, this means a molecular weight of at least about 350, but preferably of at least about 400. Secondly, the hydrocarbon feedstock must sulfonate readily. This feature is a function of the chemical nature of the feedstock. Thirdly, it must be relatively inexpensive. The present invention is concerned with a hydrocarbon feedstock which meets all of the foregoing requisites.

In addition to being useful as a feedstock for preparing oil-soluble sulfonic acids, the hydrocarbon compositions of the present invention have properties which render them useful as lubricants, and particularly as lubricants under low-temperature ambient conditions. Because of their physical properties the hydrocarbon compositions described herein can be used as the base oil to formulate crankcase lubricants, automatic transmission lubricants, hydraulic fluids, circulating fluids, and a variety of other lubricants for low-temperature service.

PRIOR ART

No references were cited against the claims in the parent application directed to the hydrocarbon composition, or process of preparing the hydrocarbon composition, described herein.

BRIEF SUMMARY OF THE INVENTION

Broadly stated, one aspect of the present invention concerns a process for preparing a hydrocarbon composition, wherein the process comprises:

(a) Contacting an admixture of alkyl-substituted tetrahydronaphthalenes and mono-n-C₁₀-C₁₅-alkaryls with a Friedel-Crafts catalyst under reaction-promoting conditions of temperature and time whereby there is produced a product containing at least about 20 volume percent, preferably at least about 30 volume percent, of a hydrocarbon mixture consisting essentially of di-n-C₁₀-C₁₅-alkaryls and polyalkyl-substituted tetrahydronaphthalenes, said tetrahydronaphthalenes containing from 26 to 36 carbon atoms and said di-n-C₁₀-C₁₅-alkaryls containing from 26 to 36 carbon atoms, and

(b) Fractionally distilling the reaction mass of step (a) to recover therefrom a bottoms fraction containing at least about 45 volume percent, preferably at least about 75 volume percent, of a hydrocarbon composition consisting essentially of from about 25 to about 60 volume percent, preferably from about 25 to about 55 volume percent, di-n-C₁₀-C₁₅-alkaryls and at least 20 volume percent polyalkyl-substituted tetrahydronaphthalenes, said tetrahydronaphthalenes containing from 26 to 36 carbon atoms and said di-n-alkaryls containing from 26 to 36 carbon atoms.

In another aspect, the present invention relates to a hydrocarbon composition, containing at least 20 volume

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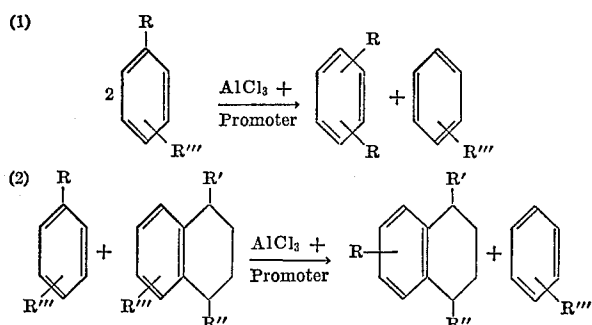
percent linear polyalkyl-substituted tetrahydronaphthalenes and from about 25 to about 60 volume percent, preferably from about 25 to about 55 volume percent, di-n-C₁₀-C₁₅-alkaryls, said tetrahydronaphthalenes containing from 26 to 36 carbon atoms and said di-n-alkaryls containing from 26 to 36 carbon atoms. Preferably, the total of the tetrahydronaphthalenes and di-n-alkaryls is at least about 75 volume percent of the hydrocarbon fraction. The hydrocarbon fraction distills above about 204° C. at 10 mm. Hg, preferably above about 220° C. at 10 mm. Hg.

In still another aspect, the present invention relates to oil-soluble sulfonic acids derived from a hydrocarbon composition consisting essentially of di-n-C₁₀-C₁₅-alkaryls and linear polyalkyl-substituted tetrahydronaphthalenes, said tetrahydronaphthalenes containing from 26 to 36 carbon atoms and said di-n-C₁₀-C₁₅-alkaryls containing from 26 to 36 carbon atoms.

In yet another aspect, the present invention relates to highly basic barium, calcium or magnesium sulfonates prepared from oil-soluble sulfonic acids derived from a hydrocarbon composition consisting essentially of di-n-C₁₀-C₁₅-alkaryls and polyalkyl-substituted tetrahydronaphthalenes, said tetrahydronaphthalenes containing from 26 to 36 carbon atoms and said di-n-alkaryls containing from 26 to 36 carbon atoms.

DETAILED DESCRIPTION

Our process can be illustrated by the following reactions which occur simultaneously:

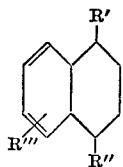


R, R', R'', and R''' will be characterized in our description of suitable starting materials.

While the above reactions produce the desired product mixture, side reactions occur which produce materials such as branched paraffins, naphthalenes, miscellaneous polycyclic compounds, sludge, etc.

In order to achieve good selectivity, partial conversion per pass is practiced. The upper limit per pass is about 60-70 percent, with the preferred conversion per pass being about 40-50 percent.

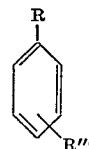
The material which is used in our process is an admixture consisting essentially of alkyl-substituted tetrahydronaphthalenes and mono-n-C₁₀-C₁₅-alkaryls. The alkyl-substituted tetrahydronaphthalenes have the following formula:



where R' and R'' are linear alkyl groups, each of which contains from 1 to 10 carbon atoms, with the sum of the carbon atoms in R' and R'' being from 6 to 11, and where R''' is hydrogen or an alkyl group containing from 1 to 3 carbon atoms. Preferably, R''' is hydrogen. The term "linear alkyl" groups are used herein refers to alkyl groups which are free of chain branching.

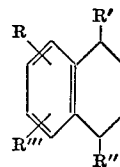
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The mono-n-C₁₀-C₁₅-alkaryl hydrocarbons are represented by the formula:



where R is a linear alkyl group containing from 10 to 15 carbon atoms and R''' is hydrogen or an alkyl group containing from 1 to 3 carbon atoms. The preferred monoalkaryl hydrocarbons are monoalkylbenzenes wherein the alkyl group is linear and contains from 10 to 15 carbon atoms.

It should be noted that the polyalkyl-substituted tetrahydronaphthalene of our product have the formula:



where:

R is a linear alkyl group containing from 10 to 15 carbon atoms,

R' is a linear alkyl group containing from 1 to 10 carbon atoms,

R'' is a linear alkyl group containing from 1 to 10 carbon atoms, and

R''' is hydrogen or an alkyl group containing from 1 to 3 carbon atoms. Preferably, R''' is hydrogen.

The sum of R' and R'' is in the range of from 6 to 11 carbon atoms.

These polyalkyl-substituted tetrahydronaphthalenes are present in the hydrocarbon composition in an amount of at least 20 volume percent, more suitably at least 28 volume percent, and preferably at least 45 volume percent.

A particularly suitable material for use in our process is a by-product fraction of a process for preparing biodegradable detergents described in U.S. Pat. No. 3,316,294. For reason of convenience, this patent is made a part of the present application. Briefly, Pat. No. 3,316,294 relates to a process of preparing a detergent alkylate wherein the process comprises the following steps, broadly stated: (a) separating a fraction of substantially straight chain C₈-C₁₈ hydrocarbons from a petroleum distillate substantially free of olefins and containing said straight chain hydrocarbons together with non-straight chain hydrocarbons, (b) chlorinating said fraction to the extent whereby between about 10 and about 35 mole percent of the straight chain hydrocarbons present are substantially only monochlorinated, and (c) alkylating an aromatic compound, selected from the group consisting of benzene, a C₁-C₃ alkyl-substituted benzene and mixtures thereof, with the chlorination product of step (b) in the presence of an alkylation catalyst.

In conducting our process, the alkyl-substituted tetrahydronaphthalenes and mono-n-C₁₀-C₁₅-alkaryls, suitably, are present in the range of about 3:1 to about 0.15:1, expressed as tetrahydronaphthalenes:alkaryls. Preferably, this ratio is from about 1:1 to about 0.33:1. More preferably, it is about 0.33:1.

Moreover, in conducting our process, preferably, the alkyl-substituted tetrahydronaphthalenes and the mono-n-C₁₀-C₁₅-alkaryls, used as charge materials, have approximately the same number of total carbon atoms.

Any of the Friedel-Crafts catalysts can be used in our invention. The term "Friedel-Crafts catalyst" is believed to be well understood in the art and refers in general to

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materials such as the aluminum halides, boron trifluoride, boron trichloride, antimony chloride, stannic chloride, zinc chloride and mercuric chloride. Of the Friedel-Crafts catalysts, aluminum chloride is preferred. The preferred material, aluminum chloride, also includes "insitu" prepared aluminum chloride, in other words, the reaction product of aluminum metal and hydrogen chloride.

A suitable amount of Friedel-Crafts catalyst is from about 0.5 to about 5 percent by weight, with a preferred amount being from about 2 to about 4 percent by weight, based on the total amount of monoalkaryls and tetrahydronaphthalenes in the charge admixture. It is to be understood that larger amounts than those stated in the foregoing can be used. However, from a practical viewpoint, the use of larger amounts is not economical.

Conventionally a proton-donor promoter is used with a Friedel-Crafts catalyst. Suitable promoters include any material which, when added to the catalyst, yields a proton. Preferred promoters are hydrogen chloride and water. When a promoter is used, only a trace is required. The selection of the amount of promoter can be made readily by those skilled in the art.

Conditions of temperature and time are not a critical feature of our invention. We have found a temperature in the range of from about 45 to about 150° C. to be satisfactory. Still further, on a batch basis, we have found reaction times of from about 15 minutes to about 2 hours to be satisfactory. It is believed that any person skilled in this art, knowing the other features of our invention can, without undue or prolonged experimentation, determine the desirable conditions of time and temperature.

While we have usually operated our process on a batch basis, we have also operated on a continuous basis.

The hydrocarbon composition is converted to oil-soluble sulfonic acids by treatment with a suitable sulfonating agent (e.g., oleum or sulfur trioxide). Using conventional techniques our hydrocarbon compositions result in a good quality oil-soluble sulfonic acid in a yield up to about 1.10 pounds sulfonic acid per pound of alkylate (theoretical yield=1.20).

The oil-soluble sulfonic acid is converted to oil-soluble metal sulfonates by treatment with bases containing the desired cation using conventional techniques.

Also, the oil-soluble sulfonic acids are converted to a highly basic barium-containing additive agent by the process of U.S. Pat. No. 2,861,951. Briefly, the process comprises:

(A) admixing under atmospheric conditions of temperature and pressure:

- (1) an oil-soluble sulfonic acid and a volatile solvent therefor (e.g., naphtha),
- (2) a non-volatile carrier (e.g., mineral lubricating oil),
- (3) a methanolic solution of barium oxide;

(B) converting the barium oxide to barium carbonate in situ in the presence of the sulfonic acid by blowing with carbon dioxide;

(C) removing the volatile solvents and any water present.

For reason of convenience, U.S. Pat. No. 2,861,951 is made a part of this application. In addition, it is to be understood that, with the exception of dispersing agents, the broad aspects of the process disclosed in this patent are applicable to the process described immediately above.

Still further, the oil-soluble sulfonic acids are converted to a highly basic calcium-containing additive agent by the process of U.S. Pat. No. 3,150,088. Briefly, the process comprises:

(A) admixing:

- (1) an alcoholic solution of a calcium alkoxide-carbonate complex wherein the alkoxide radical is derived from a monoether alcohol of ethylene glycol,
- (2) oil-soluble sulfonic acid,

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(3) non-volatile carrier (e.g., mineral lubricating oil),

(4) water in an amount which is a stoichiometric excess of that required to react with the calcium alkoxide-carbonate complex;

(B) hydrolyzing the calcium alkoxide-carbonate complex to an oil-insoluble calcium-containing inorganic compound; and then

(C) removing the volatile materials.

For reason of convenience, U.S. Pat. No. 3,150,088 is made a part of this application. In addition, it is to be understood that, with the exception of dispersing agents, the broad aspects of the process disclosed in this patent are applicable to the process described immediately above.

ILLUSTRATIONS AND COMPARISONS

Example 1

This example shows that linear dialkyl-substituted tetrahydronaphthalenes alone cannot be disproportionated to a hydrocarbon feedstock suitable for preparing oil-soluble sulfonic acids.

Two hundred and fifty parts of a linear dialkyl-substituted tetrahydronaphthalene alkylate was reacted at 100° C. for 1½ hours using 2.5 parts of AlCl₃ and HCl.

Distillation of the reaction mass indicated that very little, if any, reaction occurred.

The following examples illustrate the process of the present invention.

Example 2

Fifty parts by weight of linear dialkyl tetrahydronaphthalene (C₂₀ tetrahydronaphthalene distilled from a C₁₄ side chain alkylate¹) and 50 parts by weight of monoalkylbenzene (C₁₄ side chain external alkylate distilled from a C₁₄ alkylate²) were charged to a flask. The mixture was heated to 100° C., then 3.0 parts AlCl₃ and a trace of water were added. The mixture was stirred under these conditions and samples were taken as the reaction progressed. The samples showed the following:

Time	Percent		
	Monoalkylbenzene converted	Tetrahydronaphthalene converted	Overall conversion
0.....	0	0	0
5 minutes.....	9.7	21.0	15.6
25 minutes.....	32.3	44.5	38.9
1 hour.....	43.3	63.1	53.8
2 hours.....	56.1	74.5	65.9

The product was distilled to remove unreacted material. The material distilling above 204° C. at 10 mm. Hg pressure was desired product fraction. A sample of the product fraction was analyzed by mass spectrometer, the results of which are shown in Table I.

Example 3

Fifty parts by weight of linear dialkyl tetrahydronaphthalenes (C₂₀ tetrahydronaphthalene distilled from a C₁₄ side chain alkylate¹) and 50 parts by weight of monoalkylbenzene (C₁₄ side chain fraction distilled from a C₁₄ total alkylate²) were charged to a flask. This mixture was heated to 100° C., then 2.0 parts by weight AlCl₃ and a trace of HCl were added. The mixture was stirred under these conditions and samples were taken

¹ Produced by the process of Pat. No. 3,316,294—fraction distilling at 195–204° C. at 10 mm. Hg.

² Produced by the process of Pat. No. 3,316,294—fraction distilling at 191–195° C. at 10 mm. Hg.

as the reaction progressed. The samples showed the following:

TABLE I.—MASS SPECTROMETER ANALYSIS OF PRODUCT OF EXAMPLE 2

Carbon number	(C _n H _{2n-10})	(C _n H _{2n-8}) Tetrahydro- naphthalenes	(C _n H _{2n-6}) Dialkyl- benzenes	(C _n H _{2n-10})	(C _n H _{2n-14}) Diphenyl alkane	(C _n H _{2n-12}) Naph- thalenes
C ₂₂ -----						0.1
C ₂₃ -----						0.1
C ₂₄ -----					0.1	0.2
C ₂₅ -----					0.1	0.2
C ₂₆ -----					0.1	0.3
C ₂₇ -----					0.1	0.4
C ₂₈ -----					0.5	0.5
C ₂₉ -----			0.1	0.1	0.6	0.9
C ₃₀ -----		2.6	0.1	0.1	0.3	0.1
C ₃₁ -----		2.1		0.1	0.3	0.1
C ₃₂ -----		2.4		0.1	0.3	0.1
C ₃₃ -----	0.8	2.0	1.4		0.3	0.1
C ₃₄ -----	4.7	19.9	45.9	0.1	1.7	2.0
C ₃₅ -----		1.9	3.0		0.2	0.2
C ₃₆ -----		0.4	0.4			
C ₃₇ -----		0.3	0.3			
C ₃₈ -----		0.3				
C ₃₉ -----		0.3	0.4			
C ₄₀ -----					0.3	
Total -----	5.5	32.2	51.6	0.5	4.9	5.3

Time	Percent			
	Monoalkyl- benzene converted	Tetrahydro- naphthalene converted	Overall conversion	
0-----	0	0	0	
1 minute-----	1.8	9.5	5.5	25
3 minutes-----	5.7	11.1	8.3	
5 minutes-----	12.2	20.0	15.8	
10 minutes-----	12.9	21.1	16.7	30
20 minutes-----	18.0	25.8	21.5	
30 minutes-----	23.3	32.0	27.4	
60 minutes-----	26.7	48.0	42.0	

The product was distilled to remove unreacted material. The material distilling above 204° C. at 10 mm. Hg pressure was the desired product fraction. A sample of the product fraction was analyzed by mass spectrometer, the results of which are shown in Table II.

TABLE II.—MASS SPECTROMETER ANALYSIS OF PRODUCT OF EXAMPLE 3

Carbon number	Liquid volume percent				
	(C _n H _{2n-10})	(C _n H _{2n-8}) Tetrahydro- naphthalenes	(C _n H _{2n-6}) Dialkyl- benzenes	(C _n H _{2n-14}) Diphenyl alkanes	(C _n H _{2n-12}) Naphthalenes
C ₃₂ -----		1.5			
C ₃₃ -----	1.2	3.5	1.5	0.6	0.4
C ₃₄ -----	7.8	46.6	21.1	2.7	3.6
C ₃₅ -----		3.5	2.8	0.4	0.2
C ₃₆ -----			0.3	0.1	
C ₃₇ -----				0.1	
C ₃₈ -----			0.3		
C ₃₉ -----		0.4	1.4		
Totals-----	0.9	55.5	27.4	3.9	4.2

Example 4

This example illustrates the preparation of oil-soluble sulfonic acid from a product similar to that of Example 2.

Procedure: The hydrocarbon composition (feedstock) was sulfonated with 20 percent oleum using a 1.5:1 weight ratio of oleum:hydrocarbon in 100 pale oil as a diluent at 50–55° C. After taking a primary sludge split, the crude acid oil was diluted with hexane and allowed to settle overnight. At this point a second split was taken. A small portion of the crude acid-oil was taken for analysis. The remaining hexane-sulfonic acid solution was purified by treatment with lime and blowing with nitrogen gas.

Charge:	Parts
Alkylate ¹ -----	300
Oleum -----	450
100 pale oil -----	241
Hexane (diluent) -----	1050

¹ The alkylate had the following analysis:

Molecular weight -----	421
Dialkylbenzenes, percent -----	56.1
Trialkylated tetrahydronaphthalenes, percent -----	36.2
Diphenylalkanes, percent -----	2.9
Naphthalenes, percent -----	4.6

Product:

Sulfonic acid solution:

Amount, parts -----	1283
Total acid, meq./g. -----	0.919
Sulfonic acid, meq./g. -----	0.528
Combining weight -----	483
Yield, g. RSO ₃ H/g. alkylate -----	1.07

Example 5

This example illustrates the preparation of a highly basic barium-containing additive agent using the hexane solution of sulfonic acid prepared in Example 4.

Procedure: The procedure used was that of U.S. Pat. 2,851,951, described in the foregoing.

Charge:	Parts
Sulfonic acid -----	250
100 pale oil -----	17.9
Methanolic BaO ¹ -----	143

¹ The methanolic solution of BaO had a base number of 125.5.

Product: There was obtained 149.9 parts of a product (theory=153.1 parts) having the following properties:

Base No. (acetic) -----	69
Ba sulfonate, percent -----	49
Viscosity, 210° F., cs. -----	25.03

Example 6

This example illustrates the process of our invention employing a 0.20:1 tetrahydronaphthalenes:monoalkylbenzenes ratio.

The starting material was similar to that of Example 2, except it contained 17.1% dialkyl tetrahydronaphthalenes and 82.9% monoalkylbenzenes.

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The process was similar to that of Example 2, using the following specific conditions:

100° C.: temperature

1.5 hr.: residence time

3% AlCl_3 -water promoter: catalyst

The material distilling above 205° C. at 10 mm. Hg was the desired product fraction.

The product fraction had the following analysis by mass spectrometer:

	Percent
Dialkyl tetrahydronaphthalenes -----	3.3
Trialkyltetrahydronaphthalenes -----	36.3
Dialkylbenzenes -----	52.9
Diphenylalkanes -----	4.2
Alkylated naphthalenes -----	3.1

Sulfonation of the product fraction gave a yield of 1.13 pounds of oil-soluble sulfonic acid per pound of product fraction.

The process gave a 35% conversion of the feed alkylate and a yield of 0.58 pounds of desired product per pound of alkylate consumed.

The following table illustrates the boiling range, at 10 mm. Hg pressure, of many of the components present in our starting mixture. The table also illustrates the boiling range of the dialkylbenzenes and trialkyl-substituted tetrahydronaphthalenes of the product fraction.

TABLE III

Boiling range at 10 mm. Hg, ° C.

Alkyl side chain	Monoalkylbenzenes	Dialkyl tetrahydronaphthalenes	Dialkylbenzene plus trialkyl-naphthalenes
C_{10} -----	137-162	150-200	1200
C_{11} -----	146-175	161-216	1240
C_{12} -----	163-190	177-219	1260
C_{13} -----	173-196	188-232	1260
C_{14} -----	182-202	195-244	1275
C_{15} -----	198-214	205-250	1285

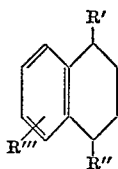
¹ Initial boiling point.

While particular embodiments of the invention have been described, it will be understood, of course, that the invention is not limited thereto; since many modifications may be made; and it is, therefore, contemplated to cover by the appended claims any such modification as fall within the true spirit and scope of the invention.

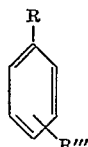
The invention having thus been described, what is claimed and desired to be secured by Letters Patent is:

1. A process for preparing a hydrocarbon composition, said process comprising:

(a) contacting an admixture of (A) alkyl-substituted tetrahydronaphthalenes represented by the formula



where R' and R'' are linear alkyl groups, each of which contains from 1 to 10 carbon atoms, with the sum of the carbon atoms in R' and R'' being from 6 to 11, and R''' is hydrogen or an alkyl group containing from 1 to 3 carbon atoms, and (B) alkaryl hydrocarbons represented by the formula



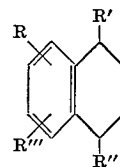
where R is a linear alkyl group containing from 10 to 15 carbon atoms and R''' is hydrogen or an alkyl group containing from 1 to 3 carbon atoms, said (A)

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and (B) being present in the admixture in a proportion in the range of from about 3:1 to about 0.15:1 of (A) to (B) on a weight basis, with an effective amount of a Friedel-Crafts catalyst under reaction-promoting conditions of temperature and time whereby there is produced a product containing at least about 20 volume percent of a hydrocarbon mixture consisting essentially of di-n- C_{10} - C_{15} -alkyls and polyalkyl-substituted tetrahydronaphthalenes, said tetrahydronaphthalenes containing from 26 to 36 carbon atoms and said dialkyls containing from 26 to 36 carbon atoms; and

(b) fractionally distilling the reaction mass of step (a) to recover therefrom a fraction distilling above about 204° C. at 10 mm. Hg pressure and containing at least 75 volume percent of a hydrocarbon mixture consisting essentially of di-n- C_{10} - C_{15} -alkaryl and polyalkyl-substituted tetrahydronaphthalenes, said tetrahydronaphthalenes containing from 26 to 36 carbon atoms and said dialkyls containing from 26 to 36 carbon atoms.

2. The process of claim 1 wherein the polyalkyl-substituted tetrahydronaphthalenes of the product fraction of step (b) are represented by the formula:



wherein R , R' , and R'' are linear, and

R contains from 10 to 15 carbon atoms,

R' contains from 1 to 10 carbon atoms,

R'' contains from 1 to 10 carbon atoms,

with the sum of R' and R'' being in the range of from 6 to 11, and wherein R''' is hydrogen or an alkyl group containing 1 to 3 carbon atoms.

3. The process of claim 2 wherein the polyalkyl-substituted tetrahydronaphthalenes and the alkaryl hydrocarbons are present in the ratio of from about 1:1 to about 0.33:1.

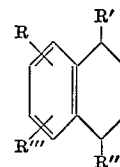
4. The process of claim 3 wherein the Friedel-Crafts catalyst is aluminum chloride and is present in an amount in the range of from about 0.5 to about 5 percent, by weight.

5. The process of claim 4 wherein the process is conducted at a temperature in the range of from about 45 to about 150° C.

6. The process of claim 5 wherein R''' of the alkaryl hydrocarbon and the tetrahydronaphthalene starting material of step (a) is hydrogen.

7. A hydrocarbon composition containing at least 28 volume percent polyalkyl-substituted tetrahydronaphthalenes and from about 25 to about 60 volume percent di-n- C_{10} - C_{15} -alkaryl, said tetrahydronaphthalenes containing from 26 to 36 carbon atoms and said dialkyls containing from 26 to 36 carbon atoms.

8. The hydrocarbon composition of claim 7 characterized further in that the polyalkyl-substituted tetrahydronaphthalenes are represented by the formula:



wherein R , R' , and R'' are linear, and

R contains from 10 to 15 carbon atoms,

R' contains from 1 to 10 carbon atoms,

R'' contains from 1 to 10 carbon atoms,

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with the sum of R' and R'' being in the range of from 6 to 11, and wherein R''' is hydrogen or an alkyl group containing 1 to 3 carbon atoms.

9. The hydrocarbon composition of claim 8 wherein the di-n-C₁₀-C₁₅-alkaryls are di-n-C₁₀-C₁₅-alkylbenzenes. 5

10. The hydrocarbon composition of claim 9 wherein the amount of di-n-C₁₀-C₁₅-alkylbenzenes is from about 25 to about 55 volume percent.

11. The hydrocarbon composition of claim 10 characterized further in that the total of the tetrahydronaphthalenes and dialkylbenzenes is at least 75 volume percent. 10

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DANIEL E. WYMAN, Primary Examiner

W. H. CANNON, Assistant Examiner

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