(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
24 March 2011 (24.03.2011)

PCT

(10) International Publication Number
WO 2011/033410 A1

(51) International Patent Classification:
A61K 8/40 (2006.01) ***C11B 9/00*** (2006.01)
A61Q 13/00 (2006.01) ***C11D 3/50*** (2006.01)

(21) International Application Number:
PCT/IB2010/053919

(22) International Filing Date:
1 September 2010 (01.09.2010)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
PCT/IB2009/054037
16 September 2009 (16.09.2009) IB

(71) Applicant *(for all designated States except US)*: **FIRMENICH SA** [CH/CH]; 1, route des Jeunes, P. O. Box 239, CH-1211 Geneva 8 (CH).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: **GAUDIN, Jean-Marc** [FR/FR]; 5, rue du Levant, F-74100 Annemasse (FR).

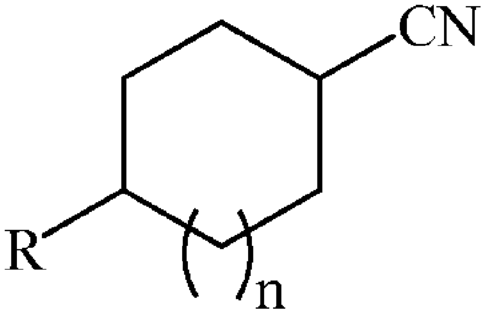
(74) Agent: **CARINA, Riccardo**; Firmenich Sa, 1, route des Jeunes, P. O. Box 239, CH-1211 Geneva 8 (CH).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
- *with international search report (Art. 21(3))*
- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

(54) Title: NITRILE COMPOUNDS AS PERFUMING INGREDIENTS



(I)

(57) Abstract: The present invention relates to the field of perfumery. More particularly, it concerns some nitrile derivatives of formula (I) in the form of any one of its stereoisomers or a mixture thereof, and wherein n represents 0 or 1, and R represents a C3-7 linear, branched or cyclic alkyl or alkenyl group optionally comprising an oxygen atom. Said compounds are useful perfuming ingredients capable of imparting nitrile/citrus notes. The present invention concerns also the compositions and the consumers' articles containing said nitrile derivatives.

NITRILE COMPOUNDS AS PERFUMING INGREDIENTS

Technical field

The present invention relates to the field of perfumery. More particularly, it concerns some nitrile derivatives of formula (I), as defined herein below, and their use as perfumery ingredients. The present invention concerns also the compositions and the consumers' articles containing said nitrile derivatives.

Prior art

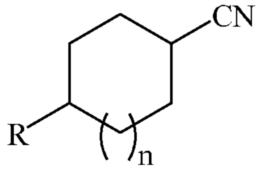
To the best of our knowledge, only few of the compounds of formula (I) are reported in prior art documents. For instance one may cite 4-isopropylcyclohexanecarbonitrile (reported in US 20020028969 as chemical intermediate) or 4-terbutylcyclohexanecarbonitrile (reported in *Org.Lett.*, **2004**, 6, 501 as chemical intermediate).

However, said prior art documents citing a compound of formula (I) do not report or suggest any organoleptic properties of the compounds of formula (I), or any use of said compounds in the field of perfumery. Indeed they all report their use or preparation as chemical as such.

The usefulness of the compounds of formula (I) as perfuming ingredients is surprising in view of the prior art perfuming ingredients. Indeed, to the best of our knowledge, only few cycloalkylnitriles are known as being useful perfuming ingredients (see WO 09/060378 or WO 08/117254). However said prior art ingredients possess a very different odor and chemical structure, and therefore do not suggest any organoleptic properties of the compounds of formula (I), or any use of said compounds (I) in the field of perfumery.

Description of the invention

We have now surprisingly discovered that a compound of formula



(I)

in the form of any one of its stereoisomers or a mixture thereof, and wherein n represents 0 or 1, and R represents a C_{3-7} linear, branched or cyclic alkyl or alkenyl group optionally comprising an oxygen atom;

can be used as perfuming ingredient, for instance to impart odor notes of the nitrile and/or citrus type, and in particular of the nitrile and citrus type.

According to a particular embodiment of the invention, n is 1, i.e. the invention's compound is a cyclohexyl derivative.

According to a particular embodiment of the invention, n is 1, and compound (I) is in the form of its trans isomer.

According to a particular embodiment of the invention, R represents a C_{4-6} linear, branched or cyclic alkyl or alkenyl group optionally comprising an oxygen atom.

According to a particular embodiment of the invention, R represents a C_{4-6} branched or cyclic alkyl or alkenyl group, in particular alkyl. Said compounds are also new chemicals, except 4-isopropylcyclohexanecarbonitrile, 1,1'-bi(cyclohexyl)-4-carbonitrile and 4-terbutylcyclohexanecarbonitrile, and are therefore also another object of the present invention.

As mentioned above, said compound of formula (I) is in the form of any one of its stereoisomers or a mixture thereof. In particular, said compound can be in the form of a mixture of cis and trans isomers wherein the trans isomers represent more than 50% w/w, or even 70% w/w, of the mixture. In particular said compound can be in the form of a trans isomers.

It is understood that other particular embodiments of the invention may be those comprising several of the above definitions.

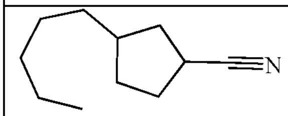
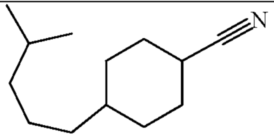
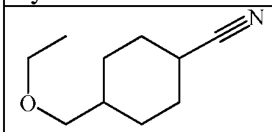
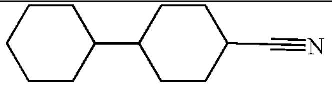
As specific examples of the invention's compound, one may cite, as non-limiting example, 4-isobutylcyclohexanecarbonitrile (cis/trans = 30/70), which possesses nitrile, citrusy notes with an interesting and characteristic verbena note.

Although having a quite different chemical structure, said compound is olfactively related to the geranyl/citronellyl nitrile family. For instance, in applications, the invention's compound displays performances which are above those of citronellyl nitrile and as good as 3,7-dimethyl-2,6-nonadienenitrile and methyl geranyl nitrile. However 4-isobutylcyclohexanecarbonitrile odor distinguishes itself from the one of geranyl/citronellyl nitrile family by being less fatty and more lemony/verbena.

As other example one may cite cis 4-isobutylcyclohexanecarbonitrile, which possesses an odor similar to the one mentioned above but distinguishing itself by having a stronger nitrile note as well as a bit weaker lemony note.

As other specific, but non-limiting, examples of the invention's compounds, one may cite the following ones in Table 1 :

Table 1: Invention's compounds and their odor properties

Compound structure and name	Odor notes
 3-pentylcyclopentanecarbonitrile	Nitrile, citrus, lemony
 4-(4-methylpentyl)-1-cyclohexanecarbonitrile	Nitrile, citrus, mandarin, reminding of 2-tridecenal (Arctander N° 2987)
 4-(ethoxymethyl)cyclohexanecarbonitrile	Nitrile, weaker than the other compounds
 1,1'-bi(cyclohexyl)-4-carbonitrile	Fatty, nitrile, citrus, somehow reminding of geranyl nitrile but more fatty

According to a particular embodiment of the invention, the compounds of formula (I) are : cis 4-isobutylcyclohexanecarbonitrile, trans 4-isobutylcyclohexanecarbonitrile, or 4-isobutylcyclohexanecarbonitrile in the form of a mixture of isomers cis/trans = 30/70.

When the odor of the invention's compounds is compared with the one of the prior art compounds described in WO 09/060378 or WO 08/117254, then the invention's compounds distinguish themselves by possessing nitrile/citrus notes and by lacking of, or by not possessing significant, patchouli or lactonic/jasminic/celery/apricot notes so characteristic of the prior art compounds. Similarly the prior art compounds do not possess the characteristic nitrile/citrus notes of the present inventions' compounds.

Said differences lend the invention's compounds and the prior art compounds to be each suitable for different uses, i.e. to impart different organoleptic impressions. Indeed the compounds (I) are well suited to impart citrus notes, especially in functional perfumery, while the prior art compounds are not suited for such use.

As mentioned above, the invention concerns the use of a compound of formula (I) as perfuming ingredient. In other words it concerns a method to confer, enhance, improve or modify the odor properties of a perfuming composition or of a perfumed article, which method comprises adding to said composition or article an effective amount of at least a compound of formula (I). By "use of a compound of formula (I)" it has to be understood here also the use of any composition containing compound (I) and which can be advantageously employed in perfumery industry as active ingredients.

Said compositions, which in fact can be advantageously employed as perfuming ingredient, are also an object of the present invention.

Therefore, another object of the present invention is a perfuming composition comprising:

i) as perfuming ingredient, at least one invention's compound as defined above;
ii) at least one ingredient selected from the group consisting of a perfumery carrier and a perfumery base; and
iii) optionally at least one perfumery adjuvant.

By "perfumery carrier" we mean here a material which is practically neutral from a perfumery point of view, i.e. that does not significantly alter the organoleptic properties of perfuming ingredients. Said carrier may be a liquid or a solid.

As liquid carrier one may cite, as non-limiting examples, an emulsifying system, i.e. a solvent and a surfactant system, or a solvent commonly used in perfumery. A detailed description of the nature and type of solvents commonly used in perfumery cannot be exhaustive. However, one can cite as non-limiting example solvents such as dipropyleneglycol, diethyl phthalate, isopropyl myristate, benzyl benzoate, 2-(2-ethoxyethoxy)-1-ethanol or ethyl citrate, which are the most commonly used.

As solid carrier one may cite, as non-limiting examples, absorbing gums or polymers, or yet encapsulating materials. Examples of such materials may comprise wall-forming and plasticizing materials, such as mono, di- or trisaccharides, natural or modified starches, hydrocolloids, cellulose derivatives, polyvinyl acetates, polyvinylalcohols, proteins or pectins, or yet the materials cited in reference texts such as

H. Scherz, Hydrokolloids : Stabilisatoren, Dickungs- und Gehermittel in Lebensmittel, Band 2 der Schriftenreihe Lebensmittelchemie, Lebensmittelqualität, Behr's VerlagGmbH & Co., Hamburg, 1996. The encapsulation is a well known process to a person skilled in the art, and may be performed, for instance, using techniques such as spray-drying, agglomeration or yet extrusion ; or consists of a coating encapsulation, including coacervation and complex coacervation techniques.

By “perfumery base” we mean here a composition comprising at least one perfuming co-ingredient.

Said perfuming co-ingredient is not of the formula (I). Moreover, by “perfuming co-ingredient” it is meant here a compound, which is used in perfuming preparation or composition to impart a hedonic effect. In other words such a co-ingredient, to be considered as being a perfuming one, must be recognized by a person skilled in the art as being able to impart or modify in a positive or pleasant way the odor of a composition, and not just as having an odor.

The nature and type of the perfuming co-ingredients present in the base do not warrant a more detailed description here, which in any case would not be exhaustive, the skilled person being able to select them on the basis of its general knowledge and according to intended use or application and the desired organoleptic effect. In general terms, these perfuming co-ingredients belong to chemical classes as varied as alcohols, lactones, aldehydes, ketones, esters, ethers, acetates, nitriles, terpenoids, nitrogenous or sulphurous heterocyclic compounds and essential oils, and said perfuming co-ingredients can be of natural or synthetic origin. Many of these co-ingredients are in any case listed in reference texts such as the book by S. Arctander, Perfume and Flavor Chemicals, 1969, Montclair, New Jersey, USA, or its more recent versions, or in other works of a similar nature, as well as in the abundant patent literature in the field of perfumery. It is also understood that said co-ingredients may also be compounds known to release in a controlled manner various types of perfuming compounds.

For the compositions which comprise both a perfumery carrier and a perfumery base, other suitable perfumery carrier, than those previously specified, can be also ethanol, water/ethanol mixtures, limonene or other terpenes, isoparaffins such as those known under the trademark Isopar® (origin: Exxon Chemical) or glycol ethers and glycol ether esters such as those known under the trademark Dowanol® (origin: Dow Chemical Company).

By "perfumery adjuvant" we mean here an ingredient capable of imparting additional added benefit such as a color, a particular light resistance, chemical stability, etc. A detailed description of the nature and type of adjuvant commonly used in perfuming bases cannot be exhaustive, but it has to be mentioned that said ingredients are well known to a person skilled in the art.

An invention's composition consisting of at least one compound of formula (I) and at least one perfumery carrier represents a particular embodiment of the invention as well as a perfuming composition comprising at least one compound of formula (I), at least one perfumery carrier, at least one perfumery base, and optionally at least one perfumery adjuvant.

It is useful to mention here that the possibility to have, in the compositions mentioned above, more than one compound of formula (I) is important as it enables the perfumer to prepare accords, perfumes, possessing the odor tonality of various compounds of the invention, creating thus new tools for their work.

Preferably, any mixture resulting directly from a chemical synthesis, e.g. without an adequate purification, in which the compound of the invention would be involved as a starting, intermediate or end-product could not be considered as a perfuming composition according to the invention.

Furthermore, the invention's compound can also be advantageously used in all the fields of modern perfumery to positively impart or modify the odor of a consumer product into which said compound (I) is added. Consequently, a perfumed article comprising:

i) as perfuming ingredient, at least one invention's compound, as defined above; and
ii) a perfumery base;

is also an object of the present invention.

The invention's compound can be added as such or as part of an invention's perfuming composition.

For the sake of clarity, it has to be mentioned that, by "consumer product base" we mean here a consumer product which is compatible with perfuming ingredients. In other words, a perfumed article according to the invention comprises the functional formulation, as well as optionally additional benefit agents, corresponding to a consumer product, e.g. a detergent or an air freshener, and an olfactive effective amount of at least one invention's compound.

The nature and type of the constituents of the consumer product do not warrant a more detailed description here, which in any case would not be exhaustive, the skilled person being able to select them on the basis of its general knowledge and according to the nature and the desired effect of said product.

Non-limiting examples of suitable perfumery bases can be a perfume, such as a fine perfume, a cologne or an after-shave lotion; a fabric care product, such as a liquid or solid detergent, a fabric softener, a fabric refresher, an ironing water, a paper, or a bleach; a body-care product, such as a hair care product (e.g. a shampoo, a coloring preparation or a hair spray), a cosmetic preparation (e.g. a vanishing cream or a deodorant or antiperspirant), or a skin care product (e.g. a perfumed soap, shower or bath mousse, oil or gel, or a hygiene product); an air-care product, such as an air freshener or a “ready to use” powdered air freshener; or a home care product, such as a wipe, a dish detergent or hard-surface detergent.

Some of the above-mentioned consumer product bases may represent an aggressive medium for the invention’s compound, so that it may be necessary to protect the latter from premature decomposition, for example by encapsulation or by chemically bounding it to another chemical which is suitable to release the invention’s ingredient upon a suitable external stimulus, such as an enzyme, light, heat or a change of pH.

The proportions in which the compounds according to the invention can be incorporated into the various aforementioned articles or compositions vary within a wide range of values. These values are dependent on the nature of the article to be perfumed and on the desired organoleptic effect as well as the nature of the co-ingredients in a given base when the compounds according to the invention are mixed with perfuming co-ingredients, solvents or additives commonly used in the art.

For example, in the case of perfuming compositions, typical concentrations are in the order of 0.001 % to 15 % by weight, or even more, of the compounds of the invention based on the weight of the composition into which they are incorporated. Concentrations lower than these, such as in the order of 0.01% to 5% by weight, can be used when these compounds are incorporated into perfumed articles, percentage being relative to the weight of the article.

The invention’s compounds can be prepared according to a method comprising the transformation of corresponding aldehyde into the nitrile derivative, Examples of such a method are given herein below in the Examples.

Examples

The invention will now be described in further detail by way of the following examples, wherein the abbreviations have the usual meaning in the art, the temperatures are indicated in degrees centigrade (°C); the NMR spectral data were recorded in $CDCl_3$ (if not stated otherwise) with a 360 or 400 MHz machine for ^{1}H and ^{13}C, the chemical shifts δ are indicated in ppm with respect to TMS as standard, the coupling constants J are expressed in Hz.

4-Bicyclohexyl-carbonitrile is prepared as described in *J. Am. Chem. Soc.* **1948**, *70, 3177.*

Example 1

Synthesis of compounds of formula (I)

A) Preparation of 4-isobutylcyclohexanecarbonitrile

Preparation of 4-isobutylcyclohexyl)methanol

1 kg of 4-sec-butylbenzaldehyde (described in *J.Med.Chem.* **1987**, 2121) was added in an autoclave with the 500ml of methanol and 10g of Ru 5% on Alox. Then the reaction was heated at 80°C and let overnight under a pressure of 400 bar of hydrogen and vigorous stirring. Then, the reaction was filtered, the organic phase was washed with brine, dried with sodium sulfate and concentrated to give 1080 g of the pure 4-isobutylcyclohexyl)methanol in a 70/30 cis/trans ratio (quantitative yield). From this cis/trans mixture, a careful distillation on a Fischer column (B.p. 83°C under 2.5 mbar) gave a fraction of cis 4-isobutylcyclohexyl)methanol (97% cis).

^{13}CNMR of the cis/trans mixture: 22.9(q), 22.9(q), 24.8(d), 25.1(d), 25.4(t), 29.0 (t), 29.5(t), 32.6 (d), 32.9 (t), 35.3 (d), 38.4(d), 40.7(d), 43.5(t), 47.0 (t), 66.3(t), 68.8(t)

^{13}C NMR of the cis isomer: d 22.9 (q), 25.1 (d), 25.4 (t), 29.0 (t), 32.6 (d), 38.4 (d), 43.5 (t), 66.3 (t)

Preparation of 4-isobutylcyclohexanecarbaldehyde

Following the procedure of oxidation procedure described in WO 2003/064362, from 15.0g of 4-isobutylcyclohexyl)methanol (97/3 cis/trans) were obtained 7.5g (46% yield) of 4-isobutylcyclohexanecarbaldehyde (83/17 cis/trans).

^{13}C NMR of the cis/trans mixture: 22.8 (q), 24.0 (t), 24.7 (d), 26.0 (t), 29.7 (t), 32.1 (t), 33.7 (d), 34.7 (d); 45.4 (t), 46.7 (t), 47.5 (d), 50.6 (d), 204.9 (d), 205.6 (d)

A partial isomerisation of this aldehyde occurs during the distillation (B.p. 80°C under 10 mbar) to give a 30/70 cis/trans quality. The equilibrium (15/85 cis/trans) was obtained by treatment with potassium hydroxide in methanol overnight at room temperature.

^{13}CNMR of the trans isomer: 22.8 (q), 24.7 (d), 26.0 (t), 32.1 (t), 34.7 (d), 46.7 (t), 50.6 (d), 204.9 (d)

Preparation of 4-isobutylcyclohexanecarbonitrile

At 30-40°C, 50g of a 50% solution in water of hydroxylamine (757mmol) was added to a solution of 4-isobutylcyclohexanecarbaldehyde (84g, 83/17 cis/trans) in 100ml isopropanol. At the end of the reaction, followed by GC, the organic phase was washed with water, brine, dried with sodium sulfate and concentrated to give 70g of the crude oxime.

This crude oxime was added, over a period of 4 hours, to 56g of acetic anhydride at 110°C. The reaction was cooled down and 100 ml of pentane was added. Then, the organic layer was washed with water, dried over magnesium sulfate and concentrated to give 46g of the crude nitrile with the same cis/trans ratio as the starting aldehyde. A careful distillation of this quality of nitrile on a Fischer column (B.p. 75-80°C under 0.5 mbar) gave fractions with high percentage of cis isomer (cis/trans ratio 93/7).

^{13}CNMR of the cis isomer: 22.8 (q), 24.6 (d), 27.3 (d), 28.3 (t), 29.1 (t), 34.2 (d), 46.0 (t), 122.3 (s)

Starting from a 30/70 cis/trans quality of 4-isobutylcyclohexanecarbaldehyde and following the procedure described above, were obtained 4-isobutyl cyclohexanecarbonitrile (30/70 cis/trans) in 40% yield after distillation.

^{13}CNMR of the cis/trans mixture: 22.77(q), 24.59(d), 24.63(d), 27.31(d), 28.38(d), 29.09(t), 29.79(t), 31.81(t), 33.78(d), 34.18(d), 46.02(t), 46.02(t), 46.22(t), 46.22(t), 122.26(s), 122.85(s)

B) Preparation of 4-(ethoxymethyl)cyclohexanecarbonitrile

Preparation of 4-ethoxymethyl-1-cyclohexanecarbaldehyde

Following the oxidation procedure described in WO 2003/064362, from 37g of 4-ethoxymethyl-1-cyclohexylmethanol (*J.Mass Spectrometry* **1995**; *30*; 1421) were obtained 19g of 4-ethoxymethyl-1-cyclohexanecarbaldehyde (16/84 cis/trans) after distillation.

^{13}CNMR for the cis/trans mixture: 15.2(q), 23.7(d) 25.5(t), 26.5(t), 28.8(t), 36.8(d), 37.7 (d), 47.3 (d), 50.5(d), 66.4(t), 75.2(t), 76 (t), 204.6 (d), 204.7 (d)

^{13}C NMR trans isomer: d 15.2 (q), 25.5 (t), 28.8 (t), 37.7 (d), 50.5 (d), 66.4 (t), 76.0 (t), 204.6 (d)

Preparation of 4-(ethoxymethyl)cyclohexanecarbonitrile

Starting from 19g of trans-4-ethoxymethyl-1-cyclohexanecarbaldehyde described above and following the procedure described for 4-isobutylcyclohexanecarbonitrile, were obtained 10g of 4-(ethoxymethyl)cyclohexanecarbonitrile (16/84 cis/trans).

^{13}C NMR trans isomer: 15.1 (q), 28.3 (d), 28.4 (t), 29.3 (t), 36.8 (d), 66.4 (t), 75.4 (t), 122.7 (s)

^{13}C NMR for the cis/trans mixture: 15.1 (q), 25.8 (t), 27.2 (d), 27.8 (t), 28.3 (d), 28.4 (t), 29.3 (t), 36.8 (d), 37.2 (d), 66.4 (t), 75.4 (t), 75.5 (t), 122.6 (s); 122.7 (s)

C) Preparation of 3-pentylcyclopentanecarbonitrile

Preparation of 2-(tert-butoxymethylene)-5-pentylcyclopentanone

In a 100ml two-necked flask, 60g of 2-(hydroxymethylene)-5-pentylcyclopentanone (*Org.Let.* **2001**, *12*; 1897) was dissolved in cyclohexane (160ml). After addition of 59,91 ml of tert-butanol and 100 mg of p-toluenesulfonique acid monohydrate, the mixture was heated under reflux 4 hours while the water formed was collected by a Dean-Stark trap. The reaction mixture was added to an ice cooled solution of $NaHCO_3$ (200ml) and extracted with diethylether (200ml). The organic layer was washed with water, dried over magnesium sulfate, and concentrated under reduced pressure to give 70.18g of crude product. Distillation (B.p. 150°C under 0.4 mbar) gave 2-(tert-butoxymethylene)-5-pentylcyclopentanone in 71% yield

^{13}C NMR: 14.1 (q), 22.6 (t), 23.1 (t), 27.0 (t), 27.2 (t), 28.3 (q), 30.3 (t), 31.9 (t), 49.7 (d), 79.6 (s), 116.3 (s), 148.1 (d), 209.2 (s)

Preparation of (3-pentyl-1-cyclopenten-1-yl)methanol

To a solution of 2-(tert-butoxymethylene)-5-pentylcyclopentanone (40.64g) in ethanol (400ml) was added $NaBH_4$ (7.42g). The reaction mixture was stirred for 2 days.

Then poured onto in water (200ml) and HCl (10%) (100ml), extracted with diethyl ether (200ml). The organic layer was washed with water, dried over magnesium sulfate, filtered and concentrated under reduced pressure to give 30.94g of a mixture of 46% 3-pentyl-1-cyclopentene-1-carbaldehyde and 22% (3-pentyl-1-cyclopenten-1-yl)methanol.

A distillation on a Widmer column (B.p. 55-76°C under 0.6-0.4 mbar) gave 22.5g of pure aldehyde.

^{13}C NMR of the aldehyde: 14.0 (q), 22.6 (t), 27.5 (t), 27.8 (t), 29.8 (t), 31.9 (t), 34.7 (t), 46.7 (d), 146.9 (s), 156.7 (d), 190.1 (d)

^{13}C NMR of the alcohol: 14.1 (q), 22.7 (t), 27.7 (t), 30.5 (t), 32.0 (t), 32.1 (t), 36.1 (t), 45.5 (d), 62.2 (t), 129.9 (d), 143.6 (s)

Preparation of 3-pentylcyclopentanecarbaldehyde

To a solution of 3-pentyl-1-cyclopentene-1-carbaldehyde (14.63g) in ethylacetate (40ml) was added 10% Pd on charcoal (150mg).The reaction mixture was stirred under atmospheric pressure of hydrogen for 6 hours, then filtered, concentrated under reduced pressure to give 13.9g of crude product. Distillation (B.p. 90°C 0.41mbar) gave 11g of pure 3-pentylcyclopentanecarbaldehyde (70/30 cis/trans; 87% yield).

^{13}C NMR of the major isomer : 14.1 (q), 22.7 (t), 25.8 (t), 28.3 (t), 32.1 (t), 32.2 (t), 33.4 (t), 35.5 (t), 40.8 (d), 51.6 (d), 204.0 (d)

Preparation of 3-pentylcyclopentanecarbonitrile

Starting from 2.57g of 3-pentylcyclopentanecarbaldehyde described above and following the procedure described for 4-isobutylcyclohexanecarbonitrile, were obtained 2.05 g of crude 3-pentylcyclopentanecarbonitrile.

Then a bulb-to-bulb distillation (90-100 °C / 0.27 mbar) gave 1.75 g of pure product (2 isomers 30/70).

^{13}C NMR : Major isomer: 14.0 (q), 22.6 (t), 27.4 (d), 28.2 (t), 30.4 (t), 31.6 (t), 32.0 (t), 35.5 (t), 38.0 (t), 40.1 (d), 123.5 (s)

Minor isomer: 14.0 (q), 22.6 (t), 27.6 (d), 28.1 (t), 30.9 (t), 31.6 (t), 32.0 (t), 35.3 (t), 37.3 (t), 39.2 (d), 125.0 (s)

D) Preparation of 4-(4-methylpentyl)-1-cyclohexanecarbonitrile

Starting from 2g (9.89mmol) of 4-(4-methylpentyl)-1-cyclohexanecarbaldehyde (described in *Bul.Soc.Chim.Fr.* 391; **1956**) and following the procedure described for 4-isobutylcyclohexanecarbonitrile, were obtained 1.99 g of crude 4-(4-methylpentyl)-1-cyclohexanecarbonitrile. Bulb-to-bulb distillation at 115 °C/ 15 mbar gave 1.63 g.

^{13}C NMR: 22.6 (q), 24.4 (t), 27.9 (d), 28.4 (d), 29.8 (t), 31.6 (t), 36.3 (d), 37.0 (t), 39.2 (t), 122.9 (s)

Example 2

Preparation of a perfuming composition

A powder detergent's perfuming composition, of the lemon type, was prepared by admixing the following ingredients :

Ingredient	Parts by weight
Linalyl acetate	130
Anisic aldehyde	30
C 10 aldehyde	70
C 8 aldehyde	30
MNA aldehyde	90
Carvone Gauche	110
Citral	135
1,1-Diethoxy-3,7-dimethyl-2,6-octadiene	10
Verdyl acetate	70
Verdyl propionate	60
Eucalyptus essential oil	30
Geraniol	160

Linalool	165
Hedione® [1]	80
10%* Neobutenone Alpha® [2]	15
10%* Cis-2-methyl-4-propyl-1,3-oxathiane[3]	15
Terpenes ex orange	320
Verdox® [4]	320
Vertofix Cœur® [5]	160
2,4-Dimethyl-3-cyclohexene-1-carbaldehyde	100
	2100

* in dipropyleneglycol

1) methyl cis-dihydrojasmonate; origin: Firmenich SA, Geneva, Switzerland
2) 1-(5,5-dimethyl-1-cyclohexen-1-yl)-4-penten-1-one; origin: Firmenich SA, Geneva, Switzerland
3) origin: Firmenich SA, Geneva, Switzerland
4) 2-tert-butyl-1-cyclohexyl acetate; origin : International Flavors & Fragrances, USA
5) methyl cedryl ketone; origin: International Flavors & Fragrances, USA

The addition of 200 parts by weight of 4-isobutylcyclohexanecarbonitrile (cis/trans = 30/70) to the above-described composition imparted to the letter a reinforced lemon connotation, which was more clean and functional. The use of the prior art cycloalkylnitriles provided totally different results.

Example 3

Preparation of a perfuming composition

A dish wash's perfuming composition, of the verbena type, was prepared by admixing the following ingredients :

Ingredient	Parts by weight
Benzyl acetate	150
Cis-3-Hexenol acetate	10
Nonanyl acetate	100
Terpenyl acetate	250

Hexyl acetate	30
Anisic aldehyde	20
10%* Benzoic aldehyde	20
C 10 aldehyde	20
C 11 aldehyde	20
C 8 aldehyde	15
C 9 aldehyde	10
Hexylcinnamic aldehyde	200
Amione	10
Methyl anthranilate	10
Amyl butyrate	5
Cis-3-Hexenol	10
Citronellal	40
Citronellol	200
Coumarine	20
Cis-2-pentyl-1-cyclopentanol (1)	40
10%* Damascenone Total (1)	20
10%* Damascone Alpha	40
Decal	10
Diethyl 1,4-cyclohexane dicarboxylate de (1)	80
Geraniol	500
Clove essential oil	20
Hedione® (2)	250
1,3-Benzodioxole-5-carbaldehyde (1)	20
Helvetolide® (3)	30
Iso E Super® (4)	100
Lavandin Grosso	20
Lemongrass Oil	40
1-P-menthene-9-carbaldehyde	100
Linalool	200
10%* Menthone	40
10%* Muscenone Delta(1)	40
10%* Cis-2-methyl-4-propyl-1,3-oxathiane(5)	20

1%* (2E,6Z)-2,6-Nonadienal	10
Amyl salicylate	100
Sclareolate® 6)	130
Undecalactone gamma	30
	2980

* in dipropyleneglycol

1) origin: Firmenich SA, Geneva, Switzerland
2) methyl cis-dihydrojasmonate; origin: Firmenich SA, Geneva, Switzerland
3) (1S,1'R)-2-[1-(3',3'-dimethyl-1'-cyclohexyl)ethoxy]-2-methylpropyl propanoate; origin: Firmenich SA, Geneva, Switzerland
4) 1-(octahydro-2,3,8,8-tetramethyl-2-naphtalenyl)-1-ethanone; origin: International Flavors & Fragrances, USA
5) 3-methyl-5-cyclopentadecen-1-one; origin: Firmenich SA, Geneva, Switzerland
6) propyl (S)-2-(1,1-dimethylpropoxy)propanoate; origin: Firmenich SA, Geneva, Switzerland

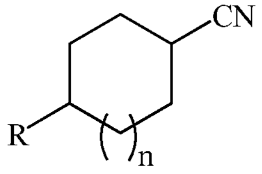
The addition of 250 parts by weight of 4-isobutylcyclohexanecarbonitrile (cis/trans = 30/70) to the above-described composition imparted to the letter a clear lemony, verbena aspect.

If instead of the invention compounds were used other lemony nitrile (i.e. geranyl nitrile, citronellyl nitrile, 3,7-dimethyl-2,6-nonadienenitrile) the result was a reinforcement of the lemony aspect but without imparting/reinforcing a verbena character.

Again, the use of the prior art cycloalkylnitriles provided totally different results.

Claims

1. Use as perfuming ingredient of a compound of formula (I)



(I)

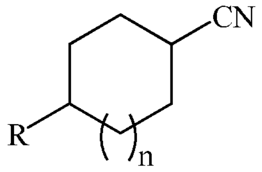
in the form of any one of its stereoisomers or a mixture thereof, and wherein n represents 0 or 1, and R represents a C_{3-7} linear, branched or cyclic alkyl or alkenyl group optionally comprising an oxygen atom.

2. Use according to claim 1, characterized in that R represents a C_{4-6} branched or cyclic alkyl or alkenyl group.

3. Use according to claim 1, characterized in that n is 1 and R represents a C_{4-6} branched or cyclic alkyl or alkenyl group.

4. Use according to claim 1, characterized in that said compound is cis 4-isobutylcyclohexanecarbonitrile, trans 4-isobutylcyclohexanecarbonitrile, or 4-isobutylcyclohexanecarbonitrile in the form of a mixture of isomers cis/trans = 30/70.

5. A compound of formula



(I)

in the form of any one of its stereoisomers or a mixture thereof, and wherein n is 0 or 1 and R represents a C_{4-6} branched or cyclic alkyl or alkenyl group, provided that 4-isopropylcyclohexanecarbonitrile, 4-bicyclohexyl-carbonitrile and 4-terbutylcyclohexanecarbonitrile are excluded.

6. As a compound of claim 5, cis 4-isobutylcyclohexanecarbonitrile, trans 4-isobutylcyclohexanecarbonitrile, or 4-isobutylcyclohexanecarbonitrile in the form of a mixture of isomers cis/trans = 30/70.

7. A perfuming ingredient in the form of a composition comprising

i) at least one compound of formula (I), as defined in claim 1;
ii) at least one ingredient selected from the group consisting of a perfumery carrier and a perfumery base; and
iii) optionally at least one perfumery adjuvant.

8. A perfumed article comprising:

i) as perfuming ingredient, at least one invention's compound, as defined above; and
ii) a perfumery base.

9. A perfumed article according to claim 8, characterized in that the perfumery base is a perfume, a fabric care product, a body-care product, an air care product or a home care product.

10. A perfumed article according to claim 8, characterized in that the perfumery base is a fine perfume, a cologne, an after-shave lotion, a liquid or solid detergent, a fabric softener, a fabric refresher, an ironing water, a paper, a bleach, a shampoo, a coloring preparation, a hair spray, a vanishing cream, a deodorant or antiperspirant, a perfumed soap, shower or bath mousse, oil or gel, a hygiene product, an air freshener, a "ready to use" powdered air freshener, a wipe, a dish detergent or hard-surface detergent.

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2010/053919

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61K8/40 A61Q13/00 C11B9/00 C11D3/50
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A61K A61Q C07C C11B C11D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, CHEM ABS Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	FLEMING FRASER F ET AL: "Metalated nitriles: halogen-metal exchange with alpha-halonitriles", ORGANIC LETTERS, AMERICAN CHEMICAL SOCIETY, US, vol. 6, no. 4, 28 January 2004 (2004-01-28), pages 501-503, XP009100697, ISSN: 1523-7060, DOI: DOI:10.1021/OL036202S cited in the application compound 3c -----	1-10
A	WO 96/18604 A1 (QUEST INT) 20 June 1996 (1996-06-20) claims ----- -/--	1-10

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search 10 January 2011	Date of mailing of the international search report 24/01/2011
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Hillebrecht, Dieter

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 146 507 A (DESIMONE ROBERT S) 27 March 1979 (1979-03-27) column 1, line 58 - line 66; claims -----	1-10
A	WO 2008/117254 A1 (FIRMENICH & CIE) 2 October 2008 (2008-10-02) cited in the application page 3, line 3 - line 8; claims -----	1-10

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IB2010/053919

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9618604 A1	20-06-1996	AU 4343196 A	03-07-1996
		DE 69510086 D1	08-07-1999
		DE 69510086 T2	28-10-1999
		EP 0797569 A1	01-10-1997
		ES 2133179 T3	01-09-1999
		JP 11501614 T	09-02-1999
		ZA 9510701 A	17-06-1997
US 4146507 A	27-03-1979	AU 511611 B2	28-08-1980
		BE 858818 A1	16-03-1978
		CA 1095424 A1	10-02-1981
		CH 625703 A5	15-10-1981
		DE 2748054 A1	27-04-1978
		FR 2369251 A1	26-05-1978
		GB 1545171 A	02-05-1979
		IL 53216 A	30-01-1981
		IT 1087093 B	31-05-1985
		JP 1359377 C	13-01-1987
		JP 53052635 A	13-05-1978
		JP 61026765 B	21-06-1986
		NL 7710850 A	28-04-1978
WO 2008117254 A1	02-10-2008	CN 101657183 A	24-02-2010
		EP 2134318 A1	23-12-2009
		JP 2010522797 T	08-07-2010
		US 2010267607 A1	21-10-2010