

[54] **NOVEL FRAGRANCE MATERIALS
AND PROCESSES THEREFOR**
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[57] **ABSTRACT**
Fragrance materials prepared by acylation with
cyclization of trimethylcyclododecatriene, processes
for producing same, and perfume compositions con-
taining such materials.

6 Claims, 2 Drawing Figures

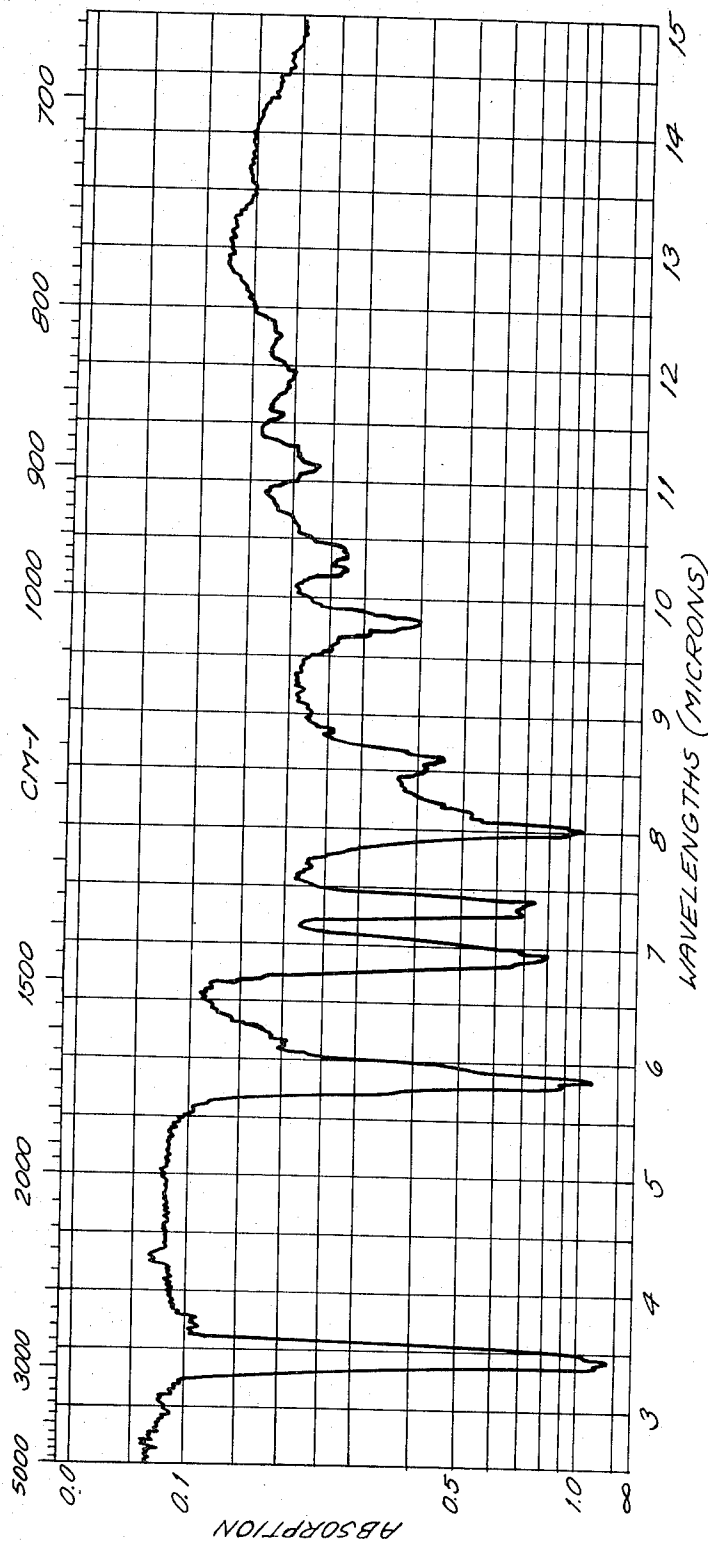


Fig. 1.

INFRARED ABSORPTION SPECTRUM
NaCl PRISM

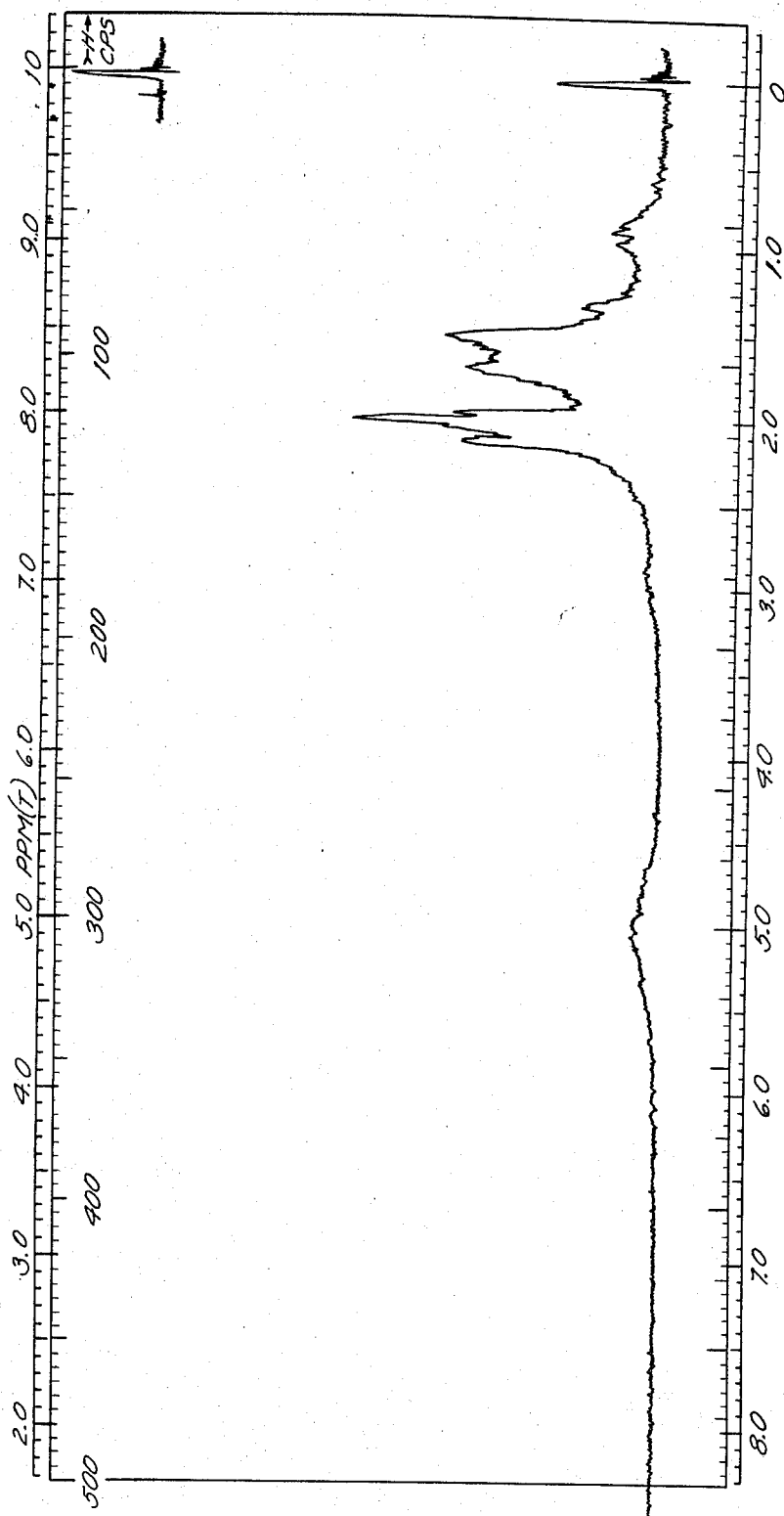


Fig. 2.

NUCLEAR MAGNETIC RESONANCE SPECTRUM
 VARIAN A-60 INSTRUMENT
 SAMPLE IN CCl_4 WITH TETRAMETHYLSILANE INTERNAL REFERENCE

NOVEL FRAGRANCE MATERIALS AND PROCESSES THEREFOR

This application is a continuation-in-part of copending application Ser. No. 667,452, filed Sept. 13, 1967, now abandoned.

BACKGROUND OF THE INVENTION

The constantly increasing demand for perfumes and fragrance-imparting materials has in many instances severely strained the traditional natural sources of supply. There is accordingly an increasing need for suitable materials which can be prepared from commercially available chemicals and which will provide the fragrance notes which are desirable in perfume compositions. There is also a continuing need for stable fragrance materials which can be incorporated into perfumed products, such as soap, shampoo, cosmetic preparations, and the like.

THE INVENTION

The invention comprises the novel compositions and component mixtures comprised in such compositions as well as the novel processes and steps of processes according to which such compositions may be manufactured, specific embodiments of which are described hereinafter by way of example only and in accordance with what is now considered the preferred manner of practicing the invention.

Briefly, the perfume and fragrance-imparting materials of this invention are (C-15 polycyclic alkyl)-lower alkyl ketones produced by acylating with cyclization trimethylcyclododecene and recovering the acylated-cyclized products. In addition, hydrogenated products can be obtained by hydrogenating the trimethylcyclododecene or the acylated-cyclized trimethylcyclododecene. The products produced according to these processes are suitable for incorporation into a wide variety of perfumes and fragrance-modifying compositions, and such perfume and fragrance-modifying compositions are also encompassed herein. It will be understood that the cyclododecene is itself a cyclic material and the cyclization according to the present invention is an internal cyclization, that is, one in which a bridge is formed across the cyclododecene ring.

It has been found that the novel materials of this invention have a persistent fragrance, as more fully described below, which particularly adapts them for incorporation into perfume compositions and fragrance-modifying compositions having a desirable "woody" fragrance note. It will be appreciated by those skilled in the art from the present disclosure that the fragrance character can be varied according to the reaction conditions in subsequent treatment of the materials produced in the reaction of this invention.

The invention is further illustrated in the accompanying drawings wherein

FIG. 1 is an infrared (IR) absorption spectrum of acylated-cyclized material prepared according to the present invention, and

FIG. 2 is a nuclear magnetic resonance (NMR) spectrum of such material.

The cyclododecenes treated according to this invention are polyalkyl-substituted cyclododecenes, preferably such cyclododecenes containing three alkyl groups and having two or three unsaturated carbon-to-carbon bonds. The lower alkyl groups having from one

to three carbon atoms are contemplated, and the preferred alkyl substituent is methyl. The substances produced by trimerizing methyl butadienes such as 1-methyl butadiene (piperylene) and/or 2-methyl butadiene (isoprene), to obtain cyclic derivatives are desirable sources of such materials. Thus, a preferred cyclododecene for use in the practice of this invention is 1,5,9-trimethylcyclododecatriene-1,5,9. It will be appreciated that other isomers are also satisfactory for use in the present invention.

Di- and trienoic cyclododecenes can be used, and it will be appreciated that, when the starting material is the triene obtained from the trimerization of methyl butadienes, the dihydro material can be obtained by hydrogenation of the triene. The products resulting from acylation and cyclization of the cyclododecene can also be hydrogenated to obtain a lower degree of unsaturation.

It has been found that better results are obtained when the cyclododecene is of at least 90 percent purity, and it is preferred that in the practice of this invention the cyclododecene be highly purified. When a relatively crude material is available, it can be purified to the desired degree by conventional techniques such as distillation, extraction, and the like.

The acylation-cyclization is carried out in the presence of an acylating agent and a cyclizing agent. The acylating agent is one capable of adding the desired acyl group to the ring, and the carboxylic acid anhydrides are desirable acylating agents for use in this invention. The lower alkyl carboxylic acid anhydrides, such as propionic and butyric anhydride and particularly acetic anhydride, are preferred acylating agents. Thus, the preferred lower alkyl groups on the ketone are lower alkyl groups such as methyl, ethyl and propyl.

The cyclizing agent is a material which is capable of cyclizing unsaturated hydrocarbons, and such agents herein are desirably proton donors or electron acceptors. Examples of cyclizing agents are phosphoric, sulfuric, and sulfonic acids such as p-toluene sulfonic acid, methane sulfonic acid, and the like. A particularly preferred cyclizing agent is polyphosphoric acid.

The acylation-cyclization can be carried out in the presence of a solvent or other vehicle. It is possible in the practice of this invention to carry out the acylation with an excess of the carboxylic acid anhydride, preferably acetic anhydride, which also acts as a vehicle in the reaction mass. Excess anhydride can cause polyacylation, and when it is desired to minimize or prevent polyacylation, excess cyclododecene is used.

The non-anhydride vehicle, if used, should be a liquid which is inert to reactants and is otherwise unaffected by the other reaction conditions such as temperature. Hydrocarbons and chlorinated hydrocarbons are useful vehicles in the practice of this invention, and the hydrocarbons and chlorinated hydrocarbons are preferably saturated.

The amount of acylating agent should be at least equimolar with respect to the cyclododecene, particularly when the agent acts as the vehicle for the reaction. It is generally preferred to have greater than equimolar quantities of the acylating agent present, both to act as a vehicle and to assist in moderating the reaction and controlling the temperature. On the other hand, use of large excesses of the acylating agent merely results in

greater handling and separation problems in recovering the final product, so that three moles of acylating agent per mole of cyclododecene is generally adequate. Accordingly, the preferred range of acylating agent is from about one to about two times the amount of cyclododecene, on a molar basis.

The amount of cyclizing agent used will vary according to the particular agent chosen and its strength. It has generally been found that the cyclizing agent is desirably present in substantially less than molar amounts, based on the cyclododecene, and ordinarily less than 0.5 mole of cyclizing agent is required per mole of cyclododecene. It is generally preferred to have at least 0.1 mole of the cyclizing agent present per mole of cyclododecene so that the process of this invention proceeds with reasonable velocity. Accordingly it is preferred to use from about 0.1 to about 0.5 mole of cyclizing agent to each mole of cyclododecene.

The temperature of the reaction can be varied over a range to obtain a reasonable reaction velocity, depending upon the type and quantity of acylating agent and the type and quantity of the cyclizing agent. The reaction temperature will also be affected by the vehicles, if any, used. The process of this invention is desirably carried out at temperatures in the range of from about 50° to about 100° C, and it is preferred to carry out the reaction at temperatures from 70°–80° C.

The times required will vary according to the temperatures, the concentrations of the various reactants, and the types of reactants used. In general, the time should be sufficient to produce significant quantities of the products of this invention without degrading substantial quantities of the reactants or the products. The reactants can be added in any order. Thus, the cyclododecene can be added to a mixture of vehicle, if any, acylating agent, and cyclizing agent over a period of time to permit good temperature control and then the mass can be held at the aforementioned temperatures to provide the desired end product. Generally the reaction of this invention is carried out over periods of about 2 to about 10 hours.

The process of this invention can be carried out at sub- or superatmospheric pressure. This will vary according to the added vehicle, if any, contained in the reaction mixture, the acylating agent, the cyclizing agent, and the temperature. It is generally preferred that the process of this invention be carried out substantially at atmospheric pressure.

After the reaction has been completed or carried out to the desired extent, the reaction product is separated from the mass. Generally, the cyclizing and acylating agents are diluted with cold water or other aqueous medium, and the reaction product is then extracted with a suitable solvent, such as benzene, toluene, and the like. The extract is then washed with base until a neutral reaction is obtained. The organic phase can further be washed with salt solutions. The neutralized and washed material is then dried and the solvent removed.

It is generally desirable further to purify the reaction product to remove any traces of solvent, unreacted cyclododecene, and unwanted by-products. This can be carried out by distillation, extraction, or the like. Fractional distillation of the material has produced

good results. When a higher degree of purity is desired, a preparative chromatographic technique can be used. If desired, the various fractions of the reaction product can be selected to provide the various nuances of fragrance desired by the perfumer for the composition being prepared.

The purified materials described above are olfactory agents and can be incorporated into a wide variety of compositions which will be enhanced by the woody fragrance note and good persistence of the acylated-cyclized trialkyl cyclododecene. The material produced according to this invention can be added to perfume compositions in their pure form or as mixtures of materials in fragrance-imparting compositions to give a desired fragrance character to a finished perfume material. The perfume and fragrance compositions of this invention are suitable in a wide variety of perfumed materials and can be also used to enhance, modify, or reinforce natural fragrance materials.

Thus, the acylated-cyclized materials of this invention are useful as olfactory agents and fragrances. As disclosed above, the product may be employed in admixture with its isomers as obtained from the reaction mixture or the individual components may be employed alone. The acylated materials contribute a woody odor.

The term "perfume composition" is used herein to mean a mixture of compounds, including, for example, natural oils, synthetic oils, alcohols, aldehydes, ketones, esters, lactones, and frequently hydrocarbons which are admixed so that the combined odors of the individual components produce a pleasant or desired fragrance. Such perfume compositions usually contain: (a) the main note or the "bouquet" or foundation-stone of the composition; (b) modifiers which round off and accompany the main note; (c) fixatives which include odorous substances which lend a particular note to the perfume throughout all stages of evaporation; and (d) top-notes which are usually low-boiling fresh-smelling materials. Such perfume compositions or the novel materials of this invention can be used in conjunction with carriers, vehicles, solvents, dispersants, emulsifiers, surface-active agents, aerosol propellants, and the like.

In perfume compositions the individual components contribute their particular olfactory characteristics, but the overall effect of the perfume composition will be the sum of the effect of each ingredient. Thus, the individual compounds of this invention, or mixtures thereof, may be used to alter the aroma characteristics of a perfume composition, for example, by highlighting or moderating the olfactory reaction contributed by another ingredient in the composition.

The amount of mixtures of compounds of this invention which will be effective in perfume compositions depends on many factors, including the other ingredients, their amounts, and the effects which are desired. It has been found that perfume compositions containing as little as 0.002 percent by weight of mixtures or compounds of this invention, or even less, can be used to impart a woody odor to soaps, cosmetics and other products. The amount employed will depend on considerations of cost, nature of the end product, the effect desired on the finished product and the particular fragrance sought.

The materials disclosed herein can be used alone, in a fragrancesmodifying composition, or in a perfume composition as olfactory components in detergents and soaps; space deodorants; perfumes; colognes; bath preparations such as bath oil, bath salts; hair preparations such as lacquers, brilliantines, pomades, and shampoos; cosmetic preparations such as creams, deodorants, hand lotions, sun screens; powders such as talcs, dusting powders, face powder, etc.

The following examples serve to illustrate embodiments of the invention as it is now preferred to practice it. It will be understood that these examples are illustrative and the invention is to be considered restricted thereto only as indicated in the appended claims.

EXAMPLE I

Into a 1-liter reaction flask equipped with stirrer, thermometer, reflux condenser, funnel and heating mantle, are placed 160 grams of acetic anhydride and 52 grams of polyphosphoric acid. The mixture is heated to 75° C. and 200 grams of 1,5,9-trimethylcyclododecatriene-1,5,9 is added during a 2-hour period while the temperature is maintained at 75°-80° C.

Subsequent to the addition of the cyclododecatriene, the reaction mass is stirred at 75°-80° C. for a period of 7 hours. The reaction mass is then allowed to come to room temperature and two volumes of ice water are added. The resulting mixture is extracted with two volumes of benzene followed by three washes with aqueous sodium bicarbonate and three with saturated aqueous sodium chloride.

The benzene solution is then dried over magnesium sulfate, and the solvent is evaporated to obtain 173 grams of crude product. This product is subsequently stripped in an 8-inch packed column and redistilled at 134°-186° C at 0.2 mm Hg on a 2-foot column. The distillate is a (C-15 polycyclic alkyl)-methyl ketone having the infrared absorption (IR) spectrum shown in FIG. 1, as obtained undiluted on a Perkin-Elmer Infracord spectrophotometer. This spectrum shows an acetate absorption band at 1,350 cm⁻¹,



absorption at 830 cm⁻¹, and carbonyl absorption at 1,710 cm⁻¹.

The material so obtained has a woody amber fragrance with an emphatic amber character.

EXAMPLE II

The procedure of Example I is carried out in a five-liter flask with 2,700 grams acetic anhydride, 390 grams of polyphosphoric acid, and 1,500 grams of the trimethylcyclo-dodecatriene. This material has substantially the same physical and chemical properties as the distillate produced in Example I. The NMR spectrum of this material after fractional distillation is shown in FIG. 2. This spectrum is obtained on a Varian A-60 with tetramethyl silane as reference. This NMR spectrum shows the characteristics set forth in Table I below:

TABLE I

Assignment C=CH	Chemical Shift (ppm) 5.00 (multiplet)	Number of Protons 1.8
5 $\begin{array}{c} \text{H} \\ \\ \text{=C}-\text{C}-\text{C=O} \\ \\ \text{=C}-\text{CH}_2-\text{C=} \end{array}$	3.00-2.50 (multiplet)	1.4
10 $\begin{array}{c} \text{=C}-\text{CH}_2 \\ \\ \text{CH}_3-\text{C=O} \end{array}$	2.10, 2.03, 1.98 (singlets)	9.1
15 $\begin{array}{c} \text{=C}-\text{CH}_3 \\ \\ -\text{CH}_2- \end{array}$	1.72-1.33	13.7

EXAMPLE III

The procedure of Example I is carried out with a mixture of 800 grams of acetic anhydride, 260 grams polyphosphoric acid, and 1,000 grams of 1,5,9-trimethylcyclo-dodecatriene-1,5,9. The gross weight of the product prior to distillation is 1,040 grams.

The product has substantially the same characteristics chemically and physically as set forth in Examples I and II.

The use of sulfuric acid, methane sulfonic acid, or p-toluene sulfonic acid in lieu of the polyphosphoric acid gives substantially the same results in the foregoing Examples.

EXAMPLE IV

Into a 1-liter reaction flask equipped with stirrer, heating mantle, "Y" adaptor, dropping funnel, thermometer and reflux condenser, are introduced 240 grams of acetic anhydride and 78 grams of polyphosphoric acid. The mixture is brought to 75°-80° C and 300 grams of 1,5,9-trimethylcyclododecatriene-1,5,9 is added over a 2 hour period. During the addition, a moderate exothermic reaction occurs. Subsequently, the reaction mixture is stirred for 8 hours at 75°-80° C and then cooled to room temperature.

The cooled reaction mass is poured into twice its volume of ice water and permitted to stand until it separates into two phases. The mass is then extracted three times with one-third its volume of benzene, and the aqueous layer is discarded.

The organic layer so obtained is washed three times with warm saturated aqueous sodium bicarbonate, three times with one-third its volume of saturated sodium chloride solution, and then dried over magnesium sulfate. The benzene is removed by flash evaporation.

The organic product remaining is fractionally distilled under vacuum to obtain 260 grams of liquid product having a woody-amber fragrance note.

EXAMPLE V

Into a 2-liter reaction flask equipped with stirrer, thermometer, reflux condenser, addition funnel and drying tube are charged 900 grams of 1,5,9-trimethylcyclododecatriene-1,5,9 and 360 grams of acetic anhydride. The mixture is cooled to 10° C and then 60 grams of methane sulfonic acid is added dropwise over a period of one hour while the temperature is maintained at 5°-10° C. The mixture is stirred for 5 hours at 10°-15° C. Subsequently cooling is discontinued, the

temperature increases to about 55° C, and the reaction mixture is heated to 70° C for about one-half hour.

The reaction mixture is cooled to 65° C, and 1 liter of water and 100 ml of toluene are added with 15 minutes of stirring. After standing overnight the organic phase is separated and washed once with an equal volume of 5 percent aqueous sodium hydroxide solution, whereupon an emulsion forms and is broken with toluene. The organic phase is stripped to remove the toluene, and 967 grams of material is obtained.

The material is distilled in nitrogen at 0.5 mm Hg over a liquid temperature range of 133°–220° C and the fractions boiling from 169°–220° C at 0.5 mm Hg are redistilled at 1.0 mm Hg. The liquid so obtained has a woody fragrance and an IR spectrum similar to that of FIG. 1.

EXAMPLE VI

The following composition is prepared:

Ingredient	Amount (grams)
Cassia absolute	60
Methyl ionone	60
Jasmin extra	60
Neroli oil, bigarade	60
Patchouli oil	60
Vanillin	60
Violet perfume base	60
The distilled cyclized acylate of Example I	60
Lemon oil	60
Rose geranium oil	120
Lavender oil, French	120
Sweet orange oil	80
Musk extract, 3%	50
Civet extract, 3%	50

The foregoing blend is tested and found to have the same desirable characteristics of richness and persistence provided by the very expensive vetivert oil, and it further possesses a novel woody, amber-like quality. The material of Example I thus permits replacement of, or substitution in, traditional materials such as sandalwood, vetivert, and patchouli. The materials of Examples II–V can be used similarly to produce a woody fragrance note in the foregoing blend.

EXAMPLE VII

Trimethyl cyclododecatriene is prepared by reacting piperylene in a benzene reaction medium using a catalyst mixture comprising chromyl chloride and triethyl aluminum at a temperature of 50° C.

The following mixture is introduced into a 50 ml flask equipped with stirrer, thermometer, and addition funnel:

Ingredient	Amount
2-Nitropropane	20 ml.
Piperylene cyclotrimer as above	20 g. (0.099 mole)
Acetyl chloride	0.1 mole.

This reaction mixture is cooled to 0°–5° C and 0.08 moles of aluminum chloride is added during 1 hour while the reaction mixture is maintained at 5° C. After addition of the aluminum chloride is completed, the reaction mixture is poured onto 60 grams of ice.

The aqueous phase obtained is extracted with two 25 ml volumes of benzene, and the benzene extract is added to the organic layer obtained. The combined organic layer is then washed with one volume of 5 percent sulfuric acid and 0.5 volume of water. The solvent is stripped off, and a crude acylated trimer is obtained

in the amount of 21 grams. This material is distilled at 98°–162° C at 0.6 mm Hg to provide 11 grams of product.

The product is an acylated-cyclized material similar to that obtained in Example II. The product has a pleasant woody-amber fragrance note. This acylated-cyclized material is a (C-15 polycyclic alkyl)-lower alkyl ketone.

When more highly saturated or fully saturated ketones are desired, either the cyclododecene can be partially hydrogenated or the acylated-cyclized product (the ketone) can be hydrogenated to provide partially or fully saturated material. It will be appreciated that the starting cyclododecene must not be hydrogenated to the point where less than two double bonds are present. The hydrogenation can be carried out by treating the hydrocarbon starting material or the ketone with gaseous hydrogen in the presence of a catalyst. When a high degree of hydrogenation is desired for the finished ketone, higher temperatures and pressures can be utilized. The hydrogenation is carried out with gaseous hydrogen at pressures of 1 to 20 atmospheres at temperatures of 20° to 100° C and higher in the presence of hydrogenation catalysts such as Raney nickel, palladium on carbon, and the like.

It will be understood from this disclosure that the internal cyclization of the cyclododecene can form one or two bridges so that the C-15 polycyclic alkyl group on the ketone of this invention can be bicyclic or tricyclic. If partial hydrogenation of the cyclododecene is carried out before acylation-cyclization, the bicyclic material can occur alone without any substantial amount of tricyclic material.

Those skilled in the art will appreciate that the novel ketones prepared according to the present invention can further be treated to provide derivatives according to known reactions, and accordingly these ketones can be used as intermediates in the preparation of other useful materials. Thus, the novel ketones can be treated with hydroxylamine to form oxime derivatives.

What is claimed is:

1. A process for the preparation of a (C-15-polycyclic alkyl)-lower lower alkyl ketone which comprises reacting a trimethylcyclododecene having two or three unsaturated carbon-to-carbon bonds with a lower alkyl carboxylic acid anhydride acylating agent in the presence of a phosphoric acid, sulfuric acid, sulfonic acid or polyphosphoric acid cyclizing agent at a temperature of from about 50° C to about 100° C, said acylating agent being in an amount of at least equimolar to said trimethylcyclododecene and said cyclizing agent being in less than molar amount based on said trimethylcyclododecene.

2. The process of claim 1 wherein the acylating agent is acetic anhydride.

3. The process of claim 1 wherein the cyclizing agent is polyphosphoric acid.

4. A process as defined in claim 1, wherein said trimethylcyclododecene is a trimethylcyclododecatriene.

5. A process as defined in claim 1, wherein said trimethylcyclododecene is 1,5,9-trimethylcyclododecatriene-1,5,9.

6. A polycyclic ketone prepared by the process defined in claim 1.

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