

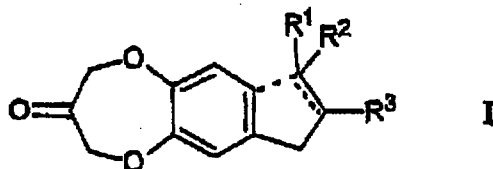
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1,2-Substituted 2,3-dihydro-1H-
5,9-dioxacyclohepta[f]inden-7-ones and 7-substituted
benzo[b][1,4]dioxepin-3-ones

5 The invention relates to 1,2-substituted
2,3-dihydro-1H-5,9-dioxacyclohepta[f]inden-7-ones and
7-substituted benzo[b][1,4]dioxepin-3-ones and to the
use of these compounds in fragrance compositions.

10 With the launch of an unusual marine women's
fragrance, a new trend began to be established in
perfumery at the beginning of the 1990s, which was
continued in numerous similar marine fragrance
creations and peaked in very successful feminine
perfumes in 1996 and 1997. However, as soon as 1991 a
15 successful marine men's fragrance also appeared on the
market and in 1997 a bodycare series having an
extremely marine effect. Virtually all of these marine
fragrances are based on 7-methylbenzo[b][1,4]dioxepin-
3-one (Calon 1951®). This key compound is described in
20 US patent 3 647 479 together with derivatives which
bear methyl, ethyl, propyl and butyl groups in the
7 position. Published patent EP 0 902 024 A1 describes
the compound 7-propylbenzo[b][1,4]dioxepin-3-one and
its use in perfumery. This compound comes under the
25 general formula of US patent 3 647 479 and has a
similar odor to the abovementioned methyl derivative.
To date, no further compounds of similar marine odor
are known in perfumery. The object of the invention is
to remedy this deficiency.

30 Surprisingly, it has now been found that
compounds outside of the general formula of
US patent 3 647 479 also have marine odor properties,
with, in addition, completely unexpected, novel,
interesting facets. These compounds are summarized in
35 the general formula I



where $R^1 = H, CH_3, CH_2CH_3, CH_2CH_2CH_3, CH(CH_3)_2,$
 $CH_2CH_2CH_2CH_3,$
 $R^2 = H, CH_3,$
 $R^3 = H, CH_3, CH_2CH_3,$

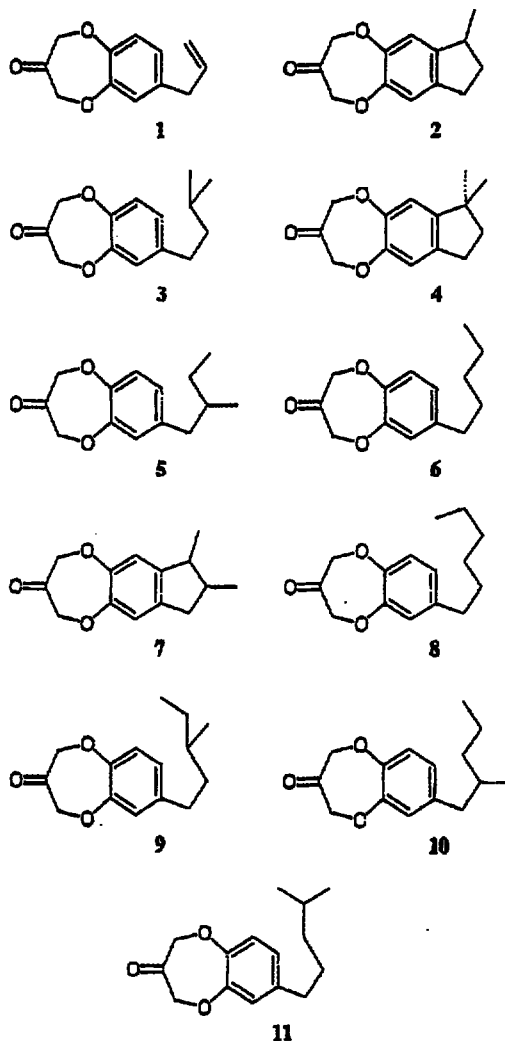
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and the dashed line is an optional double bond or an optional ring closure to form the indane ring system, where in the case of a double bond $R^1 = R^2 = H$, and in all other cases the total number of carbon atoms of all
 10 residues is given by $C_8 > R^1 + R^2 + R^3 > C_1$.

In the case of the indane ring system, R^1 or R^2 is preferably CH_3 .

The general formula I thus comprises the compounds 1-11:

15



The compounds of the general formula I generally have a fresh, marine fragrance, generally with predominantly aldehydic, flowery characters and are therefore particularly suitable for building up fresh, marine and aquatic effects, in particular, for instance, for modern marine Fougere perfumes and floral-aquatic women's fragrances. Those which are of particular interest for perfumes are harmonious blends containing Tropional®, Melonal®, or Floralozon®. However, the use is neither restricted to these harmonious blends nor to specific fragrances, classes of substances or fragrance odors. Examples of further classes of substances which harmonize well which may be listed are:

- 15
- | | |
|-------------------------------------|--|
| - Essential oils and extracts, e.g. | bergamot oil, grapefruit oil, jasmine absolute, mandarin oil, patchouli oil, vetiver oil, ylang-ylang oil, lemon oil. |
| - Alcohols, ethers, acetals, e.g. | Acetal E®, citronellol, dihydromyrcenol, Ebanol®, eugenol, Florol®, geraniol, Helional®, cis-hex-3-enol, Mayol®, 2-phenylethyl alcohol, Sandalor®, Spirambren®. |
| - Aldehydes and ketones, e.g. | Adoxal®, Bourgeonal®, Cyclohexal®, damascone, damascenone, Florhydral®, Hedion®, Iralia®, Iso E Super®, lauryl aldehyde, Lilial®, methyl ionone, 2-methylundecanal, Myralden®, undecanal, Vertofix®. |

- Esters and lactones, allyl amyl glycolate,
e.g. benzyl salicylate,
Cyclogalbanat[®], gamma-
decalactone, Gardenol[®],
geranyl acetate,
cis-hex-3-enyl acetate,
linalyl acetate, gamma-
undecalactone, Verdox[®].
- Macrocycles, polycycles, Ambroxan[®], Cashmeran[®],
heterocycles, e.g. Galaxolid[®], Habanolid[®],
Thibetolid[®].

Further advantages, features and details of the invention are given by the examples below.

5 Example 1: 7-allylbenzo[b][1,4]dioxepin-3-one (1)

A solution of 354 ml (2.30 mmol) of eugenol and
292 g (6.89 mol) of lithium chloride in 3.7 l of
N,N-dimethylformamide was refluxed for a total of
44 hours (h), and, after 4 h, 18 h and then 7 h, a
10 further 292 g (6.89 mol) of lithium chloride were added
each time. After cooling, 2 l of toluene were added and
the resultant precipitate was filtered off with suction
and extracted with toluene. The organic extracts were
combined and concentrated on a rotary evaporator. After
15 flash chromatography (ether/pentane, 1:1, $R_f = 0.37$) on
silica gel, 173 g (50%) of 4-allylcatechol were
obtained.

12.8 g (225 mmol) of 95% pure sodium methoxide
were introduced into a solution of 16.8 g (112 mmol) of
20 4-allylcatechol in 250 ml of methanol, with stirring,
followed by 21 ml (225 mmol) of methyl bromoacetate.
After refluxing for 8 h, a further 21 ml (225 mmol) of
methyl bromoacetate were added, and, after a further
4 h of heating, a further 12.8 g (225 mmol) of sodium
25 methoxide and a further 21 ml (225 mmol) of methyl
bromoacetate. After a further 4 h under reflux, the
mixture was worked up by adding 500 ml of ether and
filtering off the precipitate formed. The filtrate was

concentrated on a rotary evaporator and taken up in ether/water/saturated ammonium chloride solution (1:1:1). The organic phase was separated off, and the aqueous phase was extracted three times, each time with 200 ml of ether. The combined organic phases were dried over sodium sulfate and concentrated to dryness on a rotary evaporator. After flash chromatography (ether/pentane, 1:1, R_f = 0.35) on silica gel, 21.4 g (65%) of methyl 4-allyl-2-(ethoxycarbonylmethoxy)-phenoxyacetate were obtained.

A solution of 69.0 g (234 mmol) of methyl 4-allyl-2-(ethoxycarbonylmethoxy)phenoxyacetate was added dropwise in the course of 2.5 h to a suspension of 12.0 g (500 mmol) of sodium hydride in 500 ml of tetrahydrofuran. The reaction mixture was then refluxed for 20 h and, after cooling, poured into 1.5 l of ice water. The resultant mixture was acidified to pH 2 with 2N hydrochloric acid and extracted three times, each time with 2 l of ether. The combined ether extracts were dried over sodium sulfate, freed from solvent on a rotary evaporator and taken up into 400 ml of ethanol. 400 ml of 2N hydrochloric acid were added and the mixture was refluxed for 20 h. The mixture was then poured into 1.5 l of ice water, the product was extracted four times, each time with 1.5 l of ether, and the combined ether extracts were washed with 1 l of water and 100 ml of saturated sodium chloride solution. After drying over sodium sulfate, concentration on a rotary evaporator and flash chromatography (pentane/ether, 4:1, R_f = 0.37) on silica gel, 20.0 g (42%) of 7-allylbenzo[b][1,4]dioxepin-3-one (1) were obtained as a colorless liquid.

Odor: linear, very intensive marine-floral odor with nuances of ozone, watermelons and fatty aldehydes. - IR (film): ν = 1502/1581/1436/1639 cm^{-1} (ν C=C, Ar), 1742 cm^{-1} (ν C=O), 1267/1305 cm^{-1} (ν ring), 1051 cm^{-1} (ν C-O-C). - $^1\text{H-NMR}$ (CDCl_3): δ = 3.30 (d, J = 6.8 Hz, 2H, 1'-H₂), 4.68 (d, J = 7.2 Hz, 2-, 4-H₂) 5.05-5.10



(m, 2H, 3'-H₂), 5.92 (m, 1H, 2'-H), 6.77-6.93 (m, 3H, 6-, 8-, 9-H). - ¹³C-NMR (CDCl₃): δ = 39.15 (t, C-1'), 75.41/75.63 (2t, C-2,-4), 116.00 (t, C-3'), 120.67/120.73 (2d, C-6,-9), 123.73 (d, C-8), 135.94 (s, C-7), 136.88 (d, C-2'), 146.46 (s, C-9a), 148.00 (s, C-5a), 204.61 (s, C-3). - MS (EI): m/z (%) = 91 (97) [C₇H₇⁺], 120 (25) [C₇H₄O₂⁺], 161 (13) [M⁺-C₂H₃O], 175 (6) [M⁺-CHO], 204 (100) [M⁺].

10 Example 2: 1-methyl-2,3-dihydro-1H-5,9-dioxacyclo-
hepta[f]inden-7-one (2)

A mixture of 19.1 ml (150 mmol) of veratrol and 19.2 ml (225 mmol) of vinylacetic acid in 230 g of 83% strength polyphosphoric acid was stirred for 15 h at 15 60°C and then poured into 500 ml of ice water. After 30 minutes (min) of stirring, the product was extracted three times, each time with 200 ml of ether. The combined organic phases were washed twice, each time with 100 ml of 2N NaOH, once with 100 ml of water and 20 once with 50 ml of saturated sodium chloride solution, dried over sodium sulfate and freed from solvent on a rotary evaporator. After recrystallizing the residue (AcOEt/pentane), 22.8 g (74%) of 5,6-dimethoxy-3-methylindan-1-one were obtained.

25 To a suspension of 53.3 g (815 mmol) of zinc dust in 74 ml of water were added 4 ml of concentrated hydrochloric acid. The supernatant was decanted off after stirring for 30 min, and to the residue were added, with ice cooling, 42 ml of water and then, 30 dropwise, 55 ml of concentrated hydrochloric acid. 28.0 g (136 mmol) of 5,6-dimethoxy-3-methylindan-1-one dissolved in 53 ml of toluene were added and the mixture was refluxed for 3 days (d), in the course of which, after 48 h, a further 55 ml of concentrated 35 hydrochloric acid were added. After cooling, the reaction mixture was poured into 200 ml of water and the product was extracted twice in 300 ml of ether. The combined extracts were washed with 100 ml of water and 25 ml of saturated sodium chloride solution, dried over



sodium sulfate and concentrated on a rotary evaporator. After flash chromatography (pentane/ether, 9:1, $R_f = 0.23$) on silica gel, 19.6 g (75%) of 5,6-dimethoxy-1-methylindane were obtained.

5 In the course of 90 min at room temperature, 27.5 ml (202 mmol) of iodotrimethylsilane were added dropwise with stirring to a solution of 19.4 g (101 mmol) of 5,6-dimethoxy-1-methylindane in 150 ml of acetonitrile. The mixture was stirred for a further
10 2.5 d at room temperature, in the course of which, after 48 h, again 10 ml (73.5 mmol) of iodotrimethylsilane were added. The reaction mixture was then poured into 500 ml of water and the product was extracted twice, each time with 200 ml of ether.
15 The combined extracts were washed with 100 ml of 40% strength sodium hydrogen sulfite solution, 100 ml of water and 50 ml of saturated sodium chloride solution, dried over sodium sulfate and concentrated on a rotary evaporator. After flash chromatography (pentane/ether, 2:1, $R_f = 0.28$) on silica gel, 15.5 g (93%) of
20 1-methylindane-5,6-diol were obtained.

A suspension of 25.7 g (186 mmol) of potassium carbonate were heated to reflux with stirring. At this temperature, in the course of 5 h, a mixture of 15.3 g
25 (93.2 mmol) of 1-methylindane-5,6-diol and 11.6 g (92.8 mmol) of 3-chloro-2-chloromethylprop-1-ene dissolved in 50 ml of dioxane was added dropwise. When addition was complete, the mixture was stirred for a further 1 h under reflux and the inorganic solids
30 precipitated out were filtered off with suction after cooling the reaction mixture. The solids were washed with acetone and the combined organic phases freed from solvent on a rotary evaporator. After flash chromatography (pentane/ether, 19:1, $R_f = 0.66$) on
35 silica gel, 7.3 g (36%) of 1-methyl-7-methylene-2,3,7,8-tetrahydro-1H,6H-5,9-dioxacyclohepta[f]indene were obtained.

6.6 g (30.5 mmol) of 1-methyl-7-methylene-2,3,7,8-tetrahydro-1H,6H-5,9-dioxacyclohepta[f]indene

were dissolved in a mixture of 140 ml of acetonitrile, 140 ml of water and 90 ml of carbon tetrachloride. 6.50 g (30.5 mmol) of sodium periodate were added at room temperature with stirring, with the temperature falling to 15°C. After stirring for 30 min, 0.3 g (1.5 mmol, 5 mol%) of ruthenium (III) chloride hydrate were then added, with the temperature increasing back to 30°C. The mixture was stirred for 48 h at room temperature, in the course of which, after 6 h, a further 6.50 g (30.5 mmol) of sodium periodate and 0.3 g (1.5 mmol, 5 mol%) of ruthenium (III) chloride hydrate were added. The reaction mixture was then poured into 500 ml of water and the product was extracted three times, each time with 200 ml of dichloromethane. The combined organic extracts were washed with 200 ml of 20% strength sodium hydrogen sulfite solution and 200 ml of water and dried over sodium sulfate. After removing the solvent on a rotary evaporator and flash chromatography (pentane/ether, 4:1, R_f = 0.32) on silica gel, 3.3 g (50%) of 1-methyl-2,3-dihydro-1H-5,9-dioxacyclohepta[f]inden-7-one (2) were obtained as colorless crystals of m.p. 79-80°C.

Odor: Linear, very intensive marine odor with strongly flowery aspects. - IR (film): $n = 1323/1280/1256/1351 \text{ cm}^{-1}$ (n ring), 1735 cm^{-1} (n C=O), 1041 cm^{-1} (n C-O-C sym), $1482/1439/1577 \text{ cm}^{-1}$ (n C=C, Ar), 1155 cm^{-1} (n C-O-C asym). - $^1\text{H-NMR}$ (CDCl_3): δ = 1.24 (d, J = 7.0 Hz, 3H, 1-Me), 1.60 (qd, J = 12.4, 8.7 Hz, 1H, 2- H_b), 2.30 (tdd, J = 12.4, 7.7, 3.9 Hz, 1H, 2- H_a), 2.74 (ddd, J = 15.7, 8.7, 7.7 Hz, 1H, 3- H_b), 2.82 (ddd, J = 15.7, 8.7, 3.9 Hz, 1H, 3- H_a), 3.10 (br. sext, J = 7.0 Hz, 1H, 1-H), 4.66 (d, J = 1.6 Hz, 4H, 6-,8- H_2), 6.80 (s, 1H, 4-H), 6.83 (s, 1H, 10-H). - $^{13}\text{C-NMR}$ (CDCl_3): δ = 19.78 (q, 1-Me), 30.70 (t, C-2), 35.13 (t, C-3), 38.88 (d, C-1), 75.49/75.53 (2t, C-6,-8), 115.15/116.17 (2d, C-4,-10), 139.19 (s, C-10a), 144.39 (s, C-3a), 146.82/146.97 (2s, C-4a, 9a), 205.03 (s, C-7). - MS (EI): m/z (%) = 91 (97) [C_7H_7^+], 103 (20) [C_8H_7^+],



115 (13) $[C_8H_{19}^+]$, 175 (14), $[M^+-CH_3-CO]$, 203 (100) M^+-CH_3 , 218 (57) $[M^+]$.

The compounds of the general formula I listed in the examples below were synthesized similarly to Example 2 by reaction of veratrol with the corresponding unsaturated and saturated carboxylic acids. Therefore, of these, only the odor descriptions and the spectroscopic data are listed.

10 Example 3: 7-(3-methylbutyl)benzo[b][1,4]dioxepin-3-one
(3)

Odor: Very intensive and diffuse, linear, marine odor with nuances of Adoxal[®] (2,6,10-trimethylundec-9-en-1-al). - IR (film): $n = 1502/1435/1581/1467\text{ cm}^{-1}$ (n C=C, Ar), $1265/1304/1201\text{ cm}^{-1}$ (n ring), 1050 cm^{-1} (n C-O-C sym), 1740 cm^{-1} (n C=O), - $^1\text{H-NMR}$ ($CDCl_3$): d = 0.92 (d, $J = 6.4\text{ Hz}$, 6H, 3'-Me₂), 1.46/1.47 (2dd, $J = 8.0, 6.8\text{ Hz}$, 2H, 2'-H₂), 1.57 (nonett, $J = 6.8\text{ Hz}$, 1H, 3'-H), 2.52 (t, $J = 8.0\text{ Hz}$, 2H, 1'-H₂), 4.68 (d, $J = 9.2\text{ Hz}$, 4H, 2-, 4-H₂), 6.77 (dd, $J = 8.2, 2.4\text{ Hz}$, 1H, 8-H), 6.82 (d, $J = 2.4\text{ Hz}$, 1H, 6-H), 6.90 (d, $J = 8.4\text{ Hz}$, 1H, 9-H). - $^{13}\text{C-NMR}$ ($CDCl_3$): d = 22.36 (2q, 3'-Me₂), 27.43 (d, C-3'), 32.69 (t, C-1'), 40.53 (t, C-2'), 75.35/75.63 (2t, C-2,-4), 120.27/120.50 (d, C-6,-9), 123.45 (d, C-8), 138.99 (s, C-7), 146.00/147.86 (2s, C-5a,-9a), 204.71 (s, C-3). - MS (EI): m/z (%) = 77 (26) $[C_6H_6^+]$, 135 (12) $[M^+-C_4H_9-C_2H_2O]$, 149 (21) $[M^+-C_4H_9-CO]$, 177 (100) $[M^+-C_4H_9]$, 191 (7) $[M^+-C_3H_7]$, 234 (52) $[M^+]$.

30 Example 4: 1,1-dimethyl-2,3-dihydro-1H-5,9-dioxacyclohepta[f]inden-7-one (4)

Odor: Marine-aldehyde-like, flowery-rosy odor with nuances of citronelloxyacetaldehyde [(3,7-dimethyl-6-octenyl)oxyacetaldehyde]. - IR (film): $n = 1322/1253/1281/1350\text{ cm}^{-1}$ (n ring), $1040/1067\text{ cm}^{-1}$ (n C-O-C), $1484/1438\text{ cm}^{-1}$ (n C=C, Ar), 1736 cm^{-1} (n C=O). - $^1\text{H-NMR}$ ($CDCl_3$): d = 1.22 (s, 6H, 1-Me₂), 1.92 (t, $J = 7.2\text{ Hz}$, 2H, 2-H₂), 2.79 (t, $J = 7.2\text{ Hz}$, 2H, 3-H₂), 4.67



(d, $J = 2.8$ Hz, 4H, 6-, 8-H₂), 6.75 (s, 1H, 4-H), 6.81 (s, 1H, 10-H). - ¹³C-NMR (CDCl₃): d = 28.43 (2q, 1-Me₂), 29.29 (t, C-3), 41.68 (t, C-2), 43.61 (s, C-1), 75.47/75.51 (2t, C-6,-8), 113.99 (d, C-10), 116.31 (d, C-4), 138.98 (s, C-3a), 146.83/147.22 (2s, C-4a, -9a), 148.30 (s, C-10a), 205.06 (s, C-7). - MS (EI): m/z (%) = 133 (33) [C₉H₉O⁺], 145 (6) [C₁₁H₁₃⁺], 161 (7) [M⁺-CH₃-2CO], 189 (2) [M⁺-CH₃-CO], 217 (100) [M⁺-CH₃], 232 (30) [M⁺].

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Example 5: 7-(2-methylbutyl)benzo[b][1,4]dioxepin-3-one (5)

Odor: Intensive, marine-floral odor. IR (film):
 $n = 1501/1434/1460/1580$ cm⁻¹ (n C=C, Ar),
 15 1265/1302/1201 cm⁻¹ (n ring), 1050 cm⁻¹ (n C-O-C),
 1740 cm⁻¹ (n C=O). - ¹H-NMR (CDCl₃): d = 0.84 (d, $J = 6.4$ Hz, 3H, 2'-Me), 0.90 (t, $J = 7.5$ Hz, 3H, 4'-H₂), 1.16 (m, 1H, 3'-H_b), 1.39 (m, 1H, 3'-H_a), 1.60 (m, 1H, 2'-H), 2.28 (dd, $J = 11.6, 8.0$ Hz, 1H, 1'-H_b), 2.53 (dd, $J = 11.6, 6.0$ Hz, 1H, 1'-H_a), 4.69 (d, $J = 8.4$ Hz, 4H, 2-, 4-H₂), 6.74 (dd, $J = 8.0, 2.0$ Hz, 1H, 8-H), 6.78 (d, $J = 2.0$ Hz, 1H, 6-H), 6.90 (d, $J = 8.0$ Hz, 1H, 9-H). -
¹³C-NMR (CDCl₃): d = 11.32 (q, C-4'), 18.75 (q, 2'-Me), 28.95 (t, C-3'), 36.42 (d, C-2'), 42.22 (t, C-1'),
 25 75.36/75.64 (2t, C-2,-4), 120.30/121.03 (2d, C-6,-9), 124.27 (d, C-8), 137.62 (s, C-7), 146.06/147.70 (2s, C-5a,-9a), 204.74 (s, C-3). - MS (EI): m/z (%) = 77 (11) [C₈H₅⁺], 91 (7) [C₇H₇⁺], 135 (5) [M⁺-C₄H₉-C₂H₂O], 149 (4) [M⁺-C₄H₉-CO], 177 (100) [M⁺-C₄H₉], 191 (2) [M⁺-C₃H₇],
 30 205 (1) [M⁺-C₂H₅], 219 (1) [M⁺-CH₃], 234 (26) [M⁺].

Example 6: 7-Pentylbenzo[b][1,4]dioxepin-3-one (6)

Odor: Marine, bloomy odor with aldehydic nuances. - IR (film): $n = 1502/1435/1580$ cm⁻¹ (n C=C, Ar),
 35 1265/1304/1201 cm⁻¹ (n ring), 1050 cm⁻¹ (n C-O-C), 1740 cm⁻¹ (n C=O). - ¹H-NMR (CDCl₃): d = 0.89 (t, $J = 7.0$ Hz, 3H, 5'-H₂), 1.28-1.35 (m, 4H, 3'-, 4'-H₂), 1.59 (br. quint, $J = 7.6$ Hz, 2H, 2'-H₂), 2.51 (t, $J = 7.8$ Hz, 2H, 1'-H₂), 4.69 (d, $J = 9.6$ Hz, 4H, 2-, 4-H₂), 6.77



(dd, $J = 8.0, 2.0$ Hz, 1H, 8-H), 6.81 (d, $J = 2.0$ Hz, 1H, 6-H), 6.90 (d, $J = 8.0$ Hz, 1H, 9-H). - $^{13}\text{C-NMR}$ (CDCl_3): d = 13.88 (q, C-5'), 22.38 (t, C-4'), 30.90/31.26 (2t, C-2', -3'), 34.84 (t, C-1'), 75.35/75.64 (2t, C-2, -4), 120.31/120.47 (2d, C-6, -9), 123.51 (d, C-8), 138.85 (s, C-7), 146.03/147.83 (2s, C-5a, -9a), 204.72 (s, C-3-). - MS (EI): m/z (%) = 77 (18) [C_6H_5^+], 91 (10) [C_7H_7^+], 135 (9) [$\text{M}^+ - \text{C}_4\text{H}_9 - \text{C}_2\text{H}_2\text{O}$], 149 (22) [$\text{M}^+ - \text{C}_4\text{H}_9 - \text{CO}$], 177 (100) [$\text{M}^+ - \text{C}_4\text{H}_9$], 191 (8) [$\text{M}^+ - \text{C}_3\text{H}_7$], 205 (1) [$\text{M}^+ - \text{C}_2\text{H}_5$], 234 (42) [M^+].

Example 7: (E/Z)-1,2-dimethyl-2,3-dihydro-1H-5,9-dioxacyclohepta[f]inden-7-one (7)

Odor: Mixed odor of walnuts, *Trigonella foenum-graecum*, seawater and moss. - IR (film): $\nu = 1736$ cm^{-1} (n C=O), 1324/1263/1289/1352 cm^{-1} (n ring), 1484/1439 cm^{-1} (n C=C, Ar), 1042 cm^{-1} (n C-O-C sym), 1159 cm^{-1} (n C-O-C asym). - $^1\text{H-NMR}$ (CDCl_3): d = 0.95/1.08/1.17/1.24 (4d, $J = 7.0$ Hz, 6H, 1-, 2-Me), 1.91-2.02 (m, 1H, 2-H), 2.41 (dd, $J = 15.0, 9.6$ Hz)/ 2.49 (dd, $J = 15.0, 6.4$ Hz)/ 2.55 (dd, $J = 14.0, 6.8$ Hz)/ 2.59 (dd, $J = 14.0, 7.2$ Hz) [2H, 3-H₂], 2.89 (td, $J = 15.7, 7.2$ Hz)/3.06 (quint, $J = 7.2$ Hz) [1H, 1-H], 4.66 (d, $J = 1.6$ Hz, 4H 4-, 8-H₂), 6.76-6.80 (m, 2H, 4-, 10-H). - $^{13}\text{C-NMR}$ (CDCl_3): d = 14.50/15.00/17.54/18.31 (4q, 1-, 2-Me), 38.64/39.38 (2t, C-3), 38.24/41.83/44.41/46.18 (4d, C-1, -2), 75.49/75.50/75.53/75.54 (4d, C-6, -8), 115.11/115.56/116.06/116.39 (4d, C-4, -10), 138.26/138.43 (2s, C-3a), 144.22/144.37 (2s, C-10a), 146.73/146.79/146.91/146.95 (4s, C-4a, -9a), 205.03/205.10 (2s, C-7). - MS (EI): m/z (%) = 77 (13)/91 (19)/105 (20)/133 (20)/161 (7)/175 (4) [$\text{C}_n\text{H}_{2n7}^+$], 189 (18) [$\text{M}^+ - \text{CH}_3 - \text{CO}$], 203 (1) [$\text{M}^+ - \text{C}_2\text{H}_5$], 217 (100) [$\text{M}^+ - \text{CH}_3$], 232 (70) [M^+].

Example 8: 7-Hexylbenzo[b][1,4]dioxepin-3-one (8)



Odor: Marine, aquatic. - IR (film): ν = 1502/1435/1580 cm^{-1} (ν C=C, Ar), 1265/1304/1201 cm^{-1} (ν ring), 1051 cm^{-1} (ν C-O-C), 1741 cm^{-1} (ν C=O). - $^1\text{H-NMR}$ (CDCl_3): δ = 0.88 (t, J = 6.8 Hz, 3H, 6'-H₂), 1.27-1.35 (m, 6H, 3'-H₂-5'-H₂), 1.57 (br. quint, J = 8.0 Hz, 2H, 2'-H₂), 2.51 (t, J = 7.8 Hz, 2H, 1'-H₂), 4.68 (d, J = 8.0 Hz, 4H, 2-, 4-H₂), 6.77 (dd, J = 8.0, 4.0 Hz, 1H, 8-H), 6.81 (d, J = 4.0 Hz, 1H, 6-H), 6.90 (d, J = 8.0 Hz, 1H, 9-H). - $^{13}\text{C-NMR}$ (CDCl_3): δ = 13.96 (q, C-6'), 22.46 (t, C-5'), 28.77 (t, C-3'), 31.19/31.56 (2t, C-2', -4'), 34.89 (t, C-1'), 75.35/75.63 (2t, C-2, -4), 120.31/120.47 (2d, C-6, -9), 123.50 (d, C-8), 138.85 (s, C-7), 146.03/147.83 (2s, C-5a, -9a), 204.73 (s, C-3). - MS (EI): m/z (%) = 77 (16) [C_8H_6^+], 91 (9) [C_7H_7^+], 135 (9) [$\text{M}^+ - \text{C}_5\text{H}_{11} - \text{C}_2\text{H}_2\text{O}$], 149 (21) [$\text{M}^+ - \text{C}_5\text{H}_{11} - \text{CO}$], 177 (100) [$\text{M}^+ - \text{C}_5\text{H}_{11}$], 191 (2) [$\text{M}^+ - \text{C}_4\text{H}_9$], 205 (3) [$\text{M}^+ - \text{C}_3\text{H}_7$], 248 (43) [M^+].

Example 9: 7-(3-methylpentyl)benzo[b][1,4]dioxepin-3-one (9)

Odor: Marine, animal-like, civet-like, floral-aldehyde odor, also somewhat reminiscent of citronelloxyacetaldehyde ([3,7-dimethyl-6-octenyl]oxyacetaldehyde). - IR (film): ν = 1502/1435/1460/1580 cm^{-1} (ν C=C, Ar), 1265/1304/ 1202 cm^{-1} (ν ring), 1051 cm^{-1} (ν C-O-C), 1741 cm^{-1} (ν C=O). - $^1\text{H-NMR}$ (CDCl_3): δ = 0.87 (t, J = 7.2 Hz, 3H, 5'-H₃), 0.91 (d, J = 6.4 Hz, 3H, 3'-Me), 1.18 (m_{c1}, 1H, 2'-H_b), 1.34-1.43 (m, 3H, 2'-H_a, 4'-H₂), 1.56-1.62 (m, 1H, 3'-H), 2.48 (ddd, J = 14.0, 10.0, 6.4 Hz, 1H, 1'-H_a), 2.56 (ddd, J = 14.0, 10.4, 5.2 Hz, 1H, 1'-H_b), 4.67 (d, J = 2.4 Hz, 4H, 2-, 4-H₂), 6.78 (dd, J = 8.2, 2.4 Hz, 1H, 8-H), 6.82 (d, J = 2.0 Hz, 1H, 6-H), 6.90 (d, J = 8.4 Hz, 1H, 9-H). - $^{13}\text{C-NMR}$ (CDCl_3): δ = 11.14 (q, C-5'), 18.93 (q, 3'-Me), 29.18 (t, C-4'), 32.42 (t, C-1'), 33.84 (d, C-3'), 38.23 (t, C-2'), 22.38 (t, C-4'), 30.90/31.26 (2t, C-2', -3'), 75.35/75.64 (2t, C-2, -4), 120.27/120.51 (2d, C-6, -9), 123.45 (d, C-8), 139.11 (s, C-7), 146.00/147.86 (2s, C-5a, -9a), 204.72 (s, C-3). - MS



(EI): m/z (%) = 77 (21) $[C_8H_5^+]$, 92 (14) $[C_7H_8^+]$, 135 (11) $[M^+-C_5H_{11}-C_2H_2O]$, 149 (16) $[M^+-C_5H_{11}-CO]$, 177 (100) $[M^+-C_5H_{11}]$, 191 (4) $[M^+-C_4H_9]$, 205 (7) $[M^+-C_3H_7]$, 248 (45) $[M^+]$.

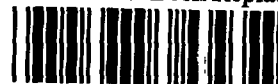
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Example 10: 7-(2-Methylpentyl)benzo[b][1,4]dioxepin-3-one (10)

Odor: Marine, floral-aldehyde odor. - IR (film): $n = 1501/1434/1460/1580\text{ cm}^{-1}$ (n C=C, Ar), 1265/1303/1201 cm^{-1} (n ring), 1049 cm^{-1} (n C-O-C), 1740 cm^{-1} (n C=O). - $^1\text{H-NMR}$ (CDCl_3): $\delta = 0.83$ (d, 3H, 2'-Me), 0.88 (t, $J = 7.0\text{ Hz}$, 3H, 5'-H₃), 1.11-1.40 (m, 4H, 3'-, 4'-H₂), 1.68 (m_{c1} 1H, 2'-H), 2.26 (dd, $J = 13.6, 8.4\text{ Hz}$, 1H, 1'-H_b), 2.54 (dd, $J = 13.6, 6.0\text{ Hz}$, 1H, 1'-H_a), 4.69 (d, $J = 8.4\text{ Hz}$, 4H, 2-, 4-H₂), 6.73 (dd, $J = 8.0, 2.0\text{ Hz}$, 1H, 8-H), 6.78 (d, $J = 2.0\text{ Hz}$, 1H, 6-H), 6.89 (d, $J = 8.0\text{ Hz}$, 1H, 9-H). - $^{13}\text{C-NMR}$ (CDCl_3): $\delta = 14.15$ (q, C-5'), 19.17 (q, 2'-Me), 20.02 (t, C-4'), 34.50 (d, C-2'), 38.77 (t, C-3'), 42.61 (t, C-1'), 75.36/75.63 (2t, C-2, -4), 120.30/121.04 (2d, C-6, -9), 124.28 (d, C-8), 137.61 (s, C-7), 146.05/147.70 (2s, C-5a, -9a), 204.77 (s, C-3). -MS (EI): m/z (%) = 77 (9) $[C_6H_5^+]$, 91 (6) $[C_7H_7^+]$, 135 (5) $[M^+-C_5H_{11}-C_2H_2O]$, 149 (3) $[M^+-C_5H_{11}-CO]$, 177 (100) $[M^+-C_5H_{11}]$, 205 (2) $[M^+-C_3H_7]$, 248 (21) $[M^+]$.

Example 11: 7-(4-methylpentyl)benzo[b][1,4]dioxepin-3-on (11)

Odor: Marine, floral-aldehyde odor. - IR (film): $n = 1502/1418/1466/1580\text{ cm}^{-1}$ (n C=C, Ar), 1265/1304/1201 cm^{-1} (n ring), 1050 cm^{-1} (n C-O-C), 1741 cm^{-1} (n C=O). - $^1\text{H-NMR}$ (CDCl_3): $\delta = 0.88$ (2d, $J = 6.4\text{ Hz}$, 6H, 4'-Me₂), 1.18-1.24 (m, 2H, 3'-H₂), 1.53-1.61 (m, 4H, 2'-H₂, 4'-H), 2.50 (t, $J = 7.8\text{ Hz}$, 2H, 1'-H₂), 4.69 (d, $J = 8.0\text{ Hz}$, 4H, 2-, 4-H₂), 6.78 (dd, $J = 8.0, 4.0\text{ Hz}$, 1H, 8-H), 6.82 (d, $J = 4.0\text{ Hz}$, 1H, 6-H), 6.90 (d, $J = 8.0\text{ Hz}$, 1H, 9-H). - $^{13}\text{C-NMR}$ (CDCl_3): $\delta = 22.44$ (2q, 4'-Me₂), 27.74 (d, C-4'), 29.07 (t, C-2'), 35.14 (t, C-1'), 38.39 (t, C-3'), 75.35/75.63 (2t, C-2, -4),



120.30/120.48 (2d, C-6,-9), 123.50 (d, C-8), 138.86 (s, C-7), 146.03/147.83 (2s, C-5a,-9a), 204.76 (s, C-3). - MS (EI): m/z (%) = 77 (13) $[C_6H_5^+]$, 91 (8) $[C_7H_7^+]$, 135 (7) $[M^+-C_5H_{11}-C_2H_2O]$, 149 (16) $[M^+-C_5H_{11}-CO]$, 177 (100) $[M^+-C_5H_{11}]$, 191 (1) $[M^+-C_4H_9]$, 205 (3) $[M^+-C_3H_7]$, 248 (38) $[M^+]$.

The compounds 7-(2-ethylbutyl)benzo[b]-[1,4]dioxepin-3-one and 7-heptylbenzo[b][1,4]dioxapin-3-one also have the faceted marine odor typical of this class of compound and are therefore suitable, as are the abovementioned compounds, for preparing harmonious fragrance blends having marine notes. In this regard, the abovementioned compounds 1 and 3 are particularly outstanding, as shown by the examples below.

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Example 12: Flowery-marine-fruity womens fragrance containing compound 1

No.	Compound/constituent	Contents by weight	
		in parts	per thousand
1.	Citronellol extra	30	
2.	Cyclohexal	150	
3.	Damascone 10 percent strength in DPG	2	
4.	<i>gamma</i> -Decalactone	2	
5.	<i>beta</i> -Dihydroionone	55	
6.	DPG (dipropylene glycol)	76	
7.	Eugenol, pure	35	
8.	Galaxolid 50 BB	275	
9.	Hedion	110	
10.	Iso E Super	145	
11.	Jasmolactone (Firmenich) 1 percent strength in DPG	25	
12.	Linalool, synthetic	30	
13	Compound 1, 10 percent strength in DPG	65	

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The composition produces a feminine-sensual, transparent, modern perfume with a rosy-flowery, fresh jasmine-like head and flowery-fruity heart note with
5 spicy aspects on a musky-wooden base.

Compound 1 gives the composition its marine aspects, and gives it its radiance and richness in character. It transforms the traditional flowery fragrance into a modern-transparent, trend-setting
10 perfume. In comparison with the compound 7-methylbenzo[b][1.4]dioxepin-3-one, that is to say Calon 1951® mentioned at the outset, compound 1 is much more intense and, at the same dosage, is accompanied by a much stronger marine impression without transforming
15 into fishy or salty, as is the case with Calon 1951® at high dosage here. The compound 1 is much more flowery than Calon 1951® and therefore harmonizes much better with the flowery elements of the composition. It develops the floral-aquatic harmonious blend better,
20 but remains transparent.

Example 13: Feminine floral-marine perfume containing compound 3

No.	Compound/constituent	Contents by weight in parts per thousand
1.	Algenon PB	100
2.	Benzyl salicylate	110
3.	Bergamot oil, Italian	50
4.	Boisambren forte	10
5.	Cyclohexal	12
6.	Dihydromyrcenol	35
7.	DPG (dipropylene glycol)	358
8.	Eugenol, pure	10
9.	Fixolid	10
10.	Galaxolid 50 PHT	65
11.	Georgywood	25
12.	Hedion	20

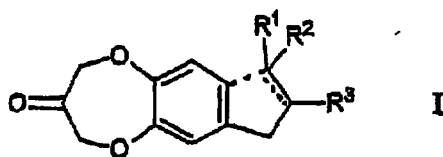
13.	Linalool, synthetic	10
14.	Linalyl acetate, synthetic	30
15.	Sandela	25
16.	Tropional	75
17.	Vertofix Coeur	35
18.	Compound 3, 10 percent strength in DPG	20

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Compound 3 enhances the fresh, marine impression of the composition. It combines harmoniously with the hesperidic headnote, emphasizes the flowery heart note and finally blends in the base with woody and musk-like notes to give a character-giving harmonious composition. Compound 3 gives the composition volume, radiance and body. It gives the impression of a fresh sea breeze. Compared with Calon 1951[®] (see Example 12), the compound 3 is much more intense, but nevertheless does not have a heavy or suppressive effect on the other constituents of the composition. In contrast, compound 3 gives the perfume more development power, diffusivity and volume than Calon 1951[®].



1. A compound of the general formula I



5

where

- $R^1 = \text{H, CH}_3, \text{CH}_2\text{CH}_3, \text{CH}_2\text{CH}_2\text{CH}_3, \text{CH}(\text{CH}_3)_2,$
 $\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3,$
10 $R^2 = \text{H, CH}_3,$
 $R^3 = \text{H, CH}_3, \text{CH}_2\text{CH}_3,$

and the dashed line is an optional double bond or an optional ring closure to form the indane ring system, where in the case of a double bond $R^1 = R^2 = \text{H}$, and in all other cases the total number of carbon atoms of all residues is given by $C_8 > R^1 + R^2 + R^3 > C_1$.

2. A compound as claimed in claim 1, wherein, in the case of the indane ring system, R^1 or $R^2 = \text{CH}_3$.

- 20 3. A compound as claimed in claim 2, selected from the group consisting of 7-allylbenzo[b][1,4]dioxepin-3-one, 1-methyl-2,3-dihydro-1H-5,9-dioxacyclohepta-[f]inden-7-one, 7-(3-methylbutyl)benzo[b][1,4]dioxepin-3-one, 1,1-dimethyl-2,3-dihydro-1H-5,9-dioxacyclohepta-[f]inden-7-one, 7-(2-methylbutyl)benzo[b][1,4]dioxepin-3-one, 7-pentylbenzo[b][1,4]dioxepin-3-one, 1,2-dimethyl-2,3-dihydro-1H-5,9-dioxacyclohepta[f]inden-7-one, 7-hexylbenzo[b][1,4]dioxepin-3-one, 7-(3-methylpentyl)benzo[b][1,4]dioxepin-3-one, 7-(2-ethylbutyl)-benzo[b][1,4]dioxepin-3-one and 7-heptylbenzo[b][1,4]dioxepin-3-one.

4. A compound as claimed in claim 3 selected from the group consisting of 7-allylbenzo[b][1,4]dioxepin-3-one, 1-methyl-2,3-dihydro-1H-5,9-dioxacyclohepta-[f]inden-7-one, 7-(3-methylbutyl)benzo[b][1,4]dioxepin-3-one, 1,1-dimethyl-2,3-dihydro-1H-5,9-dioxacyclohepta-

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[f]inden-7-one, 7-(2-methylbutyl)benzo[b][1,4]dioxepin-3-one, 7-pentylbenzo[b][1,4]dioxepin-3-one, 1,2-dimethyl-2,3-dihydro-1H-5,9-dioxacyclohepta[f]inden-7-one, 7-hexylbenzo[b][1,4]dioxepin-3-one].

- 5 5. A compound as claimed in claim 3, selected from the group consisting of 7-allylbenzo[b][1,4]dioxepin-3-one and 7-(3-methylbutyl)benzo[b][1,4]dioxepine-3-one.
6. An fragrance composition comprising at least one compound as claimed in one of claims 1 to 5.
- 10 7. The use of at least one compound as claimed in one of claims 1 to 5 as fragrance.

