NOVEL FRAGRANCE DERIVATIVES

FIELD OF THE INVENTION

The present invention relates generally to the field of fragrances. More particularly, the present invention relates to improved derivatives of conventional aromachemicals, i.e., fragrance compounds that provide perfumes and other articles with properties and advantages not shared by the conventional derivatives from which they are derived. These derivatives find utility in any and all applications requiring the themes supplied by the conventional fragrances from which they are derived. The invention also relates to mixtures of these derivatives, methods for their preparation and their use as perfume materials for application to a variety of substrates.

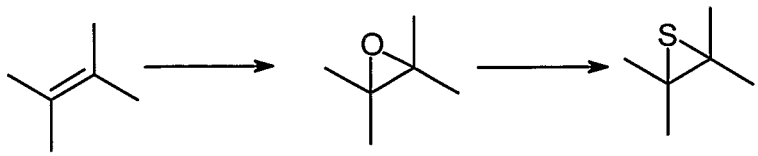
BACKGROUND OF THE INVENTION

There are a large number and variety of known fragrances used as ingredients in perfumes and in a varied range of other products. For example, perfumes for application in laundry detergents, fabric softeners, rinse conditioners and other products intended for use on textile fibers primarily contain fragrances.

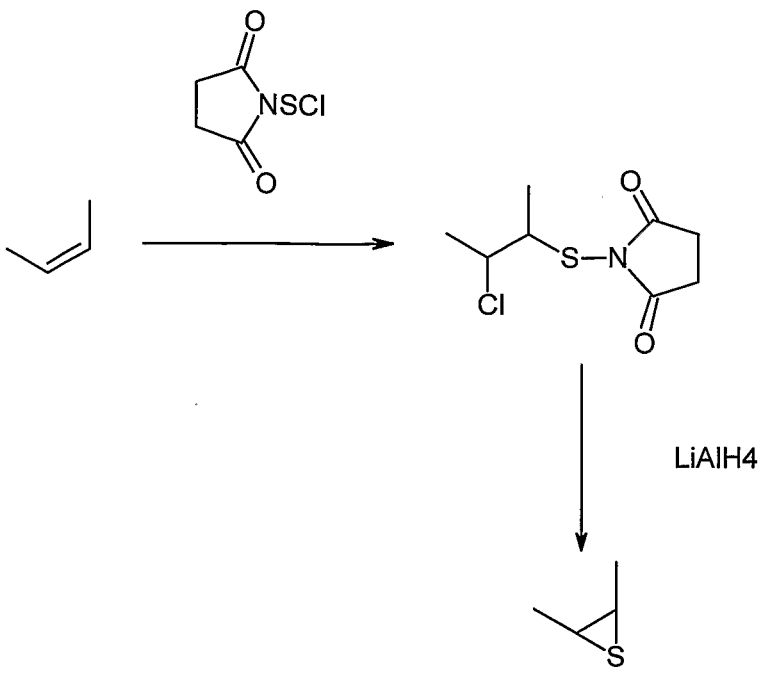
Improved fragrance and flavor derivatives that have enhanced or similar odorant intensities similar to the known fragrances from which they are derived are disclosed. In particular, derivatives that maintain the flavor and/or fragrance characteristics of fragrance molecules that contain a covalent double bond are disclosed. Also disclosed are methods of making the derivatives, and articles of manufacture including the derivatives.

SUMMARY OF THE INVENTION

The invention is directed toward the derivitization of fragrance molecules or aromachemical molecules having at least one double bond, wherein at least one double bond has been converted to an oxirane or thiirane. The inventive method may be described as the conversion of the double bond to an oxirane group and then, if desired, to a thiirane group according to the following scheme:



The invention is predicated on the discovery that replacing the double bond of a fragrance compound with an oxirane or a thiirane group enables the molecule to bind to a metal ion *without* changing the molecule's odor characteristics. Calculations suggest that the thiirane group is optimal in this respect. This ability to bind metal ions is advantageous because the receptor proteins responsible for odorant detection incorporate a zinc ion at their binding site. Metal-binding ability thereby increases the affinity of the derivative for the receptor, and therefore its potency as an odorant. The electronic structure of oxygen and especially sulfur enables them to coordinate metal ions. The conversion of the double bond to the oxirane is achieved by oxidation, for example, by reaction with a peracid such as meta-chloroperbenzoic acid (mCPBA), peroxybenzoic acid, oxygen with an Ag catalyst or t-butyl hydroperoxide in the presence of Ti(IV) isopropoxide (Sharpless reaction). The oxirane can then be used to prepare the corresponding thiirane by reacting it, for example, with triphenylphosphine sulfide-picric acid, thiourea, potassium thiocyanate on silica gel. Alternatively, the thiirane may be prepared directly from a double bond by reaction with succinimide-N-sulfenyl-chloride as depicted below:



Examples of suitable articles of manufacture in which the derivatives of the invention may be incorporated include perfumes and colognes, candles, air fresheners, detergent compositions and disinfectants.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 depicts the structural formulae of several thiiranes that can be produced according to the invention.

DETAILED DESCRIPTION OF THE INVENTION

The derivatives of the invention can be used, for example, as fragrances in any applications in which the fragrances from which they were derived are applied.

The derivatives of the invention can be included in virtually any article of manufacture that can include conventional fragrances, whether natural or artificial. Examples include bleach, detergents, flavorings and fragrances, beverages, including alcoholic beverages, and the like. The derivatives can be used in applications like soaps, shampoos, body deodorants and antiperspirants, solid or liquid detergents for treating

textiles, fabric softeners, detergent compositions and/or all-purpose cleaners for cleaning dishes or various surfaces, for both household and industrial use. Of course, the use of the compounds is not limited to the above-mentioned products, as they be used in other current uses in perfumery, namely the perfuming of soaps and shower gels, hygiene or hair-care products, as well as of body deodorants, air fresheners and cosmetic preparations, and even in fine perfumery, namely in perfumes and colognes. These uses are described in more detail below.

The compounds can be used as perfuming ingredients, as single compounds or as mixture thereof, preferably at a range of at least about 30% by weight of the perfume composition, more preferably at a range of at least about 60% by weight of the composition. The compounds can even be used in their pure state or as mixtures, without added components. The olfactive characteristics of the individual compounds are also present in mixtures thereof, and mixtures of these compounds can be used as perfuming ingredients. This may be particularly advantageous where separation and/or purification steps can be avoided by using compound mixtures.

In all cited applications, the derivatives can be used alone or in admixture with other perfuming ingredients, solvents or adjuvants of current use in the art. The nature and the variety of these co-ingredients do not require a more detailed description here, which, moreover, would not be exhaustive, and the person skilled in the art will be able to choose the latter through its general knowledge and as a function of the nature of the product to be perfumed and of the desired olfactive effect.

These perfuming ingredients typically belong to chemical classes as varied as alcohols, aldehydes, ketones, esters, ethers, acetates, nitrites, terpene hydrocarbons, sulfur- and nitrogen containing heterocyclic compounds, as well as essential oils of natural or synthetic origin. A large number of these ingredients described in reference textbooks such

as the book of S. Arctander, Perfume and Flavor Chemicals, 1969, Montclair, N.J., USA, the contents of which are hereby incorporated by reference in its entirety, or its more recent versions, or in other works of similar nature.

The proportions in which the derivatives can be incorporated in the various products vary within a large range of values. These values depend on the nature of the article or product that one desires to perfume and the odor effect searched for, as well as on the nature of the co-ingredients in a given composition when the compounds are used in admixture with perfuming co-ingredients, solvents or adjuvants of current use in the art.

As an example, the derivatives are typically present at concentrations between about 0.1 and about 10%, or even more, by weight of these compounds relative to the weight of the perfuming composition in which they are incorporated. Far lower concentrations than those mentioned above can be used when the compounds are directly applied for perfuming the various consumer products cited beforehand.

The compounds can also be used in body deodorants and antiperspirants, for example, those containing aluminum salts. These embodiments are described in more detail below.

In addition to the derivatives described herein, the compositions herein include a detersive surfactant and optionally, one or more additional detergent ingredients, including materials for assisting or enhancing cleaning performance, treatment of the substrate to be cleaned, or to modify the aesthetics of the detergent composition (e.g., perfumes, colorants, dyes, etc.). Non-limiting examples of synthetic detersive surfactants useful herein typically at levels from about 0.5% to about 90%, by weight, include the conventional C1-18 alkyl benzene sulfonates ("LAS") and primary, branch-chain and random CIO-20 alkyl sulfates ("AS"), and the like.

Preferred compositions incorporating only synthetic detergents have a detergent level of from about 0.5% to 50%. Compositions containing soap preferably comprise from about 10% to about 90% soap.

The compositions herein can contain other ingredients such as enzymes, bleaches, fabric softening agents, dye transfer inhibitors, suds suppressors, and chelating agents, all well known within the art.

The derivatives described herein can be incorporated into beverages and impart various flavorings to the beverages. The beverage composition can be a cola beverage composition, and can also be coffee, tea, dairy beverage, fruit juice drink, orange drink, lemon-lime drink, beer, malt beverages, or other flavored beverage. The beverages can be in liquid or powdered form. The beverage compositions can also include one or more flavoring agents; artificial colorants; vitamin additives; preservatives; caffeine additives; water; acidulants; thickeners; buffering agents; emulsifiers; and or fruit juice concentrates.

Artificial colorants which may be used include caramel color, yellow 6 and yellow 5. Useful vitamin additives include vitamin B2, vitamin B6, vitamin B12, vitamin C (ascorbic acid), niacin, pantothenic acid, biotin and folic acid. Suitable preservatives include sodium or potassium benzoate. Salts which may be used include sodium, potassium and magnesium chloride. Exemplary emulsifiers are gum arabic and purity gum, and a useful thickener is pectin. Suitable acidulants include citric, phosphoric and malic acid, and potential buffering agents include sodium and potassium citrate.

In one embodiment, the beverage is a carbonated cola beverage. The pH is generally about 2.8 and the following ingredients can be used to make the syrup for these compositions: Flavor Concentrate, including one or more of the derivatives described herein (22.22 ml), 80% Phosphoric Acid (5.55 g), Citric Acid (0.267 g), Caffeine (1.24 g), artificial sweetener, sugar or com syrup (to taste, depending on the actual sweetener) and

Potassium Citrate (4.07 g). The beverage composition can be prepared, for example, by mixing the foregoing syrup with carbonated water in a proportion of 50 ml syrup to 250 ml of carbonated water.

Flavored food and pharmaceutical compositions including one or more of the derivatives described herein can also be prepared. The derivatives can be incorporated into conventional foodstuffs using techniques well known to those of skill in the art. Alternatively, the derivatives can be incorporated within polymeric particles, which can, in turn, be dispersed within and/or over a surface of an orally-deliverable matrix material, which is usually a solid or semi-solid substrate. When used in chewable compositions, the derivatives can be released into the orally-deliverable polymeric matrix material as the composition is chewed and held in the mouth, thus prolonging the flavor of the composition. In the case of dried powders and mixes, the flavor can be made available as the product is consumed or be released into the matrix material as the composition is further processed. When two flavors are combined with the polymeric particles, the relative amounts of the additives can be selected to provide simultaneous release and exhaustion of the compounds.

In one embodiment, the flavored composition includes an orally-deliverable matrix material; a plurality of water insoluble polymeric particles dispersed in the orally-deliverable matrix material, where the polymeric particles individually define networks of internal pores and are non-degradable in the digestive tract; and one or more derivatives as described herein entrapped within the internal pore networks. The derivatives are released as the matrix is chewed, dissolved in the mouth, or undergoes further processing selected from the group consisting of liquid addition, dry blending, stirring, mixing, heating, baking, and cooking. The orally-deliverable matrix material can be selected from the group consisting of gums, latex materials, crystallized sugars, amorphous

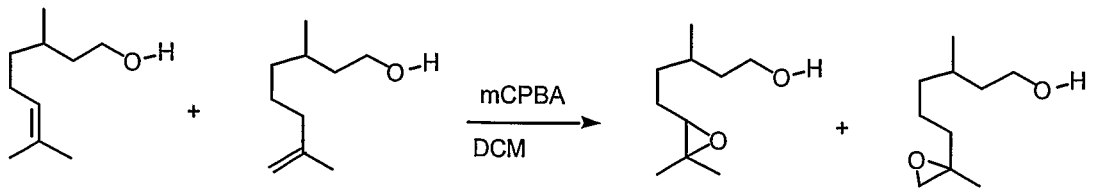
sugars, fondants, nougats, jams, jellies, pastes, powders, dry blends, dehydrated food mixes, baked goods, batters, doughs, tablets, and lozenges.

A flavorless gum base can be combined with a suitable derivative as described herein to a desired flavor concentration. Typically, a blade mixer is heated to about 11 OF, the gum base is preheated so that it is softened, and the gum base is then added to the mixer and allowed to mix for approximately 30 seconds. The flavored derivative is then added to the mixer and mixed for a suitable amount of time. The gum can be then removed from the mixer and rolled to stick thickness on waxed paper while warm.

In one embodiment, the derivatives described herein are incorporated into a system which can release a fragrance in a controlled manner. These include substrates such as air fresheners, laundry detergents, fabric softeners, deodorants, lotions, and other household items. The fragrances are generally one or more derivatives of essential oils as described herein, each present in different quantities. U.S. Pat. No. 4,587,129, the contents of which are hereby incorporated by reference in their entirety, describes a method for preparing gel articles which contain up to 90% by weight of fragrance or perfume oils. The gels are prepared from a polymer having a hydroxy (lower alkoxy) 2-alkeneoate, a hydroxy (lower alkoxy) lower alkyl 2-alkeneoate, or a hydroxy poly (lower alkoxy)lower alkyl 2-alkeneoate and a polyethylenically unsaturated crosslinking agent. These materials have continuous slow release properties, i.e., they release the fragrance component continuously over a long period of time. Advantageously, all or a portion of those derivatives that include an aldehyde group can be modified to include an acetal group, which can cause the formulations to release fragrance over a period of time as the acetal hydrolyzes to form the aldehyde compound.

EXAMPLE 1

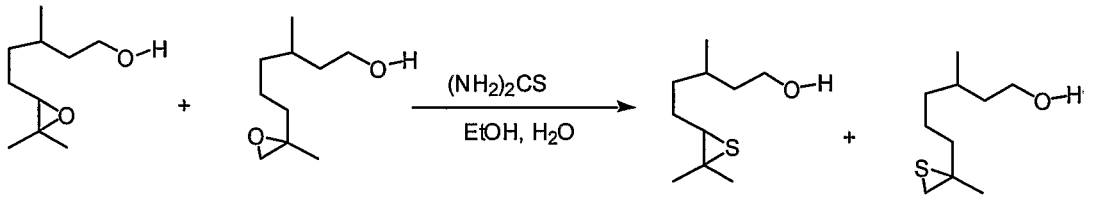
The method of the invention was applied to a mixture of citronellol isomers as follows:



In a 500-mL round bottom flask containing the mixture of alpha and beta citronellol (5 mL) in dichloromethane (200 mL) was added mCPBA (11.0 g, 50-85%), portionwise over 45 minutes and stirred for 5 hours.

The mixture was washed with a solution of saturated Na_2SO_3 (70 mL), followed by washing with brine (3x70 mL). The organic phase was dried over Na_2SO_4, filtered, and the solvent evaporated to give the pure desired product as a colorless oil (5.5 g).

The second stage of the process follows the following scheme:

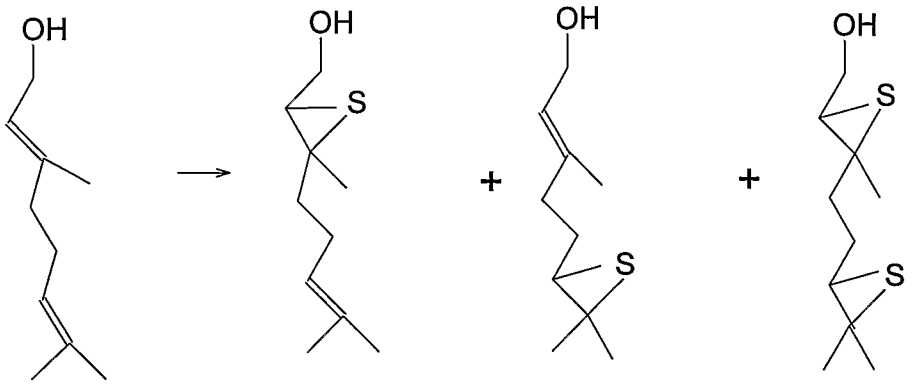


To the pure mixture of the corresponding epoxides from alpha and beta-citronellol in ethanol (5 mL) and water (3 mL) was added thiourea (1.0 g) and the reaction stirred overnight under a nitrogen atmosphere. The solvent was evaporated in vacuo. Flash column chromatography from the mixture using dichloromethane/ethyl acetate (3:2) afforded the desired pure mixture of the corresponding thiirane as a colorless oil.

Alternatively a mixture of epoxide (1 equiv), potassium thiocyanate (3 equiv) and ceric ammonium nitrate (5-100 mol%) were stirred at an appropriate temperature in a solvent such as tert-butanol or iso-propanol. When the reaction was judged to be complete (TLC) the mixture was concentrated and the residue extracted with dichloromethane. The thiirane was either pure enough for further use or was further purified if necessary.

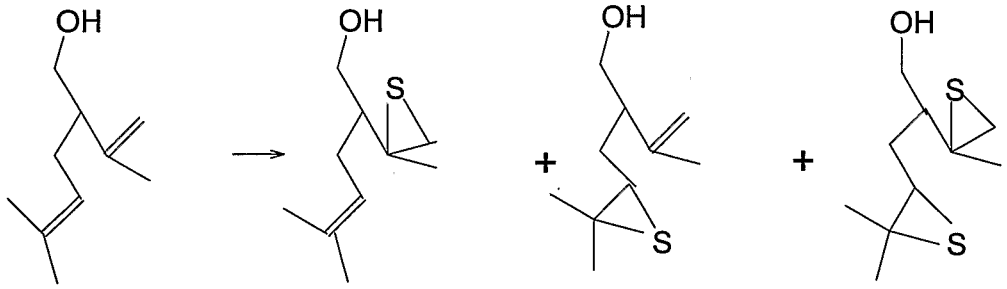
EXAMPLE 2

Similarly, the method was applied to geraniol:



EXAMPLE 3

Similarly, the method of example 1 was applied to lavandulol



EXAMPLE 4

Similarly, the same method was applied to linalool and diH-linalool. See Fig. 1

EXAMPLE 5

Similarly, the same method was applied to myrcenol and diH-myrcenol. See Fig. 1

EXAMPLE 6

Similarly, the same method was applied to ocimenol and diH-ocimenol. See Fig. 1

The invention is equally applicable to all unsaturated cyclic or acyclic fragrance compounds, e.g., the terpenes and their aldehyde and ketone derivatives.

Having hereby disclosed the subject matter of the present invention, it should be apparent that many modifications, substitutions, and variations of the present invention are possible in light thereof. It is to be understood that the present invention can be practiced other than as specifically described. Such modifications, substitutions and variations are intended to be within the scope of the present application.

I claim:

1. A method for derivatizing an aromachemical or fragrance compound containing at least one double bond in the molecular structure thereof to enhance the binding characteristics of said aromachemical or fragrance compound to metal ions without significantly affecting the odor characteristics thereof comprising converting said at least one double bond to an oxirane or thiirane group.

2. The method of claim 1 comprising derivatizing said aromachemical or fragrance compound to produce an oxirane.

3. The method of claim 2 wherein said derivitization comprises oxidizing said at least one double bond to an oxirane group.

4. The method of claim 3 wherein said oxidation is effected by reaction of said at least one double bond with a peracid, oxygen or a hydroperoxide.

5. The method of claim 4 wherein said peracid is *m*-chloroperbenzoic acid or peroxybenzoic acid.

6. The method of claim 4 wherein said reaction with oxygen is effected in the presence of a catalyst.

7. The method of claim 6 wherein said catalyst is an Ag catalyst.

8. The method of claim 4 wherein said hydroperoxide is t-butyl hydroperoxide.

9. The method of claim 4 wherein said reaction with hydroperoxide is effected in the presence of Ti(IV) isopropoxide.

10. The method of claim 2 including the step of converting said oxirane group to a thiirane group.

11. The method of claim 10 wherein said oxirane group is converted to said thiirane group by reaction thereof with an episulfidating agent.

12. The method of claim 11 wherein said episulfidating agent is a sulfide, thiourea or a thiocyanate.

13. The method of claim 12 wherein said sulfide comprises a mixture of triphenylphosphine sulfide and picric acid.

14. The method of claim 13 wherein said thiocyanate is potassium thiocyanate.

15. The method of claim 1 comprising derivatizing said aromachemical or fragrance compound to produce a thiirane.

16. The method of claim 15 wherein said thiirane is produced by the reaction of said at least one double bond with an episulfidating agent

17. The method of claim 16 wherein said thiirane is produced by reaction of said at least one double bond with succinimide-N-sulfenyl halide followed by reduction of the reaction product

18. The method of claim 17 wherein said reduction is effected by reaction of said reaction product with lithium aluminum hydride.

19. The product produced by the method of claim 1

20. A composition comprising a product produced by the method of claim 1 together with other perfuming ingredients, solvents, or adjuvants of current use in the art of perfumery.

21. The composition of claim 20 wherein the product is present in an amount of at least 30 percent by weight.

22. The composition of claim 5, wherein the product is present in an amount of at least 60 percent by weight.

23. A perfuming composition or perfumed article containing as a perfuming ingredient a product produced by the method of claim 1 or a mixture thereof.

24. The perfuming composition of claim 23 wherein the product or mixture of products is present in admixture with other perfuming ingredients, solvents, or adjuvants of current use in the art.

25. A perfumed article according to claim 23 in the form of a perfume or cologne, a soap, a bath or shower gel, a shampoo or other hair care product, a cosmetic preparation, a body deodorant or antiperspirant, an air freshener, a fabric detergent or softener or an all-purpose household cleaner.

26. A body deodorant or antiperspirant of claim 25.

27. The body deodorant or antiperspirant of claim 26 wherein the product or mixture of products is present in admixture with other perfuming ingredients, solvents, or adjuvants of current use in the art.

28. A detergent according to claim 25

29. The detergent of claim 28 wherein the product or mixture of product s is present in admixture with other perfuming ingredients, solvents, or adjuvants of current use in the art.

30. A bleach composition containing a product of claim 19.

31. A beverage containing a product of claim 19.

32. A method to improve, enhance or modify the odor of a perfuming composition or a perfumed article comprising adding to said composition or said article an effective amount of a product of claim 19 or a mixture thereof.

33. The method of claim 32 wherein the product or mixture of products is present in admixture with other perfuming ingredients, solvents, or adjuvants of current use in the art.

34. The method of claim 32 wherein the product or mixture of products are present in an amount of at least 30 percent by weight.

35. A disinfectant composition containing a product of claim 19 or a mixture thereof.

36. An article of manufacture comprising a product of claim19 or a mixture thereof.

37. A method for improving the fragrance properties of an article of manufacture comprising incorporating therein an effective amount of a product of claim 19 or a mixture thereof.

38. A method for enhancing the binding characteristics of an aromachemical or fragrance compound containing at least one double bond in the molecular structure thereof to metal ions comprising converting said at least one double bond to an oxirane or thiirane group.

39. The method of claim 1 comprising converting said double bond to an oxirane.

40. The method of claim 2 wherein said conversion comprises oxidizing said at least one double bond to an oxirane group.

41. The method of claim 40 wherein said oxidation is effected by reaction of said at least one double bond with a peracid, oxygen or a hydroperoxide.

42. The method of claim 41 wherein said peracid is *m*-chloroperbenzoic acid or peroxybenzoic acid.

43. The method of claim 41 wherein said reaction with oxygen is effected in the presence of a catalyst.

44. The method of claim 43 wherein said catalyst is an Ag catalyst.

45. The method of claim 41 wherein said hydroperoxide is t-butyl hydroperoxide.

46. The method of claim 41 wherein said reaction with hydroperoxide is effected in the presence of Ti(IV) isopropoxide.

47. The method of claim 39 including the step of converting said oxirane group to a thiirane group.

48. The method of claim 47 wherein said oxirane group is converted to said thiirane group by reaction thereof with an episulfidating agent.

49. The method of claim 48 wherein said episulfidating agent is a sulfide, thiourea or a thiocyanate.

50. The method of claim 49 wherein said sulfide comprises a mixture of triphenylphosphine sulfide and picric acid.

51. The method of claim 49 wherein said thiocyanate is potassium thiocyanate.

52. The method of claim 38 comprising converting said double bond to a thiirane to produce a thiirane.

53. The method of claim 52 wherein said thiirane is produced by the reaction of said at least one double bond with an episulfidating agent

54. The method of claim 53 wherein said thiirane is produced by reaction of said at least one double bond with succinimide-N-sulfenyl halide followed by reduction of the reaction product

55. The method of claim 54 wherein said reduction is effected by reaction of said reaction product with lithium aluminum hydride.