

Aryl-acrylic acid esters

The present invention relates to 3-(2-substituted aryl)-acrylic acid esters, especially 3-(2-hydroxyaryl)-acrylic acid esters and 3-(2-aminoaryl)-acrylic acid esters. These compounds are useful as precursors for organoleptic compounds, especially for flavours, fragrances and masking agents, antimicrobial compounds and for fluorescent whitening agents.

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A principal strategy currently employed in imparting odours to consumer products is the admixing of the fragrance directly into the product. There are, however, several drawbacks to this strategy. The fragrance material can be too volatile and/or too soluble, resulting in fragrance loss during manufacturing, storage, and use. Many fragrance materials are also unstable over time. This again results in loss during storage.

20 In many consumer products it is desirable for the fragrance to be released slowly over time. Micro-encapsulation and inclusion complexes with cyclodextrins have been used to help decrease volatility, improve stability and provide slow-release properties. However, these methods are for a number of reasons often not successful. In addition, cyclodextrins can be too expensive.

30 Fragrance precursors for scenting fabrics being washed in the presence of a lipase-containing detergent are described in WO 95/04809. The fragrance precursors

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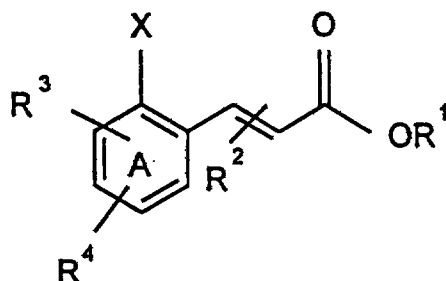


contained in the detergent and/or in the softener are cleaved by the lipase and a single active compound, either an odoriferous alcohol or aldehyde or ketone is yielded. Thereby a prolonged scenting effect on the fabric is
5 obtained. The need for a lipase-containing detergent is limiting. In many parts of the world, detergents do not contain lipase. Other consumers prefer to use 'nonbio' detergents.

10 Fluorescent whitening agents or brighteners have been added to laundry detergents since the 1950s to help maintain the original brightness of white clothing.

One object of the present invention is to provide new
15 precursors for compounds with different activities and thus impart different activities to a product by the addition of just one compound. A further object of the invention is to provide new compounds which are stable under transport and storage conditions. A further object
20 of the present invention is to provide precursor molecules supplying different active compounds simultaneously or successively.

The present invention relates to 3-(2-substituted aryl)-
25 acrylic acid esters of the formula I



wherein

5 A is a benzene or naphthalene ring,

R¹ is a saturated or unsaturated, straight, branched, alicyclic or aromatic C₁₀-C₃₀ hydrocarbon residue which can contain heteroatoms and can be substituted by an ionic
10 substituent,

R² in 2- or 3-position is hydrogen, a straight or branched C₁-C₆ residue; an optionally substituted aromatic or optionally substituted heterocyclic residue,
15

R³ and R⁴ stand for hydrogen, a straight or branched C₁-C₆ alkyl or C₁-C₆ alkoxy residue, a substituted or condensed heterocyclic residue, -OH, -NO₂, -NH₂, -N(C₁-C₆ alkyl)₂, -N(hydroxyalkyl)₂, -NHCO₂CH₃ or -NH(heterocycle),
20

R², R³ and R⁴ may be the same or different,

X stands for -OH or NHR⁶, wherein R⁶ is hydrogen a saturated or unsaturated, straight or branched C₁-C₂₂ hydrocarbon or an optionally substituted aromatic or
25 heterocyclic residue,

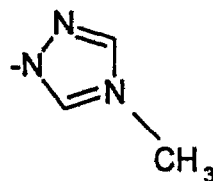
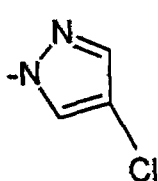
and the acrylic double bond is of the E configuration.

In the above formula I, all possible enantiomers and
5 diastereomers and all mixtures are included within the
scope of the invention.

Compounds wherein R^1 is a saturated or unsaturated,
straight or branched C_{10} - C_{30} hydrocarbon residue containing
10 one or more O and/or N atoms and/or C(O) groups and/or
alkoxy groups or substituted by an ionic substituent of
the formula $NR^5_3^+$, in which R^5 is the residue of a fatty
acid or an alkyl group with 1 to 30 carbon atoms are
preferred.

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R^2 is preferably a heterocyclic residue of the formula

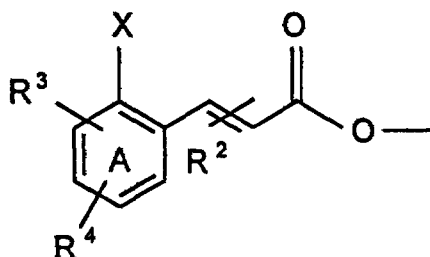


20 R^3 and/or R^4 are preferably hydrogen, $-N(C_1-C_6 \text{ alkyl})_2$,
 $-NH_2$, a five membered heterocyclic residue optionally
containing N and/or O atoms, substituted by C_1-C_6
aliphatic and/or aromatic substituents.

25 R^1 may be the residue of an olfactory alcohol of the
formula R^1OH , the enol form of an olfactory aldehyde of
the formula R^1HO or of an olfactory ketone of formula R^1O .
 R^1 may also be an optionally substituted alkyl, alkenyl or

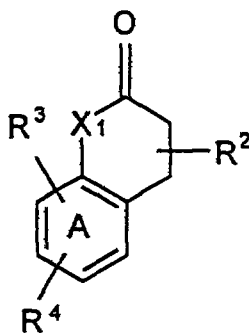
arylalkyl residue carrying an 1-alkoxy, 1-aryloxy, or 1-arylalkoxy residue.

The compounds of formula I are mostly or nearly odourless at room temperature, atmospheric conditions and about 20 to 100 % relative humidity. However, under activating conditions, they are cleaved. Thereby the residue of formula Ia



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yields a coumarin of the formula II



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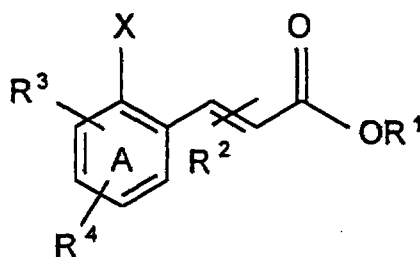
wherein X^1 stands for O or NR^6 , R^2 , R^3 , R^4 have the meaning as defined above. The coumarins of formula II can have organoleptic and/or antimicrobial properties and/or optical brightening activity. Preferred are coumarins with olfactory properties. If R^1 is the residue of an olfactory alcohol or of the enol form of an olfactory aldehyde or



ketone, upon cleavage two active compounds with the above properties can be obtained. Thus, the compounds of formula I permit the development of useful consumer products with enhanced organoleptic and/or antimicrobial properties and/or optical brightening properties. The organoleptic coumarins and alcohols or aldehydes or ketones obtained are useful as fragrances, flavours, masking agents and antimicrobial agents.

The activating conditions which lead to cleavage and thereby to the desired active compounds comprise the presence of UV light such as sunlight and elevated temperatures.

The invention relates also to the use of compounds of formula I



wherein

A is a benzene or naphthalene ring,

R¹ is hydrogen, unsaturated or saturated, straight or branched, alicyclic or aromatic C₁-C₃₀ hydrocarbon residue which can contain heteroatoms and can be substituted by an ionic substituent,

R^2 in 2- or 3-position is hydrogen, a straight or branched C_1-C_6 residue; an optionally substituted aromatic or optionally substituted heterocyclic residue,

5

R^3 and R^4 stand for hydrogen, a straight or branched C_1-C_6 alkyl or C_1-C_6 alkoxy residue, a substituted or condensed heterocyclic residue, $-OH$, $-NO_2$, $-NH_2$, $-N(C_1-C_6 \text{ alkyl})_2$, $-N(\text{hydroxyalkyl})_2$, $-NHCO_2CH_3$ or $-NH(\text{heterocycle})$,

10

R^2 , R^3 and R^4 may be the same or different,

X stands for $-OH$ or NHR^6 , wherein R^6 is hydrogen a saturated or unsaturated, straight or branched C_1-C_{20} hydrocarbon or an optionally substituted aromatic or heterocyclic residue,

and the acrylic double bond is of the E configuration,

as precursors for organoleptic compounds, e.g. flavours, fragrances, odour masking agents and as precursors for antimicrobial agents and as precursors for fluorescent whitening agents.

Preferred substituents are mentioned above.

The esters of formula I can act as fragrance precursors in laundry products. They can also act as precursors for odour masking agents in the same products as the fragrance precursors. They also can act as precursors for antimicrobial agents. In addition, they can also act as

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precursors for fluorescent whitening agents. The fragrance precursors and the precursors for odour masking agents as well as the flavour precursors of the invention may be used individually in an amount effective to enhance or to
5 mask the characteristic odour or flavour of a material. More commonly, however, the compounds are mixed with other fragrance or flavour components in an amount sufficient to provide the desired odour or flavour characteristics..

10 The brightener precursors may be used also individually in an effective amount and mixed with one or more other brightener or colorant substance.

Due to the in situ generation of the active compounds the
15 desired effect is prolonged and the substantivity on different substrates is enhanced. If two active compounds are provided by one ester of the formula I, they can be generated, depending on the precursor and/or the activating conditions, simultaneously or successively.
20 Further, the precursors of the invention provide slow release of the active compounds.

Examples of alcohols R^1OH generated upon cleavage and constituting the residue R^1 in the compounds of formula I
25 are:

amyl alcohol
hexyl alcohol*
2-hexyl alcohol*
30 heptyl alcohol*
octyl alcohol*

- nonyl alcohol*
- decyl alcohol*
- undecyl alcohol*
- lauryl alcohol*
- 5 myristic alcohol
- 3-methyl-but-2-en-1-ol*
- 3-methyl-1-pentanol
- cis-3-hexenol*
- cis-4-hexenol*
- 10 3,5,5-trimethyl-hexanol
- 3,4,5,6,6-pentamethylheptan-2-ol*
- citronellol*
- geraniol*
- oct-1-en-3-ol
- 15 2,5,7-trimethyl-octan-3-ol
- 2-cis-3,7-dimethyl-2,6-octadien-1-ol
- 6-ethyl-3-methyl-5-octen-1-ol*
- 3,7-dimethyl-oct-3,6-dienol*
- 3,7-dimethyloctanol*
- 20 7-methoxy-3,7-dimethyl-octan-2-ol*
- cis-6-nonenol*
- 5-ethyl-2-nonanol
- 6,8-dimethyl-2-nonanol*
- 2,2,8-trimethyl-7(8)-nonene-3-ol
- 25 nona-2,6-dien-1-ol
- 4-methyl-3-decen-5-ol*
- dec-9-en-1-ol
- benzylalcohol
- 2-methyl-undecanol
- 30 10-undecen-1-ol
- 1-phenyl-ethanol*

- 2-phenyl-ethanol*
- 2-methyl-3-phenyl-3-propenol
- 2-phenyl-propanol*
- 3-phenyl-propanol*
- 5 4-phenyl-2-butanol
- 2-methyl-5-phenyl-pentanol*
- 2-methyl-4-phenyl-pentanol*
- 3-methyl-5-phenyl-pentanol*
- 2-(2-methylphenyl)-ethanol*
- 10 4-(1-methylethyl)-benzene-methanol
- 4-(4-hydroxyphenyl)-butan-2-one*
- 2-phenoxy-ethanol*
- 4-(1-methylethyl)-2-hydroxy-1-methyl benzene
- 2-methoxy-4-methyl-phenol
- 15 4-methyl-phenol
- anisic alcohol*
- p-tolyl alcohol*
- cinnamic alcohol*
- vanillin*
- 20 ethyl vanillin*
- eugenol*
- isoeugenol*
- thymol
- anethol*
- 25 decahydro-2-naphthalenol
- borneol*
- cedrenol*
- farnesol*
- fenchyl alcohol*
- 30 menthol*
- 3,7,11-trimethyl-2,6,10-dodecatrien-1-ol

- alpha ionol*
 tetrahydro ionol*
 2-(1,1-dimethylethyl)cyclohexanol*
 3-(1,1-dimethylethyl)cyclohexanol*
 5 4-(1,1-dimethylethyl)cyclohexanol*
 4-isopropyl-cyclohexanol
 6,6-dimethyl-bicyclo[3.3.1]hept-2-ene-2-ethanol
 6,6-dimethyl-bicyclo[3.1.1]hept-2-ene-methanol*
 p-menth-8-en-3-ol*
 10 3,3,5-trimethyl-cyclohexanol
 2,4,6-trimethyl-3-cyclohexenyl-methanol*
 4-(1-methylethyl)-cyclohexyl-methanol*
 4-(1,1-dimethylethyl)-cyclohexanol
 2-(1,1-dimethylethyl)-cyclohexanol
 15 2,2,6-trimethyl-alpha-propyl-cyclohexane propanol*
 5-(2,2,3-trimethyl-3-cyclopentenyl)-3-methylpentan-2-ol*
 3-methyl-5-(2,2,3-trimethylcyclopentyl-3-enyl)pent-
 4-en-2-ol*
 2-ethyl-4(2,2,3-trimethylcyclopentyl-3-enyl)but-2-en-1-ol*
 20 4-(5,5,6-trimethylbicyclo[2.2.1]hept-2-yl)-cyclohexanol*
 2-(2-methylpropyl)-4-hydroxy-4-methyl-tetrahydropyran*
 2-cyclohexyl-propanol*
 2-(1,1-dimethylethyl)-4-methyl-cyclohexanol*
 1-(2-tert-butyl-cyclohexyloxy)-2-butanol*
 25 1-(4-isopropyl-cyclohexyl)-ethanol*
 2,6-dimethyl-oct-7-en-2-ol**
 2,6-dimethyl-heptan-2-ol**
 3,7-dimethyl-octa-1,6-dien-3-ol**
 30 whereby * indicates the preferred alcohols and ** indicate
 the more preferred alcohols.

Examples of aldehydes R^1HO generated upon cleavage and constituting the residue R^1 in the compounds of formula I are

- 5 2,6,10-trimethylundec-9-enal*
- 1,2,3,4,5,6,7,8,-octahydro-8,8-dimethyl-2-napthalenecarboxaldehyde
- tridecanal
- 2-[4-(1-methylethyl)phenyl]-ethanal
- 10 2,4-dimethyl-cyclohex-3-ene-1-carbox-aldehyde*
- 4-carboxaldehyde-1,3,5-trimethyl-cyclohex-1-ene*
- 1-carboxaldehyde-2,4-dimethyl-cyclohex-3-ene*
- 1-carboxaldehyde-4-(4-hydroxy-4-methylpentyl)-cyclohex-3-ene*
- 15 3,5,5-trimethyl-hexanal
- heptanal*
- 2,6-dimethyl-hept-5-enal*
- decanal**
- dec-9-enal
- 20 dec-4-enal
- 2-methyldecanal*
- undec-10-enal**
- undecanal*
- dodecanal**
- 25 2-methyl-undecanal**
- tridecanal
- octanal**
- nonanal*
- 3,5,5-trimethylhexanal
- 30 undec-9-enal**
- 2-phenyl-propanal*

- 4-methyl-phenyl-acetaldehyde*
- 3,7-dimethyl-octanal*
- dihydrofarnesal**
- 7-hydroxy-3,7-dimethyl-octanal*
- 5 2,6-dimethyl-oct-5-enal
- 2-[4-(1-methylethyl)phenyl]-ethanal*
- 3-(3-isopropyl-phenyl)-butanal**
- 2-(3,7-dimethyloct-6-enoxy)-ethanal
- 1-carboxaldehyde-4-(4-methyl-3-pentenyl)-cyclohex-3-ene*
- 10 2,3,5,5,-tetramethyl-hexanal
- longifolic aldehyde
- 2-methyl-4-(2,6,6-trimethylcyclohex-2-en-1-yl)-butanal*
- 2-methyl-3-(4-tert-butylphenyl)-propanal**
- 4-(1,1-dimethyl-ethyl)-benzene-propanal*
- 15 2-[4-(1-methyl-ethyl)-phenyl]-propanal
- alpha-methyl-1,3-benzodioxole-5-propanal*
- 3,7-dimethyl-oct-6-enal*
- 2-methyl-3-(4-isopropylphenyl)-propionaldehyde*
- 4-(4-hydroxy-4-methyl-pentyl)-cyclohex-3-en-1-
- 20 carboxaldehyde**
- alpha-methyl-1,3-benzodioxole-5-propanal*
- 1-carboxaldehyde-4-(1,1-dimethylethyl)-cyclohexane
- 4-(octahydro-4,7-methano-5H-inden-5-ylidene)-butanal
- [(3,7-dimethyl-6-octenyl)-oxy]-acetaldehyde**

25

whereby * indicates the preferred aldehydes and **
indicate the more preferred aldehydes.

Examples of ketones R¹O:

- 2-heptyl-cyclopentanone
- 2,2,6,10-tetramethyltricyclo-[5.4.0.0(6,10)]-undecan-4-one
- 5 benzylacetone*
- carvone*
- 1,2,3,5,6,7-hexahydro-1,1,2,3,3,-pentamethyl-4H-inden-4-one*
- methyl heptenone*
- 10 dimethyl octenone*
- 2-(butan-2-yl)-cyclohexanone*
- 2-hexyl-cyclopent-2-en-1-one*
- 2-(1-methylethyl)-5-methyl-cyclohexanone*
- 2-(2-methylethyl)-5-methyl-cyclohexanone*
- 15 3-methyl-cyclopentadecanone
- 4-tert-pentyl-cyclohexanone*
- 3-oxo-2-pentyl-cyclopentane-acetic acid methyl ester**
- 1-(1,2,3,4,5,6,7,8-octahydro-2,3,8,8-tetramethyl-2-naphthalenyl)-ethanone*
- 20 3-methyl-5-propyl-cyclohex-2-en-1-one*

whereby * indicates the preferred ketones and ** indicate the more preferred ketone.

- 25 Examples of fluorescent whitening coumarins of formula II generated upon cleavage and constituting the respective residue in the compounds of formula I are:

- 7-(3-methyl-1H-pyrazol-1-yl)-3-phenyl-2H-1-benzopyran-
- 30 2-one
- 7-(4-methyl-5-phenyl-2H-1,2,3-triazol-2-yl)-3-phenyl-2H-1-

benzopyran-2-one

7-(2H-naphtho[1,2-d]triazol-2-yl)-3-phenyl-2H-1-benzopyran-2-one

3-(1H-pyrazol-1-yl)-7-(2H-1,2,3-triazol-2-yl)-2H-1-benzopyran-2-one

7-(dimethylamino)-1-methyl-3-phenyl-2(1H)-quinolinone

7-(diethylamino)-1-ethyl-3-phenyl-2(1H)-quinolinone

7-amino-4-methyl-2H-1-benzopyran-2-one

7-(dimethylamino)-4-methyl-2H-1-benzopyran-2-one

7-(diethylamino)-4-methyl-2H-1-benzopyran-2-one

7-hydroxy-4-methyl-2H-1-benzopyran-2-one

6,7-dihydroxy-2H-1-benzopyran-2-one

Examples for coumarins of formula II with olfactory properties generated upon cleavage and constituting the respective residue in the compounds of formula I are:

2H-1-benzopyran

3-methyl-benzopyran-2-one

8-(1,1-dimethylethyl)-6-methyl-benzopyrone

4-methyl-7-ethoxy-coumarin

6-methyl-2H-1-benzopyran

It is a matter of course, that it is not possible to give a complete list of the active coumarins, alcohols, aldehydes and ketones which are generated as a result of the desired cleavage of the acrylic acid esters of formula I by UV-light and/or by elevated temperatures. The skilled person is, however, quite aware of those alcohols, aldehydes, ketones and coumarins which provide the desired

organoleptic, e.g. fragrance, flavour and odour masking, antimicrobial and/or brightening effects.

The compounds of formula I may preferably be used as
5 sustained release odorants and flavours but also as
sustained agents to mask or attenuate undesirable odours
or to provide additional odours not initially present in
consumer products, i.e. laundry detergents, fabric
softeners, fabric softener sheets, toiletries and
10 cosmetics such as sunscreens. Further applications are
sustained brighteners and antimicrobial agents in the same
products. The brighteners are especially useful for wool,
rayon and polyamides. These compounds are also useful for
flavouring and aromatizing tobacco products, e.g.
15 cigarettes.

The amount required to produce the desired, overall effect
varies depending upon the particular compounds of formula
I chosen, the product in which it will be used, and the
20 particular effect desired.

For example, depending upon the selection and
concentration of the compound chosen, when a compound of
the formula I is added either singly or as a mixture, e.g.
25 to a laundry product composition at levels ranging from
about 0.001 to about 10 % by weight, a coumarin and if
desired an odoriferous alcohol or aldehyde or ketone in an
organoleptically effective amount is released when the
product is used. These newly formed odorant(s) serve to
30 enhance the odour of the fragrance. Depending on the

compound of formula I an antimicrobial agent or a brightener can be released.

Depending upon the selection and concentration, addition of the compounds I, either singly or as a mixture, to
5 cigarette tobacco at levels ranging from about 5 ppm to about 50'000 ppm tends to enhance the smoking flavour and/or mask undesirable smoking odours. An important property of these compounds I is that the flavourant or odorant is covalently bound as a non-volatile compound and
10 the flavourant or odorant is released only when the tobacco product is ignited and burns.

Addition of the compounds of formula I either separately or as a mixture at levels suitably ranging from about 5
15 ppm to about 50'000 ppm by weight onto the media enclosing the tobacco serves to incorporate the odorant/flavourant in the side-stream smoke of the tobacco. Air borne flavourants and/or odorants are thus introduced. This newly formed odorant or flavourant serves to enhance or
20 mask the smoking odours depending upon selection and use levels of the compounds I.

As is evident from the above compilation of alcohols, aldehydes, ketones and coumarins, a broad range of known
25 odorants or flavours or mixtures can be generated from precursors of the invention. While manufacturing compositions the precursors of the invention may be used according to methods known to the perfumer, such as e.g. from W.A. Poucher, Perfumes, Cosmetics, Soaps, 2, 7th
30 Edition, Chapman and Hall, London 1974. The fluorescent whitening agents may be added in the same manner.

The compounds of formula I can be prepared by using standard methods known to the skilled chemist. Convenient methods are outlined in the Examples without limiting the invention thereto.

5

Example 1

(E)-3-(2-Hydroxy-phenyl)-2-methyl-acrylic acid ethyl ester

10 To a solution of 75.0 g (carbethoxyethylidene)triphenyl phosphorane in 350 ml of toluene, 23.2 g of salicylaldehyde was dropped in at 20°C while cooling in an ice-bath. After stirring at room temperature for 90 min., the reaction mixture was diluted with toluene and washed
15 to neutrality with water. The organic phase was dried, filtered and evaporated to dryness. The resulting yellow oil was purified by chromatography to yield 35.5 g of a colourless solid.

20 NMR (CDCl₃) δ 7.82 (s, 1H), 7.30-6.85 (m, 4H), 6.6 (s, OH), 4.35-4.17 (q, 2H), 2.04 (s, 3H), 1.40-1.28 (t, 3H)

Example 2

25

(E)-3-(2-Hydroxy-phenyl)-acrylic acid methyl ester

According to the procedure of Example 1, (E)-3-(2-hydroxy-phenyl)-2-methyl-acrylic acid methyl ester was
30 prepared from methyl(triphenyl-phosphoranylidene)acetate and salicylaldehyde.

Example 3(E)-3-(2-Hydroxy-phenyl)-acrylic acid ethyl ester

- 5 According to the procedure of Example 1, (E)-3-(2-hydroxy-phenyl)-2-methyl-acrylic acid methyl ester was prepared from ethyl(triphenyl-phosphoranylidene)acetate and salicylaldehyde.

10 Example 4(E)-3-(2-Hydroxy-phenyl)-2-methyl-acrylic acid

- 15 To a solution of 35.5 g of (E)-3-(2-hydroxy-phenyl)-2-methyl-acrylic acid ethyl ester in 600 ml of ethanol, a solution of 10.66 g of potassium hydroxide in 500 ml of water was dropped in. After refluxing for 5 hours, another 5.0 g of potassium hydroxide was put in and the mixture was refluxed for another 19 hours. Then the
20 reaction mixture was cooled down, diluted with ether and washed to pH 4 with HCl 2N and water. The organic phase was dried, filtered and evaporated to dryness. The resulting colourless crystals were not further purified.

- 25 NMR (CDCl₃) δ 7.90 (s, 1H), 7.31-6.83 (m, 4H), 2.07 (s, 3H)

(E)-3-(2-Hydroxy-phenyl)-2-methyl-acrylic acid 3,7
dimethyl-oct-6-enyl ester

10

A solution of 6.0 g of (E)-3-(2-hydroxy-phenyl)-2-methyl-acrylic acid, 5.3 g of citronellol and 1 g of p-toluene-sulfonic acid in 150 ml of cyclohexane was refluxed for 6.5 hours using a water separator. Then the reaction mixture was cooled down, diluted with hexane and washed to neutrality with saturated sodium bicarbonate and water. The organic phase was dried, filtered and evaporated to dryness. The resulting yellow oil was purified by chromatography to yield 6.45 g of a colourless oil.

NMR (CDCl₃) δ 7.80 (s, 1H), 7.38-6.83 (m, 4H), 6.4 (s, OH), 5.09 (t, 1H) 4.25 (t, 2H), 2.10-1.90 (m, 5H), 1.88-1.08 (m, 11H), 0.93 (d, 3H)

Example 6

(E)-3-(2-Hydroxy-phenyl)-2-methyl-acrylic acid phenethyl
ester

According to the same procedure of Example 3, (E)-3-(2-hydroxy-phenyl)-2-methyl-acrylic acid phenethyl ester was prepared from 3-(2-hydroxy-phenyl)-2-methyl-acrylic acid, phenyl ethyl alcohol and p-toluenesulfonic acid.

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Example 73-(4-Diethylamino-2-hydroxy-phenyl)-but-2-enoic acid ethyl ester

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To a suspension of 5.27 g ethoxycarbonylmethylene-triphenylphosphorane in 10 ml of toluene, a solution of 2.02 g 1-(4-diethylamino-2-hydroxy-phenyl)-ethanone (DE 28 44 606) was dropped in at room temperature. Then the
 10 reaction mixture was heated to reflux. After refluxing for 31 hours the mixture was cooled down and evaporated to dryness. The resulting dark oil was purified by chromatography to yield a colourless oil.

15 NMR (CDCl₃) δ 7.22-7.09 (m, 1H), 6.57-6.42 (m, 1H),
 6.32-6.20 (m, 2H), 5.01 (s, 1H), 4.18-
 4.01 (q, 2H), 3.42-3.24 (q, 4H), 2.49
 (s, 3H), 1.31-1.08 (m, 9H).

20 The compounds of Examples 1-4 yield upon cleavage organoleptic coumarins, Examples 5 and 6 organoleptic coumarins and organoleptic alcohols and Example 7 a brightener coumarin.

25 Example 8(E)-3-(2-Hydroxy-5-methyl-phenyl)-acrylic acid ethyl ester

A solution of 193.7 g 3-[5-methyl-2-(tetrahydro-pyran-2-
 30 yloxy)-phenyl]-acrylic acid ethyl ester (Bunce, R., Moore, J., Org. Prep. Proc., 29(3), 293 (1997)) and 2 g p-toluenesulfonic acid in 2.5 l of ethanol was stirred at

room temperature for 24 hours. Then the reaction mixture was concentrated and the residue was diluted with ether, washed with saturated sodium bicarbonate and brine, dried and evaporated to dryness. The resulting yellow solid was
 5 recrystallized to yield 97.7 g of colourless crystals.

NMR (CDCl₃) δ 8.10-7.93 (d, 1H), 7.27 (s, 1H), 7.10-6.98 (d, 1H), 6.82-6.70 (d, 1H), 6.69-6.55 (d, 1H), 4.38-4.20 (q, 2H), 2.27 (s, 3H),
 10 1.42-1.28 (t, 3H) ppm.

(E)-3-(2-Hydroxy-phenyl)-acrylic acid

15 To a solution of 100.0 g 3-(2-hydroxy-phenyl)-acrylic acid ethyl ester in 500 ml of ethanol, a solution of 50.9 g potassium hydroxide in 500 ml of water was dropped in at room temperature. After stirring at reflux for 28 hours, the reaction mixture was concentrated. The residue was
 20 diluted with 500 ml HCl 2N and extracted with ether. The organic phase was washed with 2N HCl and water, dried and evaporated to dryness. The resulting solid was recrystallized to yield 44.3 g of colourless crystals.

25 NMR (DMSO) δ 12.2 (br s, 1H), 10.2 (br s, 1H), 7.95-7.75 (d, 1H), 7.65-7.50 (d, 1H), 7.32-7.15 (m, 1H), 6.99-6.76 (m, 2H), 6.62-6.45 (d, 1H) ppm.

30 (E)-3-(2-Hydroxy-phenyl)-acrylic acid dec-9-enyl ester

A mixture of 5.0 g 3-(2-hydroxy-phenyl)-acrylic acid ethyl ester, 6.1 g dec-9-en-1-ol and 1.0 g tetraisopropyl-orthotitanate was heated to 150°C removing the ethanol formed. After stirring for 2.5 hours at this temperature, the
 5 reaction mixture was cooled, diluted with ether and washed with brine. The organic phase was dried and evaporated to dryness. The resulting oil was Kugelrohr-distilled, crystallized and recrystallized to yield 1.69 g of colourless crystals.

10

NMR (CDCl₃) δ 8.11-7.96 (d, 1H), 7.55-7.40 (d, 1H),
 7.32-7.15 (m, 1H), 6.99-6.72 (m, 2H),
 6.71-6.57 (d, 1H), 5.93-5.69 (m, 1H),
 5.07-4.88 (m, 2H), 4.31-4.15 (t, 2H),
 15 2.12-1.93 (m, 2H), 1.85-1.55 (m, 2H),
 1.54-1.15 (m, 10H) ppm.

(E)-3-(2-Hydroxy-phenyl)-acrylic acid 2-ethyl-4-(2,2,3-trimethyl-cyclopent-3-enyl)-but-2-enyl ester

20

According to the same procedure, 3-(2-hydroxy-phenyl)-acrylic acid 2-ethyl-4-(2,2,3-trimethyl-cyclopent-3-enyl)-but-2-enyl ester was prepared from 3-(2-hydroxy-phenyl)-acrylic acid ethyl ester, 2-ethyl-4(2,2,3-trimethyl
 25 cyclopentyl-3-en-1-yl)-but-2-en-1-ol and tetraisopropyl-orthotitanate.

(E)-3-(2-Hydroxy-5-methyl-phenyl)-acrylic acid 2-ethyl-4-(2,2,3-trimethyl-cyclopent-3-enyl)-but-2-enyl ester

30

According to the same procedure, 3-(2-hydroxy-5-methyl-phenyl)-acrylic acid 2-ethyl-4-(2,2,3-trimethyl-cyclopent-3-enyl)-but-2-enyl ester was prepared from 3-(2-hydroxy-5-methyl-phenyl)-acrylic acid ethyl ester, 2-ethyl-4(2,2,3-trimethyl cyclopentyl-3-en-1-yl)-but-2-en-1-ol and tetraisopropyl-o-titanate.

(E)-3-(2-Hydroxy-5-methyl-phenyl)-acrylic acid 3-methyl-5-phenyl-pentyl ester

10

According to the same procedure, 3-(2-hydroxy-5-methyl-phenyl)-acrylic acid 3-methyl-5-phenyl-pentyl ester was prepared from 3-(2-hydroxy-5-methyl-phenyl)-acrylic acid ethyl ester, 3-methyl-5-phenyl-pentanol and tetraisopropyl-o-titanate.

(E)-3-(4-Diethylamino-2-hydroxy-phenyl)-but-2-enoic acid dec-9-enyl ester

20 According to the same procedure, 3-(4-diethylamino-2-hydroxy-phenyl)-but-2-enoic acid dec-9-enyl ester was prepared from 3-(4-diethylamino-2-hydroxy-phenyl)-but-2-enoic acid ethyl ester, dec-9-en-1-ol and tetraisopropyl-o-titanate.

25

(E)-3-(4-Diethylamino-2-hydroxy-phenyl)-but-2-enoic acid 3-methyl-5-phenyl-pentyl ester

30 According to the same procedure, 3-(4-diethylamino-2-hydroxy-phenyl)-but-2-enoic acid 3-methyl-5-phenyl-pentyl ester was prepared from 3-(4-diethylamino-2-hydroxy-

phenyl)-but-2-enoic acid ethyl ester, 3-methyl-5-phenyl-pentanol and tetraisopropyl-o-titanate.

Example 9

5

3-[2-(tert-Butyl-dimethyl-silanyloxy)-phenyl]-acrylic acid tert-butyl-dimethyl-silyl ester

To a solution of 5.0 g of (E)-3-(2-hydroxy-phenyl)-acrylic
10 acid and 4.6 g of imidazole in 100 ml of DMF was added at
room temperature a solution of 10.1 g of TBDMS-Cl. The
reaction mixture was stirred overnight, poured onto 200 ml
of cold water and extracted 3x with 150 ml of MTBE. The
combined organic phases were dried (MgSO₄) and evaporated
15 to dryness. The resulting oil was dried at 0.08 Torr/120-
170°C to remove excess of TBDMS-Cl to yield 11.4 g of 3-
[2-(tert-butyl-dimethyl-silanyloxy)-phenyl]-acrylic acid .
tert-butyl-dimethyl-silyl ester as a yellowish oil.

20 NMR (CDCl₃) δ 7.96 (d, 1H), 7.52 (dd, 1H), 7.23 (m, 1H),
6.94 (m, 1H), 6.82 (dd, 1H), 6.37 (d, 1H),
1.00 (s, 9H), 0.97 (s, 9H), 0.32 (s, 6H),
0.22 (s, 6H)

25 Example 10

3-[2-(tert-Butyl-dimethyl-silanyloxy)-phenyl]-acryloyl chloride

30 To a 0°C cold solution of 6.3 g of 3-[2-(tert-Butyl-
dimethyl-silanyloxy)-phenyl]-acrylic acid tert-butyl-

dimethyl-silyl ester and 8 drops of DMF in 15 ml of CH_2Cl_2 was added dropwise 2.0 ml of oxalyl chloride. After complete addition the reaction mixture was allowed to warm to room temperature and stirring was continued for 60 h.

- 5 The reaction mixture was filtered, evaporated to dryness and taken up in MTBE. The solution was cooled in the refrigerator overnight, filtered and evaporated to yield 4.4 g of 3-[2-(tert-Butyl-dimethyl-silanyloxy)-phenyl]-acryloyl chloride.

10

NMR (CDCl_3) δ 8.28 (d, 1H), 7.55 (dd, 1H), 7.35 (m, 1H), 7.01 (m, 1H), 6.87 (dd, 1H), 6.63 (d, 1H), 1.04 (s, 9H), 0.26 (s, 6H)

15 Example 11

3-(2-Hydroxy-phenyl)-acrylic acid 3-(3-isopropyl-phenyl)-but-1-enyl ester

- 20 To a suspension of 0.72 g of NaH (55% in oil), previously washed with hexane, in 22.5 ml of THF was added 1.67 ml of tert-butanol over a period of 12 min. The reaction mixture was stirred at room temperature for 1.25 h, was then cooled to -15°C and 2.85 g of 3-(3-isopropyl-phenyl)-
 25 butanal (Florhydral) was slowly added. Stirring was continued for 45 min. and then this cold enolate solution was added via Teflon canula to a -5°C cold solution of 4.44 g of 3-[2-(tert-butyl-dimethyl-silanyloxy)-phenyl]-acryloyl chloride in 7.5 ml of THF. After complete
 30 addition stirring at -5°C was continued for 1 h, the reaction mixture was quenched with 80 ml of water / 40 ml

of brine and was extracted with MTBE. The combined organic phases were washed with water/brine 2:1, dried (MgSO₄) and evaporated to dryness to yield 6.65 g of crude 3-[2-(tert-Butyl-dimethyl-silanyloxy)-phenyl]-acrylic acid 3-(3-isopropyl-phenyl)-but-1-enyl ester as a yellowish, viscous oil.

To a 0°C cold solution of 6.2 g of this oil in 70 ml of THF was added slowly 13.7 ml of a 1M TBAF/THF solution. The reaction mixture was stirred at 0°C for 1.5 h, poured onto 200 ml of H₂O and extracted 3x with 150 ml of MTBE. The combined organic phases were washed with brine, dried (MgSO₄) and evaporated to dryness. The resulting oil was purified by chromatography to yield 2.64 g of 3-(2-Hydroxy-phenyl)-acrylic acid 3-(3-isopropyl-phenyl)-but-1-enyl ester in form of a yellowish oil.

NMR (CDCl₃) δ 8.12 and 8.01 (d, 1H), 7.50-6.80 (m, 10H), 6.66 and 6.56 (d, 1H), 5.75 and 5.13 (m, 1H), 4.13 (m, CH), 3.53 (m, CH), 2.89 (m, CH), 1.42 (d, 3H), 1.25 (d, 6H)

Example 12

(E)-3-[2-(tert-Butyl-dimethyl-silanoxy)-phenyl]-acrylic acid

To a solution of 8.2 g of (E)-3-(2-hydroxy-phenyl)-acrylic acid and 15.2 g of TBDMS-Cl in 10 ml of DMF was added 11.9 g of imidazole and the mixture was stirred at room temperature for 24 h. After aqueous work-up, the bis-

silylated product was saponified with 2.1 g of LiOH in THF-H₂O for 0.5 h at 0°C. The mixture was concentrated in vacuo and TBDMS-OH removed by extraction with hexane. The aqueous layer was acidified to pH 4 with KHSO₄ and
 5 extracted with EtOAc. The organic phases were washed with brine, dried (Na₂SO₄) and evaporated to dryness. The semi-solid residue was suspended in hexane, filtered and the filtrate evaporated to dryness to yield 7.5 g of a pale yellow oil, which solidified upon standing.

10

NMR (CDCl₃) δ 8.08 (d, 1H), 7.46 (dd, 1H), 7.18 (dt, 1H),
 6.87 (t, 1H), 6.75 (dd, 1H), 6.31 (d, 1H),
 0.93 (s, 9H), 0.13 (s, 6H)

15 Example 13

(E)-3-(2-Hydroxy-phenyl)-acrylic acid 1-ethoxy-3-(3-isopropyl-phenyl)-butyl ester

20 A solution of 6.5 g of (E)-3-[2-(tert-Butyl-dimethyl-silanoxy)-phenyl]-acrylic acid and 5.5 g of 1-(3-ethoxy-1-methyl-allyl)-3-isopropyl-benzene, accessible from 3-(3-isopropyl-phenyl)-butyraldehyde via a two step procedure according to P.D. Bartlett and A.A. Frimer, Heterocycles
 25 11, 419-435, (1978), in 25 ml of toluene was heated to reflux and stirred for 16 h. After concentration, the reaction mixture was purified by flash chromatography to yield 7.5 g of the intermediate (E)-3-[2-(tert-Butyl-dimethyl-silanoxy)-phenyl]-acrylic acid 1-ethoxy-3-(3-isopropyl-phenyl)-butyl ester as a pale yellow oil. This
 30 was dissolved in 50 ml THF and treated at 0°C with 4.7 g

of TBAF·3H₂O. After 20 min., the mixture was concentrated and purification by flash chromatography yielded 2.2 g of the title ester (a mixture of diastereoisomers) as a pale yellow oil.

5

NMR (CDCl₃) δ 8.12 and 8.08 (d, 1H), 7.47 (dt, 1H), 7.35 (br s, 1H), 7.31-7.18 (m, 2H), 7.12-6.98 (m, 3H), 6.92 (dt, 1H), 6.83 (dd, 1H), 6.68 and 6.61 (d, 1H), 5.96 and 5.77 (dd, 1H), 3.82-3.65 (m, 1H), 3.63-3.40 (m, 1H), 3.05-2.77 (m, 2H), 2.22-1.95 (m, 2H) and 1.38-1.12 (m, 12H)

10

Example 14

15

(E)-3-(2-Hydroxy-phenyl)-acrylic acid 3-(4-tert-butyl-phenyl)-1-ethoxy-propyl ester

A solution of 3.1 g of (E)-3-[2-(tert-Butyl-dimethyl-silanoxy)-phenyl]-acrylic acid, 3.0 g of 1-tert-butyl-4-(3-ethoxy-2-methyl-allyl)-benzene, accessible from 3-(4-tert-butyl-phenyl)-2-methyl-propionaldehyde via a two step procedure according to P.D. Bartlett and A.A. Frimer, Heterocycles 11, 419-435, (1978), and 20 mg of *p*-TSA in 25 ml of toluene was stirred at 0 °C for 4 h and at room temperature for 14 h. The reaction mixture was partitioned between saturated sodium carbonate and hexane and the organic layer was washed with brine, dried over (Na₂SO₄) and evaporated to dryness to yield 5.3 g of the crude intermediate

(E)-3-[2-(tert-Butyl-dimethyl-silanoxy)-phenyl]-acrylic acid 3-(4-tert-butyl-phenyl)-1-ethoxy-

20

25

30

propyl ester as a pale yellow oil. This was dissolved in 20 ml of THF and treated at 0 °C with 3.2 g of solid TBAF·3H₂O. After 30 min., the mixture was concentrated and purification by repeated flash chromatography yielded 1.2 g of the title ester (a mixture of diastereoisomers) as a pale yellow oil.

NMR (CDCl₃) δ 8.17 and 8.13 (d, 1H), 7.50 (ddd, 1H), 7.36-7.18 (m, 4H), 7.11 (br dd, 2H), 6.98-6.83 (m, 2H), 6.73 and 6.69 (d, 1H), 5.94 (t, 1H), 3.92-3.70 (m, 1H), 3.71-3.54 (m, 1H), 3.05-2.81 (m, 1H), 2.52-2.34 (m, 1H), 2.30-2.12 (m, 1H) and 1.31 (s, 9H), 1.33-1.20 (m, 3H), 0.97 and 0.90 (t, 3H)

Example 15

Test cloth was washed with detergent to which one or more of the precursors of Examples 1-14 had been added. The cloth was then line dried. The cloth dried in sunlight had a distinct fragrance note, as determined by a trained panel. In contrast, the cloth dried without sunlight was olfactively neutral.

Example 16

Test cloth was washed with a detergent and then a fabric softener, containing one ore more of the precursors of Examples 1-14, was added to the rinse cycle. The cloth was then line dried. The cloth dried in sunlight had a distinct fragrance note, as determined by a trained panel.

In contrast, the cloth dried without sunlight was olfactively neutral.

Example 17

5

A 1% solution of one or more of the products of Examples 1-14 in ethanol was applied to cigarette papers to produce levels of 5-50'000 ppm of each flavourant. The paper was incorporated in cigarettes and, upon burning, released a
10 fragrant odour.

Example 18

15 A broad spectrum (UV-A and UV-B) oil/water sunscreen lotion was prepared with 0,5%.

Part A

20	<u>Recipe: %</u>	<u>Compound</u>	<u>Chemical Name</u>
	2 %	PARSOL MCX	Octyl methoxycinnamate
	3 %	PARSOL 1789	4-4-Butyl-4'methoxy- dibenzoyl methane
	12 %	Cétiol LC	Coco-caprylate/caprate
25	4 %	Dermol 185	Isostearyl neopentanoate
	0,25 %	Diethyl- eneglycol monostearate	PEG-2-stearate
	1 %	Cetylalcohol	Cetylalcohol
30	0,25 %	MPOB/PPOB	Methyl-propylparabene
	0,1 %	EDTA BD	EDTA-sodium salt

1 %	Amphisol DEA (Giv.)	Diethanolamine cetyl- phosphate
-----	------------------------	------------------------------------

Part B

5		
20 %	Permulse TR-1 (+%)	Acrylate C10-C30 Alkyl- acrylate
50,1 %	water deion	water deion
5 %	Propyleneglycol	1,2-Propanediol
10	0,8 %	KOH (10%) Potassium hydroxide

Part A was heated in a reactor to 85°C.

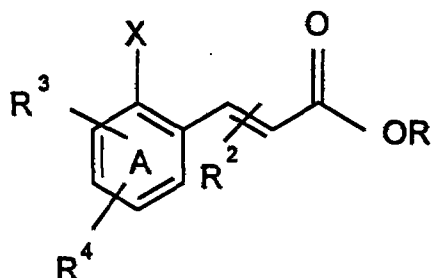
Part B was slowly added within 10 min., followed by addition of KOH and 0.5% of the product of Example 5. The emulsion was then cooled and degassed.



Claims

1. Compounds of the formula I

5



wherein

10

A is a benzene or naphthalene ring,

15

R¹ is a saturated or unsaturated, straight or branched, alicyclic or aromatic C₁₀-C₃₀ hydrocarbon residue which can contain heteroatoms and can be substituted by an ionic substituent,

20

R² in 2- or 3-position is hydrogen, a straight or branched C₁-C₆ residue; an optionally substituted aromatic or optionally substituted heterocyclic residue,

25

R³ and R⁴ stand for hydrogen, a straight or branched C₁-C₆ alkyl or C₁-C₆ alkoxy residue, a substituted or condensed heterocyclic residue, -OH, -NO₂, -NH₂, -N(C₁-C₆ alkyl)₂, -N(hydroxyalkyl)₂, -NHCO₂CH₃ or -NH(heterocycle),



R^2 , R^3 and R^4 may be the same or different,

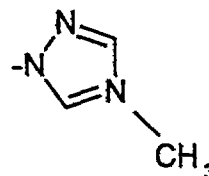
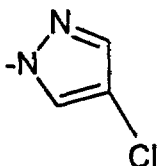
X stands for $-OH$ or NHR^6 , wherein R^6 is hydrogen a
 5 saturated or unsaturated, straight or branched C_1-C_{20}
 hydrocarbon or an optionally substituted aromatic or
 heterocyclic residue,

and the acrylic double bond is of the E configuration.

- 10
2. Compounds according to claim 1, wherein R^1 is a
 saturated or unsaturated, straight or branched $C_{10}-C_{30}$
 hydrocarbon residue containing one or more O and/or N
 atoms and/or C(O) groups and/or alkoxy groups.

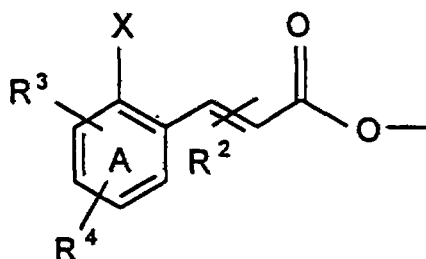
- 15
3. Compounds according to one of the preceding claims,
 wherein R^1 is a saturated or unsaturated, straight or
 branched $C_{10}-C_{30}$ hydrocarbon residue substituted by an
 ionic substituent of the formula $NR^5_3^+$, in which R^5 is
 20 the residue of a fatty acid or an alkyl group with 1
 to 30 carbon atoms.

4. Compounds according to one of the preceding claims,
 wherein R^2 is a heterocyclic residue of the formula



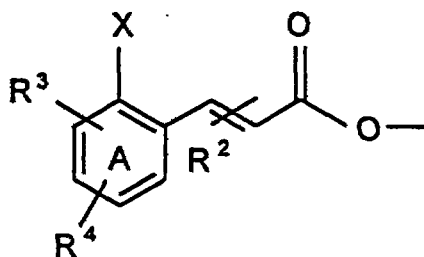


5. Compounds according to one of the preceding claims, wherein R^3 and/or R^4 are five membered heterocyclic residues containing N and/or O atoms.
- 5 6. Compounds according to one of the preceding claims, wherein R^3 and/or R^4 is hydrogen, $-N(C_1-C_6 \text{ alkyl})_2$, $-NH_2$, a five membered heterocyclic residue, substituted by C_1-C_6 aliphatic and/or aromatic substituents.
- 10 7. Compounds according to one of the preceding claims, wherein R^2 is hydrogen or methyl.
8. Compounds according to one of the preceding claims, wherein R^1 is the residue of an olfactory alcohol, of
15 the formula R^1OH .
9. Compounds according to one of the claims 1 to 7, wherein R^1 is the residue of the enol form of an olfactory aldehyde of formula R^1HO .
- 20 10. Compounds according to one of the claims 1 to 7, wherein R^1 is the residue of the enol form of an olfactory ketone of formula R^1O .
- 25 11. Compounds according to one of claims 1 to 7, wherein R^1 is an optionally substituted alkyl, alkenyl arylalkyl residue carrying a 1-alkoxy, 1-aryloxy or 1-arylalkoxy residue.
- 30 12. Compounds according to one of the preceding claims, wherein the residue of formula Ia



is the precursor for fragrant coumarins.

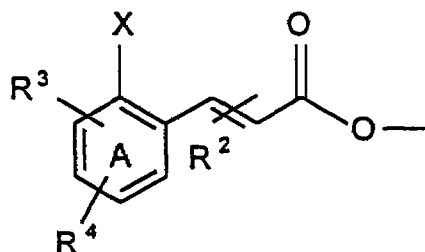
- 5 13. Compounds according to one of the claims 1-11, wherein the residue of formula Ia



- 10 is the precursor for fluorescent whitening coumarins.

14. Compounds according to claims 8-12, wherein R¹ is the residue of an olfactory alcohol, aldehyde or ketone and the residue of formula Ia

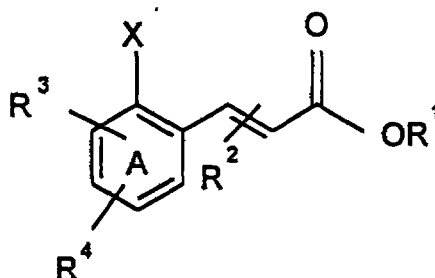
15



is the precursor for a fragrant coumarin.



15. Use of compounds of formula I



5

wherein

A is a benzene or naphthalene ring,

10 R^1 is hydrogen, unsaturated or saturated straight or branched, alicyclic or aromatic C_1 - C_{30} hydrocarbon which can contain heteroatoms and can be substituted by an ionic substituent,

15 R^2 in 2- or 3-position is hydrogen, a straight or branched C_1 - C_6 residue; an optionally substituted aromatic or optionally substituted heterocyclic residue,

20 R^3 and R^4 stand for hydrogen, a straight or branched C_1 - C_6 alkyl or C_1 - C_6 alkoxy residue, a substituted or condensed heterocyclic residue, $-OH$, $-NO_2$, $-NH_2$, $-N(C_1-C_6 \text{ alkyl})_2$, $-N(\text{hydroxyalkyl})_2$, $-NHCO_2CH_3$ or $-NH$ (heterocycle),

25

R^2 , R^3 and R^4 may be the same or different,



X stands for -OH or NHR^6 , wherein R^6 is hydrogen a
saturated or unsaturated, straight or branched $\text{C}_1\text{-C}_{20}$
hydrocarbon or an optionally substituted aromatic or
heterocyclic residue,

and the acrylic double bond is of the E configuration,

as precursors for organoleptic, antimicrobial
compounds and/or fluorescent whitening agents.

16. Use according to claim 15 in laundry products.

17. Use according to claim 15 in tobacco products.

18. Use according to claim 15 in cosmetics and toiletries.